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Sustainable Industry: Promoting Strategic Environmental Protection In The Industrial Sector

Phase 1 Report
Metal Finishing Industry

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TABLE OF CONTENTS

1.1 HISTORICAL CONTEXT

EPA's traditional programs have focused on end-of-pipe pollution controls implemented largely through command-and-control regulations. These programs were effective in addressing many industrial sector pollution problems of the 1970's and 1980's. However, these approaches may not work as well in the 1990's and beyond, as environmental problems become difficult to identify and prioritize and environmental priorities shift toward pollution prevention and waste minimization.

In addition, current and future pollution problems will have to be addressed within an economic climate that demands cost-effective policies and business practices, a focus on sustainable growth, and long-term technological development.

Given the environmental and economic challenges of the 1990's, the Agency believes it is increasingly important to achieve broad private sector commitment and investment in strategic, economically-based approaches to environmental management -- approaches that will move individual firms beyond baseline compliance. For these firms, strategic environmental management will require the permanent integration of environmental management functions into the basic, profit-oriented activities of the organization.

Firms taking this approach will seek cost-effective pollution prevention and waste minimization opportunities as part of their overall commitment to develop innovative new products, improve product and process quality, and achieve economic growth. For many firms, this sort of commitment to a more strategic approach to environmental management represents a difficult adjustment in corporate culture, particularly within the current economic and regulatory climate.

In order to effectively promote industrial culture change of this nature, EPA is rethinking its traditional approach to regulation of the industrial sector, with the goal of harmonizing, to the extent possible, the Agency's future environmental programs with the economic goals of society. EPA's Administrator, Carol Browner, has emphasized this objective:

> President Clinton and Vice President Gore [want to achieve] real and meaningful environmental protection, and to prove once and for all that such protection can exist harmoniously with a growing economy . . . . We have an opportunity . . . to firmly establish a productive relationship between environmental and economic policies.

At present, the strategies and policies to establish that linkage between environmental and economic priorities have not been fully developed. However, the Administrator has taken the lead in promoting innovative approaches to deal with environmental issues facing the industrial sector, both within EPA and under the auspices of the President's Council on Sustainable Development (PCSD). Administrator Browner is committed to the development of EPA policies that promote "cleaner, cheaper, smarter" environmental performance by industrial firms of all types and sizes.

The Sustainable Industry Project is one of the Agency's new industrial sector eco-efficiency initiatives, focusing specifically on corporate decision-making issues that are crucial to long-term sustainable development policies for the industrial sector. In developing this project, EPA's Office of Policy, Planning and Evaluation (OPPE) is seeking to complement the Agency's traditional emphasis on media-specific regulatory/enforcement programs and recent emphasis on voluntary programs and technology transfer.

For example, pollution prevention is a critical component of any strategic environmental management program, and thus should be a major component of EPA's policy agenda for the 1990's. However, the principal focus of pollution prevention programs at EPA has been on technical and outreach issues relating to the implementation of pollution prevention in the industrial sector. While such work is of considerable value, relatively little has been done to evaluate the economic basis upon which firms may choose to pursue pollution prevention options, or to identify and assess incentive approaches to promote cost-effective pollution prevention by industry sub-sectors or individual firms. Analysis of these types of issues is crucial to the development of effective environmental policies and programs for the industrial sector.

OPPE initiated the Sustainable Industry Project with the intent of establishing a strong information and analytic base on which to build an industrial sector environmental program for the 1990's. In order to accomplish the widespread adoption of strategic environmental protection throughout U.S. industry, companies will have to permanently integrate environmental management functions into the basic, profit-oriented activities of their organizations. These innovative new approaches will be embodied in industrial sector policies and programs that recognize the need for U.S. industry to remain competitive, while also fostering a move toward sustainable production strategies through continual and systematic improvements in environmental performance.

1.2 PROJECT GOAL

The primary goal of the Sustainable Industry Project is to develop, test, and implement industry-specific policy recommendations that will remove barriers to innovation and promote strategic environmental protection in the selected industries. The recommended policies and programs should promote a culture change throughout the industrial sector, among firms of all types and sizes, in the form of long-term corporate commitment to achieve cleaner, cheaper, and smarter environmental performance. The Agency's sustainable industry policies and programs should be achieved with a reduced reliance by EPA on command and control regulations. The recommended policies and programs should be widely implementable and acceptable to all relevant stakeholders (e.g., EPA, states, industry, and NGOs).

This goal statement is in keeping with the Clinton Administration's commitment to the concept of sustainable development, which has been defined by the Bruntland Commission and the PCSD as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."[1] In the context of wealthy nations, sustainable development involves "maintaining economic growth while producing the absolute minimum of new pollution, repairing the environmental damages of the past, using far fewer non-renewable resources, producing much less waste, and extending the opportunity to live in a pleasant and healthy environment to the whole population".[2] Achieving sustainable development in developed economies requires promoting "eco-efficiency" -- becoming more efficient, using less energy and material, producing less waste and pollution, and destroying less natural habitat per unit of economic growth -- in all economic sectors, including industry.[3]

Achieving eco-efficiency in U.S. industry will require companies to build strategic environmental protection into their business decisions. By strategic environmental protection we mean long-term planning and investment by companies to develop the most cost-effective and innovative environmental management approaches, starting with pollution prevention. We want to encourage and enable companies to link those approaches to ongoing efforts to improve product quality, process efficiency, financial performance, and overall competitiveness. Over the long term, we seek to enhance their environmental and economic performance and reduce unnecessary conflicts between these two priorities. In so doing, we will demonstrate how sustainable economic growth can be compatible with innovative environmental protection in the industrial sector.

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[1] President's Council on Sustainable Development, Task Force on Principles, Goals and Definitions, Discussion Paper (final draft), October 1, 1993, p. 2.

[2] Ibid., p. 3.

[3] Ibid., pp. 2-3.

1.3 REPORT ORGANIZATION

This version of the report focuses on the metal finishing industry, one of the three industries studied during the first phase of the Sustainable Industry Project. The remainder of this report is organized in two chapters. Chapter 2 presents the methodology employed in the first phase of the study. The last chapter is listed as Chapter 4, retaining its designation from the complete Phase 1 report. Chapter 4 presents the first phase results for the metal finishing industry; it describes the approach used in the initial analysis of that industry, and the major findings with regard to industry characteristics, key drivers and barriers affecting environmental performance, and possible policy options for EPA to explore further.

2.1 INTRODUCTION

Chapter 2 provides an in-depth discussion of the methodology and approach. The chapter covers issues that are general to the entire study. Information on the methodology used that is specific to the three selected industries is provided in the chapters that follow.

2.2 INITIAL RESEARCH ON INDUSTRY DECISION-MAKING

A key early task in the project was to gather economic and environmental data on the full range of manufacturing industries, as a basis for selecting three industries for detailed study. This in turn required that we first identify characteristics of industries that we thought would be relevant to factors that drive environmental performance. Once we had selected the three industries for initial study, this framework was also important in guiding our industry-specific research and the topics we addressed in interviews with industry contacts.

We conducted an initial literature search to review what other studies had said about factors that influence environmental performance. This literature review used a broad brush, including all factors (economic, cultural, regulatory, and other) that might drive environmental practices. While there is a large and growing literature on this topic, there does not yet exist a predictive model of firms' environmental decision-making that is in any sense rigorous or quantifiable. In part, this is because of two factors:

- It is difficult to develop quantifiable decision-making models that provide valid comparisons across firms and facilities.[4]

[4] OPPE and other EPA offices have been conducting research into ways of measuring environmental performance, that may yield more quantifiable measures in the future. See, for example, Industrial Economics, Inc., Pollution Prevention Frontiers (PPF) and Other Approaches to Pollution Prevention Assessment: Comparison Based on New Jersey Materials Accounting Data, prepared for the U.S. EPA, Office of Policy, Planning and Evaluation, Pollution Prevention and Toxics Branch, June 1994.

- Many of the factors that are believed to influence environmental decision-making are "fuzzy" and not readily measured -- such as various aspects of firm culture and internal structure.

In addition, much of the information on sustainable performance in industry and on industrial environmental performance is anecdotal in nature and incomplete. The literature describes exemplary practices and programs, but does not provide clear evidence on why some firms are taking these proactive measures and others in the same industry are not.

While we did not find an explicit model of industrial environmental decision-making, we were able to compile a list of variables influencing firms' environmental decisions. Exhibit 2-1 lists the factors we identified from the literature and that we used as a checklist of characteristics for evaluation.

Business decisions of industry are often analyzed using a profit-maximization model. While many factors influence business decisions, it is useful as a starting point to assume that businesses will act in ways that maximize profits (by reducing costs and/or increasing revenues) and will choose their least-cost option, other things being equal. Of course, other things are not always equal, and different businesses choose different business strategies in the same markets.[5]

For example, one firm may take a high-quality strategy to product design or customer service that results in both higher revenues and higher costs than another competitor that chooses a low-cost approach to allow competing on price. Any market may offer room for different competitive strategies. However, assuming initially that businesses will act to minimize costs provides a useful first approximation of industry responses to policies that affect costs. A major task in analyzing industry responses is therefore to understand how environmental policies affect their costs, revenues, and profits.

More broadly, a number of factors affect industry environmental and economic decision-making. These factors include federal and state regulation, changes in production technologies, and foreign competition. Industry structure (e.g., is the industry highly-competitive or characterized by concentrated market power?) may reflect barriers to entry such as patent ownership, economies of scale, and substantial customer brand loyalty. These characteristics are relevant to predicting environmental performance, both because they affect the resources available to invest in environmental improvements (profits) and the ability to recover the costs of environmental improvements from customers.

Other factors that are likely to affect both environmental and economic performance include the nature and capital intensity of production technologies, the size of firms, the availability of in-house technical expertise, the baseline rate of innovation in products and production processes, the availability of substitutes for manufacturing inputs, and the price sensitivity of demand for the industry's products. Identifying a list of factors that *might* influence environmental decision-making was only a preliminary step in our analysis, providing some overarching information to support our industry-specific analysis.

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[5] Michael Porter's work provides a framework for understanding the strategies of different firms as the matching of firm competencies to the demands of the target market. See Michael E. Porter, Competitive Strategy: Techniques for Analyzing Industries and Competitors, 1980, and Competitive Advantage: Creating and Sustaining Superior Performance, 1985.

Exhibit 2-1

EXAMPLES OF CORPORATE VARIABLES INFLUENCING FIRMS' ENVIRONMENTAL DECISIONS

1. Social Variables

   Employee Recruitment
   Employment Morale
   Media Treatment
   Corporate Reputation
   Community Relations
   Plant Siting

2. Market Variables

   Growth Markets
   Product Image
   Customer Loyalty
   Product Certification
   Competitive Advantage
   Industry Standards

3. Financial Variables

   Liability Exposure
   Insurance Coverage
   Damage Compensation
   Credit Quality
   Capital Access
   Investor Relations

4. Regulatory Variables

   Government Relations
   Raw Materials Costs
   Operating Costs
   Litigation Costs
   Disclosure/Reporting
   International Competitiveness

Source: National Wildlife Federation Corporate Conservation Council "SYNERGY '92" Conference, January, 1992.

2.3 TAKING AN INDUSTRY-SPECIFIC APPROACH

As stated previously, the overall goal of the Sustainable Industry Project is to develop policies that foster the permanent integration of environmental protection functions into the basic profit-oriented activities of industrial firms. To accomplish this goal, EPA needs to understand the factors that motivate or impede a firm's behavior with respect to investment in projects that result in improved environmental performance. We believe that the best way to understand these factors is to study the behavior of firms within the context of the industry of which they are a part.

EPA's traditional one-size-fits-all approach to policy-making, often dictated by statute, establishes requirements and programs that are applicable to many industries. This approach does not take into account differences among industries, such as available resources, prevailing corporate culture, market trends, and corporate decision-making factors in different industries. A one-size-fits-all approach for the industrial sector therefore may result in programs that effectively achieve environmental goals in some industries, but fail to do so (or even impose barriers to effective environmental performance) in others.

