AN ASSESSMENT OF THE FINANCIAL IMPACT OF FEDERAL GUIDELINES ON THE CANADIAN METAL FINISHING INDUSTRY

by

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ERRATA

p. 61 - Table 6.

Under the first column of values (United States):

Cd - Delete 0.1-0.4 (3)
Insert 0.1 (3)

Cr^6 - Delete 0.05
Insert 0.1 (3)

Sn - Delete 1.0 (3)
Insert 1.0

Fluoride - Insert 5.0 (3)

Nitrites - Delete 5-15 (3)

p. 62 - Notes to Table 6.

Note # (1) - Reference should be (4) not (1).

p. 64 - Table 7.

The heading should read "UPPER TAME" not "UPPER THAME".

p. 66 - References.

Reference #4. should read:

Development Document for Effluent Limitations Guidelines and Standards of Performance - Metal Finishing Industry, prepared by Battelle's Columbus Laboratories for the United States Environmental Protection Agency - DRAFT subject to review, January, 1974.

ABSTRACT

This report is an assessment of the ability of the Canadian metal finishing industry to absorb the cost of meeting the Metal Finishing Liquid Effluent Guidelines issued in November, 1977. Capital and operating costs for pollution abatement equipment are given in 1976 values. The increase in capital and operating costs can be estimated at approximately 15 percent for 1978 values. Only noncaptive, independent metal finishing installations have been assessed, on the assumption that captive operations which are only a part of a larger company will be able to meet the requirements with available financial resources.

RÉSUMÉ

Le présent rapport évalue les moyens de l'industrie canadienne d'absorber les coûts d'application des Lignes directrices concernant les effluents des effluents des établissements de finition des métaux, publiées en novembre 1977. Les frais d'exploitation du matériel antipollution et les investissements qu'il nécessite, d'après des prix fixés en 1976, devraient être majorés d'environ 15 p. 100 pour tenir compte des prix en vigueur en 1978. Seules les sociétés indépendantes de cette industrie ont été évaluées, car on suppose que les filiales, qui dépendent de sociétés mères, pourront se conformer aux lignes directrices puis qu'elles disposent des ressources financières voulues.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CONCLUSIONS

Conclusions drawn from a study of the Canadian metal finishing industry conducted in 1975 [1] described the constituents present in wastewater from the industry, and treatment technology used and available for the control of wastewater discharges. A review of those conclusions has indicated that the following comments and revisions are now applicable:

a) Wastewaters from metal finishing plants contain heavy metals, cyanides and other inorganic substances. These constituents enter the effluent stream mainly through dumps, spillages and leaks, and rinse water.

b) These constituents can be present in the effluent at very high concentrations.

c) Most of the constituents are not biodegradable, are persistent in the environment, and tend to accumulate through the biological cycle.

d) Chemical treatment remains the only technology applicable to all metal finishing effluents. The quality of effluent resulting from chemical treatment has not been improved since 1975.

e) Additional treatment methods have not yet been sufficiently developed to improve the quality of the effluent prior to discharge.

f) While centralized treatment still appears to be the best solution for disposing of spent baths and sludges, there has been no significant development in this direction.

g) Two-thirds of the industry still discharges to municipal sewers. The ineffectiveness of treatment at municipal plants requires many such discharges to be regarded as indirect discharges to water bodies.

h) Some new plants are still being installed in Canada with little or no consideration given to pollution control.

i) The cost of applying Best Practicable Technology increased between 1973 and 1976 by one-third for capital cost, and about 40% for operating cost.

j) If all plants, jobbing and captive, were to meet the Federal Guidelines, or in some cases local municipal by-laws, a total capital investment for additional waste treatment equipment of approximately $20,000,000 would be required and operating costs for waste treatment would total between $14,000,000 and $18,000,000 per year.

k) Land and building costs could add an additional $6,000 to $40,000 to the capital cost of each installation.

l) Where liquid sludges generated by chemical destruction of pollutants and other concentrated discharges cannot be disposed of nearby, the dewatering of sludges could add an additional $13,000 to the costs of each installation.

The study described in this report has resulted in the following conclusions:

1) Companies with sales of less than $250,000 and no other financial resources would be unlikely to raise sufficient capital to provide waste treatment equipment to meet all the requirements of the Federal Metal Finishing Effluent Guidelines.

2) If required by authorities to install such equipment, it is likely that such a company would continue operations provided government assistance is available.

3) The financial impact would be much less significant if these small companies were to discontinue dumping practices, adopt good housekeeping practices, and phase in the effluent control over a period of time. Some companies with sales between $250,000 and $500,000 would be able to raise capital if costs were spread over three years but would have to raise prices by 15% to 20%, or operate at reduced profit.

4) Companies with sales above $500,000 would in most cases be able to raise the necessary capital, especially if the costs were spread over three years. Selling prices would have to be increased by 10% to 12%, but this would be possible if their competitors were faced with the same requirement.

5) Fifty percent of the Canadian industry is in the Metro Toronto area where centralized treatment would probably be practical.