On the other hand, an industry-specific approach to policy-making offers opportunities to design policies that fit the particular characteristics of the industry of interest. An understanding can be gained of industry-specific decision factors and behavior that can then be used to identify incentive (driver) factors or barriers to improved environmental performance. Since operating environments and processes vary a great deal across the industrial sector as a whole, policies that are tailored to unique characteristics of specific industries are likely to be more effective in promoting cleaner, cheaper, smarter environmental performance by individual firms in those industries.

Additional factors support an industry-specific approach. Although a wide range of firm sizes, types and scales of production processes, and levels of technical and environmental sophistication may coexist within an industry, the participating firms frequently face similar environmental issues with respect to types of emissions. Development and implementation of EPA policy options at an industry level is thereby simplified because attention can be focused on promoting improved environmental performance through management of a limited number of processes.

Firms within industries classified at the 4-digit SIC level generally utilize similar technologies and production processes, purchase raw materials from the same types of suppliers, and compete with each other in many of the same markets on the basis of product design and performance, price, quality, and service. These upstream and downstream relationships can be very important with respect to environmental decision-making within an industry.

Because a relatively limited number of markets are served by a given industry, competitive imbalances that may be caused by a specific policy option can be more accurately assessed prior to implementation of the policy because EPA can more easily understand the competitive dynamic occurring among the various firms within an industry than it can assess the effects of controlling a specific pollutant across many industries. The Agency can use this knowledge of the competitive dynamic of an industry to identify points within the industry's structure and culture where policies can have the broadest, long-term impact.

While it has many advantages, an industry-based approach is not the only method that can be used to assess policy options. Historically, EPA's efforts to address environmental problems have employed geographic, industry, and/or chemical-based approaches. While all three approaches have their place, the industry-based approach has received less attention in recent years. The Sustainable Industry Project is founded on the premise that the increased tension between economic and environmental objectives in recent years demands a more sophisticated understanding of the interrelationship between these objectives, and that this understanding can be best achieved via an industry focus.

2.4 USING A BACKWARD MAPPING ANALYTICAL METHOD

"Backward mapping" is an approach to policy implementation described by Richard Elmore.[6] He distinguishes two approaches to implementation analysis:

- "Forward-mapping" begins by defining a policy objective, elaborates increasingly specific steps for achieving that objective (starting with the top of the implementation hierarchy and working down), and identifies outcomes by which success or failure will be measured. It relies on the implicit assumption that policymakers can control the organizational, political, and technological processes that determine outcomes.

- "Backward-mapping" begins not with a statement of policy objectives, but with a description of the behaviors that the policy seeks to influence. Only when the behavior creating the need for a policy is fully understood is a policy objective defined and desired outcomes identified. The policy is developed by working backward from the most directly involved parties, and asking at each level of the system what would encourage a desired change in behavior. This analysis focuses on what incentives and resources each stage would need to make the desired changes.

As applied to environmental policy, a forward-mapping approach would yield hierarchical, "command-and-control" policy solutions, with a distrust of discretion at lower levels in the system and an emphasis on compliance with inflexible standards. A backward-mapping approach seeks to capitalize on knowledge and skill at the point of impact to achieve environmental policy objectives, by creating incentives or removing barriers to the desired behavior. In Elmore's words, backward mapping emphasizes "that it is not the policy of the policymaker that solves the problem, but someone with immediate proximity... . Rather than reasoning from top to bottom, trying to discover how each layer can control the next, one begins at the point of the problem and tries to find the most parsimonious way of reaching it."[7]

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[6] Richard F. Elmore, "Backward Mapping: Implementation Research and Policy Decisions," Political Science Quarterly, Vol. 94, No. 4, Winter 1979-80, pp. 601ff.

[7] Ibid., p. 612.

Based on the backward mapping approach, the sustainable industry project emphasizes understanding the factors that influence the behavior of different players in each industry, before recommending any policy prescriptions. We use the concepts of "drivers" and "barriers" to distinguish factors that encourage or hinder, respectively, improved environmental performance in industry. Drivers and barriers include any variables that influence decision-making with respect to environmental performance. For example, if a firm has to undertake an investment in pollution controls to comply with a specific regulation, then the regulation acts as a driver of environmental improvements. If the firm is contemplating an environmental investment but cannot obtain the necessary financing, then financial constraints act as a barrier to environmental improvements.

Understanding the factors that influence environmental performance provides the basis for designing policies to encourage improved performance. Starting with a thorough understanding of the factors that influence the key industrial actors gives EPA the opportunity to align policy objectives with their business objectives. With this insight into the dynamics of the industry, EPA has the opportunity to use a broader and potentially more effective set of policy levers, rather than being limited to traditional command-and-control options.

2.5 SELECTING THREE INDUSTRIES FOR STUDY

Our intended scope for this project was to work with a set of two to four industries. We started with a preliminary list of about ten industries, identified by 4-digit Standard Industrial Classification (SIC). We collected economic, environmental, regulatory, and other data on the original list of industries, and selected three for the first phase of this project: photographic manufacturing and processing (photoimaging), metal finishing, and plastics and resins. (We subsequently focused on the thermosets subset of the plastics industry.) The types of data and the selection criteria are summarized below. A more extensive discussion of the "candidate" industries is provided in the Appendix of this report.

We conducted the industry selection process using Standard Industrial Classifications (SICs), because most data sources that provide comparable data across industries report data aggregated by SIC.[8] The following measures of economic and financial characteristics were collected for all manufacturing SICs:

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[8] SICs are two- and four-digit codes that group similar establishments by industry. An establishment is a single location: a manufacturing facility, a headquarters location, a retail outlet, and the like. Most establishments in the manufacturing SICs (SIC 20 through 39) are manufacturing facilities. The basis for defining SICs varies, and the categories are often not ideally defined for the purposes of a particular analysis. Some SICs combine industry subsectors that have very different characteristics, and in other cases a single "industry" (as defined by the markets served or the type of processes used) includes several SICs. In addition, establishments report data based on their primary product, but may produce products associated with other SICs as well. Therefore, some of the products or services which define the primary SIC may be produced as secondary products by establishments in other SICs. While the SICs provide a useful standardized reporting system for data, it is important to realize that there may be a discrepancy between an "industry" and the most closely related SIC.

- o Number of establishments;
- o Size distribution of establishments;
- o Production characteristics (capital versus labor intensive);
- o Market concentration (based on share of value of shipments);
- o Geographical concentration; and
- o Economic performance (using capital utilization as a proxy).[9]

We also collected data on various environmental outcomes as a measure of environmental performance. The available data give only a general picture of the environmental characteristics of an industry, however, and do not reveal the extent to which industry participants have taken full advantage of all existing methods for improving performance -- that is, how many industry players are operating with state-of-the-art production processes and pollution controls. We used two sources of environmental data in the industry selection process: Toxics Release Inventory (TRI) releases and transfers of toxic chemicals (total and by media), and energy consumption (a proxy for emissions from fuel combustion and potential for energy efficiency improvements).

Finally, we investigated the current regulatory status of the candidate industries. For each industry, we considered the size of current and historical pollution abatement and control expenditures, and the extent of current and future EPA regulation (particularly under the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act).

The selection of the industry sectors for detailed investigation in the first phase of the Sustainable Industry Project was guided by the following criteria:

- o We wanted to select industry sectors that present significant opportunities for EPA to encourage movement toward sustainable practices. This criterion suggested that we pick industries with substantial releases to the environment, as reported in the Toxics Releases Inventory.
- o In addition, we wanted to select industries that might benefit from use of innovative policy approaches that go beyond the traditional command-and-control paradigm. This goal encouraged selection of industries (1) with multi-media rather than single-medium releases, (2) with significant historical expenditures on pollution abatement and control, and (3) facing significant current and future regulatory requirements.

[9] Later research on the three selected industries also included other important economic variables, such as extent of foreign competition, growth rates, and financial characteristics.

- Similarly, we were interested in picking industries that would particularly benefit from an industry-wide, life-cycle focus. Therefore, we picked industries that appeared to present life-cycle issues, and to present interesting relationships among suppliers, manufacturers, downstream businesses, and end-users.

- We also wanted to select a set of industries that appeared to have different characteristics from one another, so that we could learn as much as possible about the applicability of our analytical approach to different types of industries. A more diverse set of industries, in terms of company size, scope of environmental issues, and market and product trends will provide us with a broader range of experience as we seek to implement the policy options developed through this project.

- Finally, we wanted the results of the sector studies to provide insights into influences on environmental performance and the effects of different policy strategies for other industries as well. This goal of generalizing results required that we pick industries that presented common rather than unique environmental issues, and that we pick a set of industries that together would cover a range of economic and environmental characteristics.

The selection of three industries for detailed study was necessarily judgmental. Other industry sectors could easily have been chosen, applying the same decision criteria. Exhibit 2-2 summarizes some of the key data for the three selected industries.

As a group, these three industries provide us with a variety of economic characteristics which we expect to influence environmental performance, including establishment size, difference in capital versus labor intensive production, and more and less concentrated markets. All present multi-media pollution problems, when viewed from a life-cycle perspective, and are subject to current and forthcoming regulations at the federal level.

As for the desired diversity of characteristics, the three selected industries clearly reflect different types of companies and issues. The metal finishing industry includes a large number of relatively small operations, often with limited resources and a large set of regulatory requirements with which to comply. The photoimaging industry is highly concentrated on the manufacturing side and widely diffuse on the processor side, with fewer environmental issues but significant opportunities for cleaner, cheaper, smarter initiatives nonetheless -- particularly in view of the highly technical, innovative nature of the industry. The plastics and resins industry was selected to represent a typical huge, widely diverse industry, with many different types of companies, products, and issues. Even with the subsequent change in focus to the thermoset plastics subsector, these characteristics remain valid.

As discussed in the industry-specific chapters, further work led us to refine our focus in each of the three sector studies; we narrowed the scope of our analysis enough to allow us to understand technical, economic, management, and environmental issues in detail, and to identify the key leverage points for each industry. Despite these adjustments in focus, the desired variety in issues and industry characteristics has been retained from the initial selection process.

Exhibit 2-2

KEY CHARACTERISTICS OF SELECTED INDUSTRIES

	Photographic Equipment & Supplies (SIC 3861)	Electroplating & Polishing (SIC 3471)	Plastics Materials & Resins (SIC 2821)	Photographic Processing (SIC 7384 & 7819)††
Total Number of Establishments*	787	3,451	480	580,000
Number of Establishments by Employee Size Category:*				
1-19 employees	508 (65%)	2,408 (70%)	160 (33%)	522,000 (>90%)
20-249 employees	242 (31%)	1,032 (30%)	266 (55%)	58,000 (<10%)
250+ employees	37 (4%)	11 (<1%)	54 (11%)	0
Concentration Ratios -- Share of Value of Shipments by:*				
4 largest companies	77%	7%	20%	NA
8 largest companies	84%	10%	33%	NA
20 largest companies	90%	16%	61%	NA
Ratio of Capital to Labor Expenditures**	30.3	10.0	72.2	NA
Capacity Utilization Rate (1990)***	77%	82%	96%	NA
TRI Releases (1990):				
Air	29,968,807	11,830,549	102,874,467	NA
Water & POTWs	1,153,916	3,963,623	16,27,877	NA
Land & Underground	115,244	45,252	4,452,326	NA
Offsite Transfers	6,156,799	16,480,193	39,730,186	NA
Total	37,394,766	32,319,617	163,284,856	NA
Pollution Abatement and Control Expenditures (& percent of total expenditures)**,***,†	$157 mill (1.4%)	$236 mill (7.0%)	$929 mill (3.9%)	$45 mill
Purchased Fuels and Electricity as Percent of Total Expenditures**,†	1.7%	6.2%	4.4%	NA
Future Federal Rule-Makings	CA: VOC limits RCRA: Solvents listings	CA: MACT for surface coating, degreasing/ metal cleaning RCRA: Solvents listing	CA: MACT for numerous individual plastics & resins RCRA: solid waste legislation affecting end-uses of plastics CA: Effluent guidelines	CWA: Effluent Guidelines RCRA: Silver listing

* 1987 Census of Manufactures

** 1991 Annual Survey of Manufactures

*** Current Industrial Reports, Survey of Plant Capacity 1990

† Total expenditures includes capital equipment, labor and materials.

†† Values for this industry were obtained from the National Association of Photographic Manufacturers (personal communications) and The Silver Coalition (An Economic Assessment of the Impact Resulting from Silver Pretreatment Standards, June 26, 1992).

2.6 IDENTIFYING DRIVERS, BARRIERS, AND POSSIBLE POLICY OPTIONS

Once the three industry sectors were selected, our goal was to gather extensive information on each industry, including corporate decision-making factors in the industries, in order to create the knowledge base necessary to support policy recommendations that would meet the goal of the project. A team of OPPE and contractor staff from Industrial Economics, Inc, (IEc) was formed for each of the industries. The Phase 1 work for each industry followed the same major steps, but each industry study differed somewhat in the topics emphasized and the results achieved to date.

The first step of the data-gathering process was to develop a thorough understanding of the relevant characteristics of the industries -- the industry-specific economic, institutional, cultural, technical, life-cycle, and regulatory factors -- that may promote or hinder environmental improvements. A key aspect of this characterization of the selected industries was the identification of the driver factors and barriers that influence corporate decision-making and environmental performance. The drivers and barriers represent the key leverage points for the industries -- the regulatory, informational, economic, or other factors -- that provide the greatest incentives or impose the most significant obstacles to improved environmental performance. Our emphasis here was on the identification and prioritization of corporate decision factors, rather than on EPA's traditional role of assessing and managing environmental risks. The driver factors and barriers provided the basis for subsequent policy development.

The next crucial step in the analytical approach of this project was the development of a menu of policy options and recommendations that we would anticipate having the greatest long-term impact on the selected industries in terms of achieving the overall goal of the project -- to promote strategic environmental protection in the industries. The identification of these policy options is based on our knowledge of the industries, their characteristics, unique driver factors, and barriers to innovation. The recommended actions are both regulatory and non-regulatory in nature.[10] The actions may be taken by EPA headquarters or regions, states and localities, the industries themselves or their suppliers or customers, or other entities.[11] Some actions might require statutory changes, while many are achievable within existing statutory mandates.[12] Our approach was to link the

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[10] The description of policy options as regulatory or non-regulatory is somewhat arbitrary, and the line between the two categories is blurred. Strict use of the term "non-regulatory" would include only those options that rely solely on incentives to influence behavior, without any mandatory provisions. In practice, a very wide range of incentives, quasi-regulatory, and regulatory policies are typically discussed in studies of "non-regulatory" options. For example, deposit-refund systems used to encourage the return of materials to a central location include both incentives (for the ultimate customer to return the materials) and regulations (requiring intermediaries to accept the materials and return them to a central location). Similarly, marketable rights are typically used within the context of a regulatory program, e.g., trading of rights to emit criteria air pollutants in a given area, subject to a regulatory maximum on total emissions or minimum standard for ambient air quality. In this case, the creation of markets promotes compliance with the regulatory standard at the lowest aggregate cost to the regulated facilities.

[11] In all cases, we will identify steps that EPA could take to promote adoption of the best policies, even if EPA would not be the lead agency implementing the policy.

[12] However, when evaluating potential difficulties in implementing the options, we will clearly distinguish options requiring statutory changes from those that do not.

policy options to the key leverage factors for the industries, so as to promote cleaner, cheaper, smarter environmental outcomes over the long-term future, preferably with less Agency involvement over time.

An important aspect of our policy development process was to look at each industry and at policy options with a broad, holistic perspective. Often, policy strategies are considered only in the context of a single rulemaking. Many regulatory decisions are highly constrained by specific legislative mandates and by the precedents set by earlier rulemakings. This narrow focus may miss opportunities to take positive, non-regulatory actions or to coordinate and rationalize regulations and enforcement across programs. Also, the general applicability of regulations to many industries may fail to reflect unique factors that affect environmental performance in specific industrial sectors or sub-sectors.

By contrast, the approach used in the Sustainable Industry Project involves looking at environmental issues in a comprehensive life-cycle context, considering all the environmental dimensions of industrial products and processes (all media and all important end-points) and a full range of policy options. The broad perspective is necessary to ensure that policies promote true movement toward sustainability, not just shifting of problems from one medium, source or type of adverse outcome to another.

2.7 BUILDING PEER REVIEW AND STAKEHOLDER NETWORKS

Our initial outreach efforts for this project focused on peer review of our overall concepts, goal, and intended approach. Since early 1993, we have discussed the project with close to 100 individuals in EPA and other federal departments and agencies, industry, state governments, academia, the media, and other non-governmental organizations (NGOs). We have actively solicited suggestions for improving our methodology, and have attempted to be responsive to all comments about the project as a whole. This peer review effort will continue throughout the life of the project.

As we moved into the data-gathering phase of the project in mid-1993, we began the essential process of developing stakeholder networks for each of the three selected industries. In view of our intent to focus first on characteristics of the three industries, we made a significant effort early in Phase 1 to identify and connect with the key individuals and organizations in each industry, in order to begin to understand the issues as industry perceives them. These interviews with industry contacts provided an important initial source of information on drivers and barriers. These early rounds of interviews generated a wider range of hypotheses about drivers and barriers of environmental performance, which we were able to test in discussions with an expanding set of stakeholders in later stages of the Phase 1 work. Major trade associations for each industry were important sources of contacts in individual companies. In addition, we had the help of consultants with expertise in the particular industries.

In addition to interviews with trade associations and company contacts, we conducted site visits to manufacturing facilities to enhance our understanding of the manufacturing technologies and plant-level environmental issues. We also conducted a review of the trade literature and the pollution prevention and control literature for each industry.

During the course of our research and interviews, we began identifying industry and other contacts who might participate in an expert panel for each industry. The first set of expert panel meetings was held in January, 1994. The primary purpose of these meetings was to verify our understanding of the economic and environmental characteristics of each industry, and to determine the key drivers and barriers affecting performance. The initial expert panel discussions of drivers and barriers provided a preliminary list of policy options that might enhance incentives or reduce barriers to more sustainable industry practices.

After the first round of industry expert panel meetings, we began to expand our stakeholder networks to include other important, non-industry participants. These non-industry stakeholders include members of EPA offices that are responsible for programs of particular significance to the industries; NGO representatives from environmental organizations and other groups with interest in the industries (e.g., the Association of Metropolitan Sewage Agencies, representing POTWs); and representatives of relevant federal, regional, state, and small business interests.

A second round of expert panel meetings, involving more diverse groups of participants, occurred in February and March of 1994. The goals of these meetings were to verify our understanding of key industry characteristics, drivers, and barriers -- this time through a dialogue with a wider set of stakeholders -- and to select key policy areas for focus in Phase 2 of the project.

As with our peer review efforts, the development of industry-specific stakeholder networks is an ongoing process. We want all interested viewpoints to be represented in our data-gathering and analytical processes, to ensure the accuracy of our substantive findings, to elicit innovative ideas to the maximum extent possible, and to enable stakeholders with divergent points of view to engage in constructive dialogue. Over the long-term future, these networks will help to provide a solid substantive basis for our policy recommendations and a broad participant base for future public/private partnerships to implement those policies.

2.8 NEXT STEPS

This report reflects work completed through the second round of expert panel meetings for each of the three industries, the last of which occurred on March 15, 1994. The remaining chapters of the report provide in-depth discussions of the three industries that were the subject of this study, including the top policy options identified for each industry.

The Sustainable Industry Project remains a work in progress. Each of the industry sectors will need additional investigation to clarify the issues that have been raised. More work is also needed to continue broadening the stakeholder network, and involve some groups whose views have not yet been adequately represented.

During Phase 2 of this project we will further develop and characterize potential implementation projects for each industry that will test the environmental and economic impacts of the industry-specific policy options identified in Phase 1. The implementation projects, which are the logical next step of our backward mapping analytical approach, will be undertaken in Phase 3. The projects may include implementation and testing of policies on a pilot basis, cooperative efforts to develop definitions or information needed to implement new policies, tests of innovative compliance and enforcement approaches, and further research on key scientific or technical issues. We will use the implementation projects to assess whether the specific policy options effectively address the key drivers and barriers that affect long-term environmental performance in each industry.

We believe that the following tasks will likely be a part of Phase 2, subject to change as we continue to be responsive to new information, input from stakeholders, and the views of EPA management:

- Holding additional meetings with industry/stakeholder expert panels, and interviews with parties involved in each of the policy areas selected for focus, to clarify the issues involved and understand what specific actions would be required to implement a new policy to address the issues. The project team will continue to contact stakeholders whose views have not yet been fully represented in the expert panel discussions and interviews. In particular, more involvement by environmental groups, state regulators, EPA regional representatives, and groups with practical experience with various non-regulatory policies will be solicited.

- Developing EPA cross-office teams to work with OPPE project managers -- in particular, to review, assess and revise the findings for each industry and to comment on the design of useful implementation projects. These teams will include regulatory, compliance, and permitting representatives whose selection will be based on the specific issues and options identified for each industry.

- Preparing strategic plans for individual implementation projects, along with background materials on the issues motivating consideration of each project, for review by all major stakeholders, including EPA program offices and senior management. The plans will define the purpose of the projects and success measures by which the results can be evaluated. Clear definition of "success" and concrete ways of determining success will be critical to making the project results a valid basis for broader policy decisions.

We anticipate that the implementation stage of the Sustainable Industry Project will require broad stakeholder participation, with OPPE playing a coordinating and facilitating role, but not necessarily a leadership role in every implementation project. The strategic plans, participants, resource requirements, timeframe, and success measures of each project will differ based on the industry-specific driver factors and barriers that are being addressed.

Once implementation projects are developed and underway, OPPE will assess environmental and economic results of policy options, to test whether the anticipated payoffs of the recommended policies are in fact being achieved. On this basis, we can with greater confidence make broad policy and programmatic recommendations to the Administrator.

4.1 INTRODUCTION

This chapter discusses the background information and preliminary findings of the Sustainable Industry Project's analysis of metal finishing industry. This introduction outlines the contents of this chapter. The approach to our analysis, including the scope of the project, an industry profile, and our information sources are addressed in Section 4.2. Section 4.3 presents our findings to date, including:

(1) Information on the economic characteristics of the industry;

(2) Descriptions of key factors that influence environmental performance in this industry (drivers and barriers); and

(3) A list of policy options that might enhance the drivers and reduce the barriers to improved, more cost-effective environmental performance by the metal finishing industry.

4.2 APPROACH TO ANALYSIS

4.2.1 Scope

The Electroplating, Plating, Polishing, Anodizing, and Coloring industry[1] is classified under Standard Industrial Code (SIC) 3471 and includes establishments primarily engaged in all types of electroplating, plating, anodizing, coloring, and finishing of metals and formed products for the trade. This industry also includes establishments that perform these types of activities on purchased metals or formed products. Establishments that both manufacture and finish products are classified according to their products, but nonetheless are considered a part of the metal finishing industry.[2]

[1] Hereinafter referred to as the metal finishing industry.

[2] Although much of the industry data collected for this study applies to establishments classified under SIC 3471, establishments classified under SIC codes other than 3471 that have metal finishing operations are also considered in this analysis.

4.2.2 Overview of Industry

In general, establishments engaged primarily in metal finishing tend to be small, independently owned "job shops." In this report, we often refer to these establishments as independent metal finishers. Establishments that conduct metal finishing operations as part of a larger manufacturing operation are referred to as "captive" metal finishers. While most of the data analyzed in this report have been collected from independent metal finishers, we believe the analysis is applicable to the captive metal finishers as well. Enough similarities exist between the independent and captive facilities that they can essentially be considered part of one industry. In addition, the two segments have parallel ties with suppliers and customers. Differences that do exist between the two segments can be used to understand more fully the drivers of the decision-making processes and the barriers to improved environmental performance in each segment.

The independent and captive metal finishers use the same types of processes and fall within the same regulatory framework. Captive operations may be more specialized, or focused, in their operations because they often work only on a limited number of products and/or employ a limited number of processes. Independent metal finishers, on the other hand, tend to be less focused in their operations because they may have many customers, often with different requirements. In general, captive metal finishers tend to have greater access to financial and organizational resources and, as a result, tend to be more proactive in their approach to environmental management; however, this isn't always the case. Independent and captive metal finishers do not ordinarily compete against each other since captive finishers seldom look for outside contract work. However, captive facilities may use independent facilities as subcontractors to perform tasks that their own captive operations are unable or choose not to do. In addition, some captive facilities have been recently shut down in cases where management has decided that metal finishing is not of strategic importance to the firm's long-term success. In these cases, the firm's plating activities are shifted to independent shops.

The metal finishing industry has developed close relationships over the years with both its upstream material and equipment suppliers and its downstream customer base. Metal finishers have come to rely upon their suppliers to help them understand new developments in plating technology and upon their customers to define product requirements. Excellent plating quality and responsive service are the two defining competitive variables within the metal finishing industry.

4.2.3 Information Gathering and Panel Meetings

Our goal in this study was to characterize the metal finishing industry to understand the products and processes used in the industry; supplier/industry/customer relations; industry and firm-level structure and organization; financial and economic histories and trends; and the drivers toward and barriers against environmental improvement that affect the industry now and/or are likely to affect the industry in the future. As discussed in Chapter 2, we define drivers and barriers as those leverage points that directly affect corporate decisions in areas such as environmental compliance and improvement. In order to obtain this information, we collected and reviewed numerous documents and data sources which describe the metal finishing industry. In addition, we contacted numerous agencies, organizations and individuals who had knowledge of the metal finishing industry. A list of the information sources used in this analysis can be found in Exhibit 4.2-1.

Exhibit 4.2-1

CONTACTS AND SOURCES FOR THE METAL FINISHING INDUSTRY (to date)

Documents	Industry Associations	Industry Members	Government	Non-Governmental Organizations
The U.S. Census of Manufacturers	American Electroplaters and Surface Finishers Society (AESF)	Pratt & Whitney (United Technologies Corporation)	U.S. EPA:	Environmental Defense Fund
The U.S. Industrial Outlook	National Association of Metal Finishers (NAMF)	Whyco Chromium Company, Incorporated	- Office of Solid Waste	Association of Metropolitan Sewage Agencies
The Toxics Release Inventory (TRI)	Metal Finishers Suppliers Association (MFSA)	Light Metals Coloring Company, Incorporated	- Office of Water	Hopewell Regional Wastewater Facility
The Code of Federal Regulations	American Institute for Pollution Prevention (AIPP)	Mid-Atlantic Finishing, Incorporated	- Office of Air	
Numerous industry-specific reports, studies, and articles	Lawrence Livermore National Laboratory (LLNL)	Simmonds Precision Aircraft System (BF Goodrich Aerospace)	- Office of Research and Development	
		Connecticut Resource Group, Inc.	- Office of Enforcement and Compliance Assurance	
		Haward Corporation	- Risk Reduction Engineering Laboratory (RREL)	
		Universal Fasteners, Inc.		
		Frederick Gumm Chemical Company		
		Enthone-OMI Corporation		
		Integrated Technologies, Inc.		
		Pollution Prevention International		

Following this initial data collection, we compiled a preliminary list of what we felt were some of the key industry characteristics and trends, as well as lists of the drivers of decision-making; barriers to improved environmental performance; and possible incentives to improved environmental performance. These preliminary findings provided the framework for discussion at an industry expert panel meeting held on January 14, 1994, that consisted only of industry members and experts. At this meeting panel participants assisted us in clarifying the major issues, drivers, and barriers, and in identifying potential policy options that EPA could consider to remove some of these barriers. The organizations that were represented at this expert panel meeting are listed in Exhibit 4.2-2. For a complete list of the individuals who attended this meeting see Appendix 4-C.

Exhibit 4.2-2

PANEL MEETING PARTICIPANTS

Panel Meeting #1 - January 14, 1994	Panel meeting #2 - March 11, 1994
American Electroplaters and Surface Finishers Society (AESF)	American Electroplaters and Surface Finishers Society (AESF)
Connecticut Resource Group, Inc.	Association of Municipal Sewage Agencies (AMSA)
Enthone-OMI Corporation	Connecticut Resource Group, Inc.
Frederick Gumm Chemical Company	Environmental Defense Fund
Haward Corporation	EPA, Definition of Solid Waste Task Force, Office of Solid Waste
Integrated Technologies, Inc.	EPA, Engineering and Analysis Division, Office of Water
Metal Finishers Suppliers Association (MFSA)	EPA, Office of Compliance, Office of Enforcement and Compliance Assurance
Mid-Atlantic Finishing, Inc.	EPA, Risk Reduction Engineering Laboratory, Office of Research and Development
National Association of Metal Finishers (NAMF)	Frederick Gumm Chemical Company
Simmonds Precision Aircraft Systems (BF Goodrich Aerospace)	Haward Corporation
Universal Fasteners, Inc.	Hopewell Regional Wastewater Facility
	Integrated Technologies, Inc.
	Metal Finishers Suppliers Association (MFSA)
	Mid-Atlantic Finishing, Inc.
	National Association of Metal Finishers (NAMF)
	Pollution Prevention International
	Simmonds Precision Aircraft Systems (BF Goodrich Aerospace)

Based on the discussion at the panel meeting, we made changes to the initial list of drivers, barriers, and possible policy options that we had identified.

On March 11, 1994, we convened a second panel meeting for the purpose of involving other stakeholders to the metal finishing industry who are not industry or trade association members. The goal of this second meeting was to reaffirm our characterization of the industry and to identify and prioritize some of the more acceptable and feasible policy options that EPA could consider for this industry. The participants in the second panel meeting included regulators, publicly owned treatment works (POTW) representatives, environmental organizations, as well as industry members and trade association representatives. The participating organizations and agencies also are listed in Exhibit 4.2-2. A discussion of the findings of the second panel meeting is included in Section 4.3.3 below.

4.3 MAJOR FINDINGS

4.3.1 Industry Characteristics

Definition of Metal Finishing

Electroplating, plating, polishing, anodizing, and coloring are industrial processes that either coat or finish metal or other formed products. Finishing, or more broadly speaking surface finishing, is the process of coating a metallic or plastic object with one or more layers of another metal, paint, or plastic to enhance, alter, or finish its surface.[3] Firms that apply these coating processes to a metallic base material can be grouped together in what is referred to as the metal finishing industry. Surface finishing/metal finishing provides protection for the base material and/or changes the surface of the base material to create any one or some of the following desirable characteristics:

- Improved appearance
- Corrosion resistance
- Abrasion resistance
- Wear resistance
- Improved lubricity
- Improved decorative appearance
- Improved solderability
- Light reflectivity
- Improved electrical properties (e.g., insulation, conductivity)
- Temperature resistance
- Non-toxicity

Markets

The metal finishing industry is a highly diverse and flexible industry catering to many applications. Products that have undergone surface finishing can be found almost anywhere. Some examples of the major industries that depend upon metal finishing in the manufacturing of their products are:

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[3] This definition is taken from the brochure "Understanding Surface Finishing," published by the National Association of Metal Finishers (NAMF), Chicago, Illinois.

Automotive
Aerospace
Commercial Aviation
Communication
Computer Equipment
Construction Hardware
Defense
Electric Hardware
Furniture
Household Appliances and Accessories
Jewelry
Motorcycles/Bicycles
Oil Drilling Equipment
Steel Mill Products
Tools and Dyes

Processes

In general, objects to be finished (workpieces) undergo three stages of processing, each of which involves moving through a series of baths containing reagents designed to complete a certain step in the process.[4] These three stages are listed below, and Exhibit 4.3-1 illustrates each of the three basic stages and the steps typically associated with them.

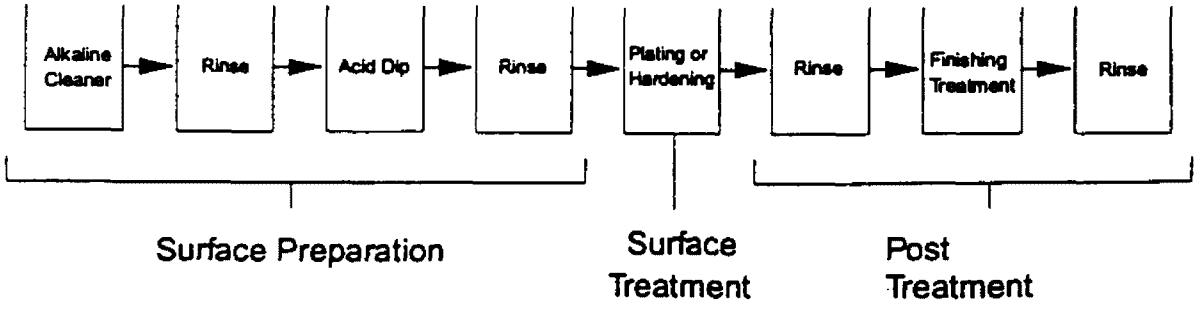
1. Surface Preparation. The surface of the workpiece is cleaned in preparation for treatment; detergents, solvents, caustics, and other media are commonly used in this stage, and the workpiece is then rinsed.

2. Surface Treatment. This stage involves the actual modification of the workpiece surface, such as plating.

3. Post Treatment. The workpiece, having been treated, is rinsed and subject to further finishing operations, such as coloring or anti-corrosion treatment.

Exhibit 4 3-1

OVERVIEW OF METAL FINISHING PROCESS



[4] Note that these steps will vary according to the specific process type (e.g., electroplating, plating, etc.)

Facilities

Exhibit 4.3-2 shows the distribution and value of sales in each size category of SIC 3471 establishments for the years 1982 and 1987. As noted earlier, there are two main types of metal finishing establishments, independent metal finishers and captive metal finishers. Approximately 3,500 independent metal finishing establishments operate in the United States. These establishments receive their workpieces from outside their company. A typical job shop is a small single establishment that employs 15 to 20 people and generates $800 thousand to $1 million in annual gross revenues.[5]

Greater than two-thirds of independent metal finishers employ less than twenty employees, and less than one-half of one percent of the establishment have 250 or more employees. Between 1982 and 1987 the total number of independent metal finishers employing less than 20 employees declined slightly, while those employing 20 employees or more increased by a corresponding amount.

Exhibit 4.3-2

ESTABLISHMENT SIZE DISTRIBUTION IN SIC 3471

	1982		1987	
Number of Employees	Number of Establishments	Value of Shipments (millions of dollars)	Number of Establishments	Value of Shipments (millions of dollars)
1-4	1,006	$ 92.2	943	$ 100.6
5-9	745	$ 206.6	706	$ 228.1
10-19	801	$ 396.0	759	$ 500.6
20-49	638	$ 815.8	719	$1,100.2
50-99	191	$ 605.6	233	$ 924.6
100-249	61	$ 481.1	80	$ 732.0
250-499	7	$ 134.0	8	$ 280.7
500-999	1	(D)	3	(D)
Totals	3,450	$2,731.3	3,451	$3,866.8

Source: Census of Manufacturers: 1982, 1987.

(D) - withheld to avoid disclosing data for individual companies; data are included in higher level totals.

[5] Taken from the brochure "Understanding Surface Finishing," published by the National Association of Metal Finishers (NAMF), Chicago, Illinois.

Captive metal finishers are integrated into a larger manufacturing operation. These establishments, which both manufacture and finish products, are classified according to their end products and, therefore, are not listed under SIC 3471. Estimates indicate that there are approximately 10,000 captive finishing operations in the United States.

Although the metal finishing industry is geographically diverse (in 1987, 35 states employed 150 or more people in SIC 3471; total employment was 71,100 persons), the industry is heavily concentrated in what are usually considered the most heavily industrialized regions in the United States. This geographic concentration occurs in part because small metal finishing facilities often find it cost-effective to be located near their customer base.

Waste Streams

Air emissions, wastewater effluent, and solid waste are all produced during the metal finishing process. These wastes predominantly result from (1) the use of organic halogenated solvents, ketones, aromatic hydrocarbons, and acids during the surface preparation stage; and (2) the use of metals (primarily present in the form of dissolved salts in the plating baths) in the surface treatment stage of the process. Cyanide, used widely in copper plating baths, is also a pollutant of concern.

The top 25 chemicals in the TRI database for SIC 3471 from 1987-1990 (ranked in order of decreasing release quantities) constitute the following categories, with the TRI rankings given in parentheses.[6]

- Acids:
  - Sulfuric acid (1)
  - Hydrochloric acid (2)
  - Nitric acid (7)
  - Phosphoric acid (17)
- Solvents:
  - 1,1,1-Trichloroethane (3)
  - Trichlorethylene (6)
  - Dichloromethane (methylene chloride) (9)
  - Tetrachloroethylene (13)
  - Methyl ethyl ketone (15)
  - Toluene (19)
  - Xylene (21)
  - Acetone (25)

[6] The list contains only 22 chemicals. Sodium sulfate (5) and aluminum oxide (18) were delisted from EPCRA Section 313 in 1988 and are no longer reported to TRI; sodium hydroxide (4) was delisted in 1989.

- o Metals: Nickel compounds (8)
  Zinc compounds (11)
  Chromium compounds (12)
  Zinc (14)
  Nickel (16)
  Copper (20)
  Chromium (22)
  Copper compounds (23)
- o Cyanide: Cyanide compounds (24)
- o Other: Freon 113 (10)

This TRI database ranking is by total release and transfer, without regard to risk to human health. In addition to the chemicals noted above, several SIC 3471 substances listed in the TRI database have National Fire Protection Association Health ratings of 3 or 4, which indicate a high level of risk to human health.

Metal finishers are required to control, treat, and reduce their wastes. Firms in SIC 3471 had annual capital expenditures of approximately $40 million for pollution abatement for the years 1989 through 1991. This amounts to greater than 20% of the total capital expenditures for the industry. Exhibit 4.3-3 breaks down the pollution abatement costs by media.

Exhibit 4.3-3

POLLUTION ABATEMENT CAPITAL EXPENDITURES
(millions of dollars)

		Air		Water		Solid Waste	
Year	Total Expenditures	End of Line	Changes in Production Processes	End of Line	Changes in Production Processes	Hazardous	Non-Hazardous
1989	$44.9	$2.9	$1.0	$18.7	$6.3	$8.5	$7.5
1990	$34.7	$2.7	$0.7	$19.2	$5.0	$5.4	$1.7
1991	$42.1	$8.3	$3.1	$19.7	$7.9	$2.9	$0.2

Source: Census of Manufacturers: 1989, 1990, and 1991.

Regulatory Framework

Three major pieces of federal legislation regulate releases and transfers from the metal finishing industry: (1) the Clean Air Act as amended in 1990 (CAAA); (2) the Clean Water Act (CWA); and (3) the Resource Conservation and Recovery Act (RCRA).

Clean Air Act

The Clean Air Act, as amended in 1990, established a list of 189 hazardous air pollutants (HAPs). Of the 56 SIC 3471 substances reported in the TRI database for 1990, 33 are included on the list of HAPs. Under the CAAA, Congress required EPA to identify major and area source categories associated with the emission of one or more listed HAPs. To date, EPA has identified 174 categories of sources. Congress also required EPA to promulgate emission standards for listed source categories within 10 years of the enactment of the CAA amendments (by November 15, 2000). These standards are known as National Emission Standards for Hazardous Air Pollutants (NESHAPS).

EPA is currently working on two NESHAPs that will directly affect the metal finishing industry. A summary of these two activities follows.

1. NESHAP: Chromium Electroplating

The chromium electroplating process emits a chromic acid mist in the form of hexavalent chromium (CR^{+6}) and smaller amounts of trivalent chromium (Cr^{+3}). Human health studies suggest that various adverse effects result from acute, intermediate, and chronic exposure to hexavalent chromium. As a result, EPA has proposed a NESHAP (58 FR 65768, 12/16/93) for chromium emissions from hard and decorative chromium electroplating and chromium anodizing tanks.

These standards propose to limit the air emissions of chromium compounds in an effort to protect public health. The proposed regulation will be a Maximum Achievable Control Technology (MACT) based performance standard that will set limits on chromium and chromium compounds emissions based upon concentrations in the waste stream (e.g., mg of chromium/m^3 of air).

EPA holds that these proposed performance standards allow a degree of flexibility since facilities may choose their own technology as long as the emissions standards (established by the MACT) are achieved. The proposed standards differ according to the sources (e.g., old sources of chromium emissions will have different standards than new ones), thereby reducing the standards' rigidity also through the recognition of diverse sources.

2. NESHAP: Organic Solvent Degreasing/Cleaning

EPA has also proposed a NESHAP (58 FR 62566, 11/29/93) for the source category of halogenated solvent degreasing/cleaning that will directly affect the metal finishing industry. This proposed standard aims at reducing halogenated solvent emissions to a MACT-equivalent level, and will apply to new and existing organic halogenated solvent cleaners (degreasers) using any of the HAPs listed in the CAAA. EPA is specifically targeting vapor degreasers that use the following HAPs: methylene chloride, perchloroethylene, trichloroethylene, 1,1,1-trichloroethane[7], carbon tetrachloride, and chloroform.

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[7] Under the Montreal Protocol, a ban on the production and importation of 1,1,1-trichloroethane will go into effect on January 1, 1996.

This NESHAP proposes to implement a MACT-based equipment and work practice compliance standard. This would require that a facility use a designated type of pollution prevention technology along with proper operating procedures. However, EPA has also provided an alternative compliance standard. Existing operations, which utilize performance-based standards, can continue in place if they can be shown to reach the same limit as the equipment and work practice compliance standard.

Clean Water Act

The Clean Water Act regulates the amount of chemicals/toxics released by industries via direct and indirect wastewater/effluent discharges. Regulations developed to implement this Act establish effluent guidelines and standards for different industries. These standards usually set concentration-based limits on the discharge of a given chemical by any one facility. If a facility is discharging directly into a body of water, then it must obtain a National Pollution Discharge Elimination System (NPDES) Permit. However, if a facility is discharging to a POTW, then it must adhere to the specified Pretreatment Standards. In addition, specific state or local conditions may require more stringent treatment or pre-treatment requirements than those provided by the effluent guidelines.

Currently, congress is considering a bill to reauthorize the Clean Water Act.[8] In addition to the reauthorization, the effluent guidelines and standards for Electroplaters (40 CFR Part 413) and Metal Finishers (40 CFR Part 433) are currently under review. These guidelines were promulgated in the 1970s and amended in the 1980s. EPA is scheduled to present an options paper reporting the findings of this review sometime in the Spring of 1994.

EPA is also currently developing effluent guidelines and standards for a related industry, the Metal Products and Machinery Industry (40 CFR Part 438), which are due by May 1996. Although this industry contains only cleaning and finishing operations as captive processes, it appears that EPA will integrate new regulatory options for metal finishing industry processes (SIC 3471) into this guideline.[9] Under this scenario, any effluent guidelines for Electroplaters and Metal Finishers would most likely reference appropriate sections of the guideline for the Metal Products and Machinery industry. It is unclear, however, how "job shop" operations, which are not part of the Metal Products and Machinery industry, would be covered under this scenario.

Resource Conservation and Recovery Act

Solid waste sludge is one of the waste products created during the metal finishing process. The Resource Conservation and Recovery Act classifies these wastes and requires certain methods for treatment, storage, and disposal under each of these classifications.

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[8] One bill (S.1114) is being proposed by Senator Max Baucus (D-Montana) and Senator John Chafee (R-Rhode Island).

[9] Taken from "Finishing Line" the newsletter of the NAMF, Vol. 15, Issue VI, p. 5.

A material is classified under RCRA as a hazardous waste if the material meets the definition of solid waste (40 CFR 261.2), and that solid waste material exhibits one of the characteristics of a hazardous waste (40 CFR 261.20-24) or is specifically listed as a hazardous waste (40 CFR 261.31-33). A material defined as a hazardous waste is then subject to Subtitle C generator (40 CFR 262), transporter (40 CFR 263), and Treatment, Storage, and Disposal Facility (TSDF) (40 CFR 254 and 265) requirements.

Within RCRA Subtitle C, EPA has subcategorized hazardous wastes from non-specific sources in a series of "F" listings. F-listed hazardous wastes which may be relevant to the electroplating industry are identified in Exhibit 4.3-4. In November of 1992, EPA promulgated revisions to the treatment standards for spent solvents (F001-F005) and electroplating wastewater treatment sludges (F006). The new revisions concerning F006 encourage recycling the metals in the sludge by allowing chromium and/or nickel-bearing electroplating F006 sludges in high-temperature metal recovery units to meet land ban requirements.

There are two reform initiatives being proposed for RCRA which will have an effect on the metal finishing industry:

(1) **The Hazardous Waste Identification Rule (HWIR)**

As of April, 1992, there were two proposals for hazardous waste identification. The first proposal, CBEC, contained approaches that were health-based, technology-based, and based upon contingent management. The second proposal, ECHO, consisted of expanding the use of hazardous characteristics.

Under this proposed rule, those units that managed wastes prior to implementation will escape Subtitle C requirements only if there is no on- or off-site contamination. TSDFs would not be subject to Subtitle C if all of their units and wastes met the CBEC or ECHO levels. This will ensure significant cost savings for those individual waste streams that will no longer have to be managed as hazardous wastes.

Currently, an EPA working group is trying to develop a series of delisting standards for RCRA hazardous waste streams that can be universally applied. In other words, if certain requirements (i.e., concentration-based standards) were achieved for a given waste, then it could be removed from the RCRA hazardous waste management system.

(2) **The Definition of Solid Waste**

The EPA and industry representatives are currently negotiating over the definition of solid waste (specifically hazardous waste). This definition will affect how wastes are classified, which in turn determines how that waste can be handled. Industry is urging EPA to reduce regulatory requirements of solid waste if specified waste management and recycling standards are achieved.

Exhibit 4.3-4

HAZARDOUS WASTES FROM NONSPECIFIC (F LIST) SOURCES RELEVANT TO THE METAL FINISHING INDUSTRY

EPA Hazardous Waste No.	Hazardous Waste
F001	Halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of 10% or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F002	Spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, one or more of the above halogenated solvents or those listed in F001, F004, F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F003	Spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of 10% or more (by volume) of one of those solvents listed in F001, F002, F004, F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F004	Spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.
F005	Spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of 10% or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvents mixtures.
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc, and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.
F007	Spent cyanide plating bath solutions form electroplating operations.
F008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.
F010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.
F012	Quenching waste water treatment sludges from metal heat treating operations where cyanides are used in the process.

Key Industry Characteristics and Trends

During the course of our discussions with industry members, trade association representatives, and industry experts, we began to focus on a set of key industry and firm characteristics and trends that may influence a company's decision-making process with regard to environmental activities.

The balance of this section focuses on these key industry and firm characteristics and trends that influence the decision-making processes within the metal finishing industry. Understanding the role that these key characteristics and trends play in decision-making is a necessary step in the process of developing or revising current and future environmental policies.

We assume that metal finishers will act in ways that maximize profits (by reducing costs and/or increasing revenues) and will choose the least-cost methods of operation, other things being equal. Depending upon firm competencies and market demands, however, different firms within the metal finishing industry may choose different business strategies (and different environmental strategies).

For example, one firm may adopt a high quality strategy in process design or customer service that results in higher revenues and higher costs, while a competitor chooses a low-cost approach that supports price-based competition. Any market may offer room for different competitive strategies and, as we will document, the metal finishing industry has a distinct multi-layer structure that reflects not only a firm's overall business strategy, but also the environmental compliance strategy that is consistent with that business strategy.

This multi-tiered structure is perhaps the single most important industry characteristic that we should understand and research to help develop any new strategy to address environmental improvements in the metal finishing industry. This structural characteristic influences firm behavior and the way firms in the metal finishing industry define their market niche; it results from and influences the firm's commitment to environmental management; it results from and affects a firm's ability to secure financing; and it affects regulatory and enforcement policy-making strategy at the federal, state, and local level.

Although this multi-tiered structure defines the metal finishing industry as a whole, many other factors, both economic and environmental, affect the performance of each individual metal finishing operation. These factors include federal and state regulations and enforcement policies; changes in production technologies; the overall industry structure; barriers to entry and/or exit; and customer requirements. These factors affect environmental performance because they determine how much capital can be invested in environmental improvements and a firm's ability to recover this invested capital from its customers. For the metal finishing industry, the nature and capital intensity of production and environmental technologies, the size of firms, the availability of substitutes for manufacturing inputs, and the price sensitivity of demand for the industry's product are all factors that are likely to affect both environmental and economic performance.

The key metal finishing industry characteristics and trends identified during the course of our analysis are as follows:

- There are approximately 3,500 independently owned metal finishing job shops, mostly small operations with limited capital and personnel; there are also about 10,000 metal finishing operations that are captive within larger manufacturing facilities, often with greater information and other resources than job shops. Based on discussions with industry members, we have grouped metal finishing firms into four distinct tiers, based on their environmental performance, as described below:

  1. Environmentally proactive firms that are in compliance with environmental rules and regulations and are actively pursuing and investing capital in continuous improvement environmental management projects that go beyond compliance.

  2A. Firms that are consistently in compliance, but do not or cannot look for opportunities to improve environmental performance beyond that level (i.e., they do not or cannot move up to Tier 1).

  2B. Firms that would like to consistently be in compliance but are not able to do so (i.e., they want to be at least a Tier 2A firm but cannot achieve that level of performance).

  3. Older firms that want to close operations, but stay in business because they fear the legal consequences of shutting down (i.e., "good people, bad managers").

  4. Out of compliance "outlaw" firms that are not substantial competitors but pull down the reputation of the industry; the panel members agreed that regulatory and enforcement policies are designed for firms in this tier but are applied to upper-tier firms.

  The larger manufacturing units in which captive facilities are contained also can be grouped into some form of a quality-based tiered structure. It seems logical to conclude that the quality of the metal finishing operations within these manufacturing operations will tend to mirror the quality of their parent facilities.

- Chemical suppliers play a key role in the product life-cycle and influence the environmental performance of platers (especially job shops). Supply firms mirror the four tiers discussed above with respect to their own efforts at developing products that are "safer" environmentally. Upper-tier suppliers recognize the need to sell "know-how" in addition to product, realizing that upper-tier metal finishers are aggressively looking for substitute products and processes that are less toxic and create less waste.

Some upper-tier suppliers appear to be moving away from their historical sales commission incentive systems and toward a system that rewards sales of new, proprietary, and environmentally safer products. These same suppliers are also investigating profit-sharing relationships with more progressive metal finishers that want new products and/or are willing to try new products. This form of risk-sharing can provide benefits to both users and suppliers.

- Several trade associations play key roles in this industry, although membership is generally limited to Tier 1 and 2 firms. These firms take pride in their environmental record, arguing that major environmental benefits have been achieved and that lower-tier firms give the entire industry a bad name.

- Metal finishers view themselves as a service industry, responding to customer specifications and demands for quality products which, in some instances, limit their environmental options. The industry is geographically concentrated in regions that are highly industrialized. Competition tends to be focused within regions; high transportation costs and customer service requirements make it necessary, in general, for metal finishers to be located close to their customers.

- The job shop segment of the metal finishing industry seems to be relatively stable. The effect of the decline in overall U.S. manufacturing on the independent job shops appears to have been balanced by cutbacks among some of the remaining manufacturers who are eliminating their captive metal finishing operations. The service formerly provided by these captives is being subcontracted out to the independents. In addition, the decline in what were historically strong markets for the metal finishing industry (e.g., defense and aerospace), has been offset by growth in such industries as electronics and communication.

- Cleaner technologies and products already exist as the result of extensive EPA/trade association cooperation on product and process technology development and technology transfer.

- Waste streams are spread relatively evenly across three media (air, water, and solid waste). Accordingly, permitting and reporting requirements are broader and more complicated than if waste streams were concentrated in one media. Uncertainty about future regulatory actions for all three media further complicates the situation.

4.3.2 Drivers and Barriers

As discussed in Chapter 2, our goal is to understand the factors that motivate an organization's behavior with respect to investments that result in improved environmental performance. To that end, the following list contains the most significant drivers and barriers to

improved environmental performance at each of the four tier levels which have been discussed during the course of our work with industry representatives and others familiar with the metal finishing industry:

1. Top firms are driven by recognition and pride in industry performance. They see the economic payoffs of strategic environmental investments and contend that flexibility in compliance would promote innovative approaches and increase their willingness to help other firms.

2. Regulatory compliance is a strong driver for firms in this large middle tier. Barriers to proactive performance include a lack of capital and information, a lack of positive reinforcement, and a "non-level" enforcement playing field. Some job shops at this level are dependent on suppliers for ingredients and process recipes that restrict their willingness and/or ability to undertake environmental improvement activities.

3. The old, outdated shops have a strong fear of liability, and have little interest in improving since they lack capital, information, and even space to do so. The firms in Tiers 1 and 2 have an incentive to help close these firms down rather than work to raise them to a higher tier.

4. The renegade shops have no incentive to improve; they do not fear enforcement because they are difficult to track down. These firms profit by undercutting top tier firms.

Some metal finishers (Tier 3 and some Tier 4 firms) may have a perverse incentive to remain operational, even in the face of disappearing profitability, due to potentially high environmental clean-up costs associated with shutting down and liquidating a business. These facilities, though operational, are not making any additional capital investments to improve environmental performance. Since they lack internal capital and cannot secure external financing to fund cleanups, these firms continue to pollute and represent a significant barrier to entry for cleaner, more efficient firms that may have higher costs in the short term.

Drivers and barriers that are more generally applicable to some or all of the tiers are as follows:

- Regulatory compliance and/or enforcement actions are the primary drivers of environmental decision-making in the metal finishing industry, particularly for the independent firms. However, many job shops lack the personnel and capital resources to look beyond baseline compliance. Liability concerns often are a barrier to obtaining loans for capital improvements.

- New, more environmentally safe product development by suppliers is driven both by the metal finishing industry (in search of lower operating costs) and the suppliers (in search of product niches and avenues to sell know-how). There continues to be, however, a lack of understanding of the metal finishing process on the part of many metal finishers and a reliance on their suppliers to provide the right recipe. Suppliers, for their part, may be reluctant to suggest environmentally proactive process or product changes because it may mean lower product sales, at least in the short term.

Any resistance on the part of customers (e.g., military purchasers) to change product quality specifications to allow for the use of environmentally safer products by metal finishers can provide a barrier to the adoption of these products. Given the right set of regulatory and/or market-based incentives (e.g., user/discharge fees on toxics use/disposal, tax incentives for investment in waste minimization, source reduction, and product substitution equipment), however, this barrier can be removed.

- Uncertainty about future regulatory activity and the effect this activity may have on plant operations inhibits long-term planning/investment and beneficial risk-taking. In addition, inconsistency in existing regulatory requirements and enforcement actions at the federal, state, and local level creates uncertainty at the very least and, at worst, competitive imbalances throughout the industry. All of this creates distrust of EPA and the states, and inhibits meaningful communication.

  For example, the proposed effluent guidelines and standards for the metal finishing industry could leave little flexibility to accommodate the differences between the two types of metal finishing operations (captive and independent). It has been indicated that the effluent guidelines and standards for electroplaters and metal finishers will be incorporated into the effluent guidelines and standards of the metal products and machinery. The unique characteristics of independent "job shop" operators could be overlooked if focus is put upon the captive operations that are part of the metal products and machinery industry.

- Some industry representatives indicated that regulations are not based on good science. Rather, they reflect a compromise among all the stakeholders, often resulting from a lack of a comprehensive understanding of the true risks involved with the use of many processes and substances. This lack of understanding may create interest in banning the use of a potentially harmful substance, and replacing it with what is thought to be a more benign substance. Substituting one type of plating process, chemical, and/or cleaning process with what are apparently better processes or chemicals may merely shift the environmental control problems from one media to another. Existing chemicals and processes, if understood and controlled, can in fact result in less environmental effects than a substitute.

- From the industry's perspective, the regulatory burdens to environmental improvement result from (1) RCRA permitting standards and hazardous waste definition (barriers to recycling and recovery); (2) Superfund *de minimus* standards (barrier to obtaining loans and to old shops shutting down); and (3) interpretations of CWA §§ 413 and 433 effluent guidelines.

- Military specifications continue to require the use, at least indirectly, of environmentally harmful products and processes, even though environmentally safer substitute products and processes are available. The apparent high cost of making such changes is cited as a reason that changes are implemented slowly.

- A large number of metal finishing firms face significant environmental liabilities and clean-up costs if they discontinue operations and attempt to liquidate their business. This potential liability, in addition to creating a barrier to exit for these firms, effectively eliminates any access to outside capital sources for these firms.

- Lower-tier firms are not active in trade association activities and are not aware of changes in product/process technology. They are also unaware of inexpensive, cost-effective changes that can be made to improve environmental and financial performance. Moreover, these firms often lack any incentive to change because any existing environmental liabilities may continue to overwhelm their ability to pay for remediation.

- There are significant research and development activities underway by industry (e.g., AESF), EPA, and other federal departments and agencies. These efforts to develop new metal finishing processes to achieve source reduction can serve as a driver to some firms to improve performance. However, the lack of information or capital to implement improvements can, as noted above, impose a barrier to improvements by other firms.

4.3.3 Possible Policy Options

EPA can consider a number of possible policy options to promote desired changes within the metal finishing industry. These options range from increased regulatory and enforcement activities concentrated on certain segments of the industry, to regulatory reform, to market-based approaches such as fees, taxes, and tax incentives. EPA will continue to keep two objectives in mind as it evaluates the different available options: (1) EPA must consider the characteristics, needs, and problems specific to each of the four tiers identified in the metal finishing industry and must consider the interactions between tiers; and (2) the agency will continue and expand its initial efforts to get its regional offices, the states, NGOs, and local POTW authorities involved in the process.

Second Expert Panel Meeting

Representatives at the second panel meeting on March 11, 1994 discussed and evaluated the many possible policy options that had been suggested during the course of this project and identified a few options with the greatest potential for removing the most significant barriers or providing the greatest incentive to sustained environmental improvement in the metal finishing industry. These selected options provide the focus for ongoing work in the next phase of this project. A complete list of the many policy options identified during the project is included as Appendix 4-B to this chapter.

The panel recognized the importance of the tiered structure of firms in the metal finishing industry and identified general policies that should be pursued within specific tiers. For example, some panelists noted that many regulations were written with the problems of Tier 4 firms in mind, but were applied almost exclusively to Tier 1 and 2 firms. The panel also concluded that there were a number of general issues relevant for all tiers within the industry that also should be pursued during the next phase of the project. The panel evaluated the list of options using the following selection criteria. Options should:

- o Promote "cleaner" environmental performance -- have a significant environmental payoff;
- o Identify "cheaper" solutions to environmental problems -- promote cost-effectiveness;
- o Promote innovative and more effective ("smarter") actions by EPA, states, and the industry;
- o Have the capacity to affect long-term thinking and action toward sustainability;
- o Be feasible, considering the length of time required for completion, the method of implementation, the size of the relevant audience, impact and importance, and the effectiveness of EPA as a player; and
- o Encourage cooperative involvement in the project among a variety of stakeholders.

The panel also noted that the metal finishing industry, largely through its trade associations, was currently working cooperatively with several offices at EPA, providing technical support on proposed policies and programs. Among these cooperative projects are the following:

- o Development of the RCRA Hazardous Waste Identification Rule: Industry representatives (especially NAMF) are involved in ongoing dialogue with EPA's Office of Solid Waste to expedite delisting of F-006 waste and thereby promote greater recycling/reclamation of waste treatment residuals.
- o Development of the Metal Products Effluent Guidelines (MP&M): Industry representatives (including NAMF) are providing comments on the proposed Phase 1 guidelines; industry also will participate in Phase 2 development and in CWA reconsideration of §§ 413 and 433 effluent guideline standards.
- o Development of Clean Air Act MACT Standards for Chromium Electroplating and Anodizing: Industry representatives are participating in the MACT development and review process; productive dialogue to date; key comments seem to be focused on associated monitoring requirements.

The panel endorsed these efforts along with the cooperative research activities being conducted by the federal government and the industry.

A majority of the meeting was spent discussing the tiered structure of the industry and increasing our level of understanding of the types of firms that are found within each of the four tiers and the drivers and barriers that are unique to each tier. We also discussed more general drivers and barriers that are relevant to all four tiers. The panel evaluated various policy options using the selection criteria listed above, but also devoted considerable discussion to understanding the differences between firms in the four industry tiers and the existing drivers and barriers to movement up the hierarchy from lower to upper tiers. We believe therefore that part of the Phase 2 work should initially focus on defining the criteria for placement into a tier and on identifying incentives that EPA and the states could provide to encourage movement from tier to tier. This effort could then progress to a further development of specific action steps for each tier. The remainder of the Phase 2 work should focus on studies that are important to all firms in the metal finishing industry.

The following sections describe each of the tier-specific and industry-wide issues that will provide the basis for ongoing work in Phase 2 of this project. We have included some suggestions in each section to provide some initial focus in Phase 2 work. We believe that these suggestions address the priorities of all the various stakeholders in the metal finishing industry. The tiered structure is a new way to look at the metal finishing industry and the various stakeholders are still trying to understand the basic dynamics of such a structure. Phase 2 work should contribute to this understanding as well as help remove some of the barriers to environmental improvement for this industry.

Metal Finishing Industry Policy Options for Tiers 1 - 4

One panel member described the regulatory and enforcement programs for the metal finishing industry as policies that were implemented to control Tier 4 firms but have instead been used to control Tier 1 and Tier 2 firms. This, in conjunction with the need to encourage firms to move up the tiered hierarchy, constitute important conclusions and observations from the first phase of this study. Attempts to regulate the activities of the worst polluting facilities that have slipped out of the regulatory/enforcement net have instead resulted in the over-regulation of the firms in Tiers 1 and 2. This over-regulation has resulted in higher compliance costs for upper-tier firms and an increased fear of enforcement activities, coupled with a high level of uncertainty about the nature and effect of future regulatory actions. Regulators, the panelists contend, tend to place unnecessary burdens on large point sources since they cannot deal adequately with nonpoint sources of pollution.

The tier-specific discussion at the panel meeting focused on lowering the regulatory burden placed on upper-tier firms and on eliminating both the short-term and long-term problems associated with the lower tier firms. A key goal of proposed policies would be to help Tier 1 firms move to higher levels of environmental protection and encourage 2A firms to move up to tier 1, and Tier 2B to Tier 2A. The discussion was complicated, however, by a lack of explicit understanding of the criteria for inclusion in Tiers 1 or 2. As discussed later in the section on more general issues, a commitment to and implementation of Best Management Practices (BMP) for the metal finishing industry can be used as a criteria for movement from a lower to an upper tier. The following subsections describe the issues specific to each of the four tiers in the metal finishing industry.

Tier 1 and Tier 2

Tier 1 metal finishing firms are characterized as environmentally proactive firms that are actively pursuing and investing capital in strategic environmental management projects. They are driven by recognition and pride in industry performance and see the economic payoffs of strategic environmental investments. Tier 2 (A and B) firms are characterized as environmentally conscious but less proactive firms that are limited in their ability or desire to actively pursue strategic environmental management practices due to lack of capital or other factors. Uncertainty about the nature and timing of future regulatory activity also contributes to the conservative strategy pursued by these firms. Regulatory compliance and fear of enforcement are the primary drivers for firms in Tier 2; barriers to improvement include lack of capital and information, and inconsistent enforcement activities that create a non-level playing field.

A major problem, however, at least for the panel members, is the lack of criteria for identifying membership in Tier 1. Most panel members believe that the Tier 1 firms are most likely small, high-tech firms. This would include captive plating operations that are relatively small, both in terms of throughput volume and value-added. The one captive metal finishing representative at the panel meeting characterized his firm as a Tier 1 facility. He had been able to implement environmental projects with a longer payback than specified in company guidelines because of the longer-term view held by management. The two independent metal finishing representatives at the meeting characterized their firms as being in Tier 2. Although both felt that their facilities were in compliance and they had invested in pollution prevention and end-of-pipe technologies, they were driven by a fear of enforcement rather than by some other sustainable philosophy.

The problem of defining Tier 1 and Tier 2 membership requirements can be resolved two ways. First, the development of industry Best Management Practices should focus on the criteria for inclusion in the top tier, as well as the criteria for continued membership. Eligibility for continued membership in Tier 1 should require a commitment to the full set of Best Management Practices and a commitment to and demonstrated success in continuous environmental improvement. The minimum requirements for Tier 2 membership should be complete regulatory compliance and a commitment to some appropriate subset of the industry Best Management Practices. Second, continued involvement by the stakeholders in an ongoing dialogue sponsored by EPA should lead to an additional understanding of the metal finishing industry with respect to the differences between Tier 1 and 2 firms and the requirements for membership in Tier 1.

What incentives are there or can be put in place to induce Tier 2 firms to move up to Tier 1? Tier 2A firms are technically in compliance and EPA can drive continued environmental improvement through regulatory actions designed to reduce the level of discharges from the metal finishing industry beyond current levels. The objective of the Sustainable Industry Project, however, is to facilitate continued voluntary environmental improvement on the part of the metal finishing industry because it makes good business sense to do so. EPA must try to remove the barriers that currently inhibit the movement from lower tiers to upper tiers, and provide incentives for firms to move up the hierarchy.

One method for removing barriers would be to lower the compliance costs for Tier 1 firms from what is estimated to be 7 to 10 percent of total costs to 2 to 5 percent of costs. Tier 1 firms would also need to make a commitment to provide a certain amount of technical assistance to lower-tier firms. Obviously, penalties for Tier 1 firms that are found to have not met their commitments should be severe.

EPA can lower the compliance costs for Tier 1 firms in a number of ways, including: using electronic reporting; requiring less frequent sampling of waste streams; eliminating some reporting requirements; implementing longer permit periods with fewer inspections; and implementing an even-handed enforcement policy that focuses on the environmental renegades and places more importance on discharge violations rather than paperwork violations. In effect, EPA will be trading a greater level of trust for continued environmental excellence. The states and the POTWs will be very important stakeholders in this program and should be involved in every step of its development process.

EPA can create additional incentives to attain Tier 1 status by linking Tier 1 status with membership in some form of an environmental leadership program. EPA should examine the applicability of ideas used in OSHA STAR and other "incentive" programs to this effort. This leadership program could attempt to reward environmentally progressive firms by helping the best firms gain access to financial resources; either through outside lending institutions or through financial assistance made available by EPA in the form of loans and/or grants. It may also be possible to link membership in this environmental leadership program with access to U.S. government agency metal finishing contract work (e.g., DOD). One additional incentive that EPA could consider is access by Tier 1 firms to an expedited delisting process for any RCRA listed waste streams that are eligible for delisting.

It will be important to determine whether the investments required to upgrade to Tier 1 status are disproportionate to the rewards associated with Tier 1 status. To help avoid this, EPA could consider assisting Tier 2 firms with their capital requirements through access to zero or low-interest loans or grants. Qualification for these funds would require passing an environmental audit, making a commitment to follow the set of industry Best Management Practices required for Tier 1 status, and developing a business plan that would commit the money to specific projects focused on doing what is necessary to attain Tier 1 status. EPA can improve the willingness of Tier 2 firms to invest their own capital in environmental improvements by reducing the uncertainty associated with future regulatory requirements. One way to accomplish this is to create a credit system for improvements made independent of regulatory requirements; this would eliminate the fear that technology improvements may be rendered obsolete by future regulatory requirements.

The second panel concluded that economic benefits would accrue to Tier 1 and Tier 2 firms as well from the implementation of policies and programs specific to Tier 3 and Tier 4 firms. The development of any tier-specific overall policy strategy should take into consideration the importance of linking tier-specific policies within a coherent framework to maximize benefit transfer from tier to tier. The following subsections discuss the possible policy options for Tier 3 and Tier 4 firms that the panel felt would, on balance, strengthen the metal finishing industry.

Tier 3

Tier 3 metal finishing firms are characterized as companies that are not environmentally proactive firms and which face severe financial limitations. These firms may want to go out of business but won't because of liability concerns from wastes generated by past (and in some cases, current) operations. These old, outdated shops have a strong fear of liability; they cannot improve

their environmental performance due to a lack of capital, information, and frequently, space. There was a strong consensus among the second panel industry members that a significant number of firms in Tier 3 exist.

The panel essentially concluded that while exit for these firms may be viewed as a short-term negative because of the loss of jobs and the costs associated with site cleanups, in fact the loss of these Tier 3 firms is a long-term positive because the jobs should be transferred to Tier 1 and Tier 2 firms that capture the business and because site remediation that is started now will prevent worse, more costly problems in the future (i.e., a pollution prevention benefit). In addition, the firms higher in the hierarchy operate in a more environmental sensitive manner, producing less pollution.

What is the best way to facilitate exit for those Tier 3 firms? The fear of disclosure and subsequent reprisal must be eliminated so that Tier 3 firms will come forward. It should not be difficult to find these firms; most are visited regularly by enforcement officials keeping tabs on their operations. The danger from EPA's and the states' perspective in following such a strategy is that the number of firms that come forward may far outweigh the agency's ability to either commit funds to initiate facility closure and cleanup or to provide investment capital to make process improvements. A necessary first step is to compile information on the population of metal finishers within the particular geographic area under consideration to provide a first cut assessment of the scope of the problem. Enforcement offices, trade associations, POTWs, and NPDES permit monitoring offices should be able to provide a wealth of information.

For those Tier 3 firms that choose an exit strategy under this proposed amnesty program, EPA and the states need to commit the necessary resources to conduct a site evaluation to determine the nature and extent of any environmental problems, to evaluate the risks associated with those problems in order to prioritize remediation alternatives, and to determine the level of cleanup required commensurate with future use alternatives for the site. One possible approach might include, in exchange for some degree of amnesty granted under this program, a commitment from a facility to take an active leadership role in shutting down the facility and in completing any remediation work at the site before it could be sold. However, this amnesty must not completely remove a firm from liability nor remove its responsibility for cleanup. In addition, deed restrictions on the use of the site appropriate for the level of remediation completed should be put in place for the facility prior to sale and/or alternative use.

There are a number of unresolved issues with such a program. First, the regulatory agencies must be willing to commit financial resources to facilitate any site remediation work that is required. Second, these same agencies must attempt to answer the question of "how clean is clean" for each site based on the projected future use of the site. Finally, the owner of the facility must be actively involved in site remediation that may include on-site treatment. The owner has a detailed understanding of the processes used at his/her facility; this individual should be able to make a valuable contribution to site cleanup.

Tier 4

Tier 4 metal finishing firms have been characterized as not environmentally proactive firms that are likely not in compliance with environmental regulations. These firms price their services below Tier 1 and Tier 2 firms, creating a competitive disincentive for more proactive firms to

continue to invest in proactive environmental strategies. These renegade shops are difficult to find -- they are probably operating without permits and do not report discharges. They have no incentive to improve and do not fear enforcement because they are difficult to track down. They profit by having a lower cost structure which undercuts upper-tier firms.

The second panel concluded that the major issue with Tier 4 firms is not that they represent a significant competitive force within the metal finishing industry, but that they give the overall industry a bad name and create additional pressure on upper-tier firms with respect to enforcement actions and regulatory/reporting requirements. There is an over-regulation of upper tier firms to compensate for the inability of regulatory agencies to alleviate the problems caused by Tier 4 firms and because of a possible misunderstanding of the industry as a whole. There was a recognition by the panel members that the extent of the environmental problems associated with the Tier 4 firms is largely unknown. They felt, however, that this should not be a deterrent to an increased focus on this sector of the industry.

The panel concluded that finding and eliminating Tier 4 firms should be a priority. To help accomplish this, it may be necessary to redirect agency and state resources currently focused on monitoring and enforcement of upper-tier firms to identifying Tier 4 firms. Some suggested that enforcement policies could be directed away from targeting upper-tier firms. Finally, POTWs should be granted increased flexibility, the panel noted, in inspection, sampling, and enforcement requirements. Presently, POTWs must inspect and sample every facility at least once per year and are required to enforce paperwork violations with the same vigor as discharge violations. POTWs can improve their monitoring capabilities and identify more Tier 4 firms if they have the flexibility to use their monitoring equipment to find these firms rather than sampling the effluent of the known Tier 1 and Tier 2 firms.

A significant unresolved issue concerns the environmental liabilities and cleanup costs associated with shutting down Tier 4 firms. The feasibility of designing programs for Tier 4 firms that are similar to those proposed for Tier 3 firms was not pursued by the panel and should be a topic for further consideration.

General Metal Finishing Industry Policy Options

The second panel also discussed three possible non-tier-specific policy options that were felt to be important with respect to drivers and barriers in the metal finishing industry. The issues addressed by these policy options are (1) the need to develop Best Management Practices for metal finishing facilities; (2) the inconsistencies in standard setting, permit review, administration, and enforcement activities at the state level; and (3) the extent to which suppliers and customers are the primary drivers of toxics use in the metal finishing industry.

Development of Best Management Practices for The Metal Finishing Industry

The second panel endorsed the idea of an industry-managed effort to develop and implement Best Management Practices for the metal finishing industry. This BMP would be used to develop pollution prevention strategies for the industry and could also be used to provide a roadmap for Tier 2 firms to move up, within the second tier and to Tier 1 status. The panel felt that EPA's role

should be limited to providing financial and administrative assistance to the effort, believing that while it was appropriate for the government to regulate discharges and emissions, it was not necessary or appropriate for government to dictate specific pollution prevention strategies.

In addition to providing a roadmap for lower tier firms to use to progress to the upper tiers, the BMP would also be designed to ensure compliance for any firm that has implemented the BMP at their facility. A commitment to follow the complete set or a subset of the BMP would be required for membership in Tier 1 or Tier 2 respectively. In these respects, a BMP would differ from Good Operating Practices because the latter does not necessarily guarantee success, only that accepted practices are being followed. The BMP would also be designed to drive continuous improvement/waste minimization strategies that Tier 1 firms would be required to commit to as a requisite for continued membership in Tier 1.

The panel also concluded that the BMP, as envisioned, could be used to help the metal finishing industry gain increased access to outside capital for investment in environmental technologies and process changes required for a company to move to a higher tier. The BMP could be used not only to educate lending institutions about the effectiveness of a given technology, but also to alleviate any fear on the part of lenders that a particular technology would have no market value. If it is clear that hundreds, if not thousands, of metal finishing facilities use this technology, then there is a ready market for resale if necessary. Educating lending institutions in this way should be linked to any ongoing efforts to weed out the bad firms in the industry and to reduce the fear factor that inhibits Tier 2 firms from applying for loans.

Eliminating Regulatory and Enforcement Inconsistencies at the State Level

Existing inconsistencies in standard setting, permit review, administration, and enforcement activities at the state level result in higher compliance costs and unnecessary uncertainty about the regulatory process for metal finishing firms. The second panel discussed some of these issues in detail and proposed a number of possible solutions to these problems. Perhaps the most important issue discussed by the panel in this area concerned the non-uniformity of discharge standards at the state and local levels.

In theory, it would be a relatively straightforward task to set uniform national discharge standards and require states (and localities) to justify more stringent standards on a scientific basis. In practice, this task seems difficult if not impossible. States and localities set standards based upon site specific conditions that depend on the number and type of other dischargers and the physical, chemical, and biological characteristics of the environment to which the pollutant is being discharged. The relative contribution to the pollutant loading by non-point sources is an important variable in this equation. If the discharge is to a POTW, the way in which the POTW disposes of their sludge is an important variable the control authority considers in setting standards. The chances that EPA could impinge upon the state's authority in this process are extremely low.

One way in which EPA can help to ensure that the process is scientifically based is through its audit of state programs. EPA must ensure that the states are reviewing technology-based POTW local limits, as well as making a concerted effort to set NPDES discharge levels, in a fair and equitable fashion. One way in which metal finishers may be granted some consideration for having

to meet regulations, more stringent than federal standards, would be to recognize their contribution to reducing the pollutant in complying with the more stringent standards. This compensation could take the form of adjustable water/sewer rates, for example, for discharges to POTWs.

Other issues discussed by the panel included the difficulty associated with obtaining permits and complying with reporting requirements for multi-media discharges from state agencies that are historically organized by media; the disincentive that arises from the requirement that permits must be modified or reissued when process changes are implemented; the lack of enforcement policies that are designed so that penalties reflect the seriousness of the infraction; and the lack of consistent cross-media technical assistance and facility inspection programs. The panel felt that the simplest and most effective solution to these problems is for the states and EPA to develop a multi-media industry-focused perspective, where multi-media service teams trained to provide permit, reporting, and technical assistance to a limited number of industries could assist individual firms with any problems.

In effect, these service teams would become a one-stop shopping resource for all firms within a particular industry. At the very least, these teams would help to ensure consistency throughout a particular industry within a given state, would facilitate technology transfer, and would minimize issues that arise when misapplied pollution prevention programs do not reduce emissions but merely transfer them from one media to another.

Analysis of Customers and Suppliers as Drivers of Toxics Use in the Metal Finishing Industry

The second panel agreed that life-cycle issues related to the use of toxic substances in the metal finishing industry were important with respect to any discussion of drivers and barriers to environmental improvement for this industry. In addition, an assessment of pollution prevention and waste minimization opportunities in the metal finishing industry necessarily requires an analysis of the effects of eliminating the use of toxic substances, either by banning their use outright or by instituting taxes or user fees that would result in a drop in usage.

There are several potentially important issues related to eliminating the use of a particular toxic substance, including the availability and suitability of substitute products; the overall life-cycle, multi-media environmental effects of the substitute compared to the original substance; the effect on the quality of the customer's product; the acceptance of any change by the ultimate consumer of the customer's product; and the ability and motivation of the suppliers to the metal finishing industry to develop and market a substitute product and process. On the other hand, suppliers also need to be concerned about Superfund *de minimis* liabilities that may arise from the continued use of toxic materials.

The panel agreed that the best way to begin to evaluate the issues related to product substitution might be to initiate a pilot project that brings the suppliers, metal finishers, and customers together to assess life-cycle issues related to the continued use of a toxic substance. The panel thought that cadmium might constitute a good candidate for this study since the U.S. Department of Defense was a significant user of cadmium-plated products and the agency moves slowly in approving any changes in product specifications. Another potential pilot project might focus more on a consumer product where it would be useful to analyze the public's reaction to changes in appearance (and perhaps performance) of plated products.

The panel wondered whether EPA was currently funding life-cycle analysis studies and, if so, whether these funds could be redirected. Currently EPA's Design for the Environment program and the President's Council on Sustainable Development are considering life-cycle issues as part of their efforts.

Appendix 4-A

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Appendix 4-A

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Appendix 4-B

ALL SUGGESTED POLICY OPTIONS

Appendix 4-B

ALL SUGGESTED POLICY OPTIONS

The following is a broader list of all the policy options that were discussed throughout the course of this project.

- Consider policies and programs that meet the unique needs of the four tiers of metal finishing firms. Specifically:

  (a) Allow for more flexibility in compliance for Tier 1 companies in exchange for measurable commitments to work toward zero discharge, and to establish and adhere to Best Management Practices for the industry;

  (b) Reduce the uncertainty about future regulations for Tier 2 companies by creating a credit system for improvements made independently of regulatory requirements, and assist these firms in obtaining outside capital through grant and/or loan programs (qualification for these funds would require an environmental audit and a commitment to follow Best Management practices);

  (c) Provide the assistance necessary for tier 3 firms to go out of business without fear of litigation and bankruptcy due to environmental liabilities; and

  (d) Target enforcement activities and more rigid requirements at Tier 4 firms.

The following policies and programs should be considered for all metal finishing industry members.

- Set uniform national standards, and require states and localities to justify more stringent standards, to avoid "cleaner-than-thou" competition that leads to unachievable and unnecessary limits; and require POTWs to target all sources of contaminants, rather than concentrating only on industrial sources that have already been reduced. It is important to recognize, however, that states and localities develop standards based upon the unique set of circumstances that are found within the jurisdiction of a particular POTW. The creation of a level playing field for the industry must take this into consideration. Total costs should be the criteria, not just compliance costs.

- Promote toxics regulations based on sound scientific risk-based approaches; send clear signals to all the stakeholders about relative risks; and avoid bias against existing chemicals while ignoring the potential risks of unknown substitutes. EPA can play a role in educating the general public about the environmental impact of electroplating that will help to eliminate the fear factor that influences the regulatory process. Above all, strive to make the regulations simple to reduce the compliance burden on small companies.

ALL SUGGESTED POLICY OPTIONS

- Expedite the permitting process and create consistency among the states in the permit review process.

- Facilitate the cooperative development of BMP for electroplaters, and trade flexibility in compliance for commitment to these practices for companies with good environmental records.

- Develop an enforcement strategy that is fair and reasonable. Rate companies based upon their performance relative to some defined baseline or benchmark and treat them accordingly. Target initial efforts at Tier 4 firms whose lack of compliance creates a competitive imbalance throughout the industry.

- Recognize positive environmental performance as a good first step toward the creation of a spirit of cooperation and open communication between EPA and the electroplating industry. Any recognition program, however, must be structured in such a way as to accrue the right kinds of benefits to environmentally proactive firms (e.g., improved credit rating and access to capital, and higher sales). EPA must also develop such a program within the context of changing perceptions of the industry.

- Support technology transfer initiatives and environmental audit programs.

- Support tax incentives for investment in waste minimization and source reduction equipment, and support the capitalization of clean-up costs.

- Support use/discharge fees to promote pollution prevention in the electroplating industry (in lieu of environmental audits).

- Strongly encourage changes in the mil specs to require the use, where possible, of environmentally safer products and processes in the electroplating industry.

- Modify RCRA to provide incentives for greater reclamation/recycling of waste treatment residuals and facilitate a move toward zero discharge facilities.

- Investigate further uses of information-based options, such as reporting and public disclosure requirements. Currently, the Toxic Release Inventory is a good example. Using this inventory effectively, specific waste stream trends can be highlighted in a media-specific and/or facility-specific format. Publicly disclosing facilities with poor release practices and trends could serve to motivate facilities to improve environmental performance. Enhanced reporting requirement in the TRI beginning in 1991 (e.g., recycling and

energy recovery) could potentially make this option even more useful. Another example would be if hazardous waset generators were required to disclose their waste minimzation plan to the public. Fear of bad publicity could propel many of the individual generators to improve their waste minimization practice. The EPA is currently considering this requirement.

Appendix 4-C

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APPENDIX 4-C

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