6) Two-thirds of the plants in Canada are discharging to municipal sewers. At present, the greatest variation in enforcement of local and provincial requirements occurs where discharge is made to municipal sewer systems. When discharge is made to municipal sewer systems, there is considerable variation in the quality of the eventual discharge to a water body for the following reasons:
    a) absence of sewage treatment facilities;
    b) variation in removal of metals depending on the operating condition of sewage treatment plants and the particular metal concerned;
    c) possibility of by-passing of sewage treatment during heavy rainfall.
7) Eighty percent of the waste treatment equipment now installed in this industry is treating direct discharges to water bodies.
8) Much of the capital and operating costs for the smaller and medium-sized companies would be ameliorated by the availability of a centralized treatment facility nearby.
9) Close supervision of the plants and good housekeeping practices would be necessary to maintain the quality of their effluent.
10) Centralized treatment of sludges and concentrated wastes would reduce capital and operating costs where industry concentration justified such installations.
11) Uniform application of the Federal Guidelines is essential to the survival of some plants, and to cooperation between industry and regulatory agencies.

1. INTRODUCTION

This report is an assessment of the ability of the Canadian metal finishing industry to absorb the cost of meeting the Federal Metal Finishing Liquid Effluent Guidelines and Code of Good Housekeeping Practices issued in November, 1977. Capital and operating costs for pollution abatement equipment are given in 1976 values. It has been estimated that these costs have increased by 15% between 1976 and 1978.

Pro forma profit and loss statements have been drafted in consultation with representatives of the industry and verified by an independent accounting firm.

In approaching this study it was assumed that in nearly all cases where the metal finishing operation was captive and only part of a larger facility, the company can reasonably be expected to meet requirements with available financial resources, or by sub-contracting the work to a metal finishing jobber. It is not expected that a precise dividing line will be found that will determine which companies can succeed and which will not succeed in absorbing the costs of pollution control. Only independant metal finishing installations have been assessed in this study.

The method used includes cost information from reports [2,5] published by the United States Environmental Protection Agency and consultants who have prepared reports for them. This study includes information obtained in interviews with suppliers of pollution control systems, a cross-section of the metal finishing jobbers in Canada, and the knowledge and background of the authors of this report.

2. DESCRIPTION OF THE INDUSTRY

The Canadian metal finishing industry, its processes, flow sheets and the pollutants found in its effluent were described in detail in "Review of the Canadian Metal Finishing Industry" published by Environment Canada in 1975 [3].

The review included a survey made in 1973 that covered over 1000 firms who were or seemed to be part of the metal finishing industry. The results of the survey and other investigations indicated that there were in the vicinity of 325 companies in Canada that fit the description of the industry as set out in the Federal Guidelines for pollution control. These companies employed 7,000 persons and had combined sales in excess of $175,000,000. Of these sales, approximately half were in captive operations, and over 90% of the industry was located in Ontario and Quebec.

While there has been some growth in the industry since 1973 it has been only in the order of 5% per year. The number of employees has not changed significantly because more efficient use of labour has been achieved.

The new Federal Guidelines for the metal finishing industry apply to those companies which are performing such operations as electroplating, electroforming, anodizing, electrochemical machining, electrochemical polishing, electroless plating, chromating, and other technical operations defined in the third edition of the Electroplating Engineering Handbook, by A. Kenneth Graham, Van Nostrand Reinhold Company, 1971.

Technical aspects of this industry were discussed in some detail in "Wastewater and Sludge Control in the Canadian Metal Finishing Industry", a report published by Environment Canada in 1976 [1]. The economic aspects of meeting the Federal Guidelines were also discussed in that document.

The report [1] used 70 companies, all non-captive, as the basis for arriving at costs for waste treatment. This study will use the same basic group of companies with minor adjustments for those that have dropped out of business and a few new entries into the field.

While the great bulk of the work, both captive and jobbing, is done in metal finishing plants with 50 or more employees, there are more than 200 companies with fewer than 50 employees, and over 100 companies with less than 10 employees.

This large variation in size of facilities also indicates a very wide variation in operating skills within the industry. This variation includes simple manual operation of a few processes, and the most sophisticated of programmed automatic plating systems with varied processes and ancillary operations.

The processes themselves range from the simple application of one or two metals for corrosion resistance to precision control of finish and appearance. Metal finishing processes are used in the aerospace, automotive, appliance, furniture, power transmission and aircraft industries, to name a few.

The metal finishing industry is clearly one of the most diversified, varied in skills, and least financed industries in Canada. The jobbing companies are mostly privately owned, and operated by the owner. Many of the captive operations are owned by some of the largest companies in Canada and the United States.

3 PHYSICAL CHARACTERISTICS OF THE INDUSTRY

Two broad classifications of the industry have been identified:

1) captive installations, in which the metal finishing service is for the particular products of a much larger manufacturing facility; and
2) independent job shops who sell their services to a wide variety of customers and have no product line of their own.

As stated in the introduction, only the second of these classifications is within the scope of this study. For the purpose of this investigation, this second classification has been broken into four categories:

1) large mixed plating,
2) medium-sized mixed plating,
3) small mixed plating,
4) anodizing.

The large mixed plating shops serve some or all of the industrial users indicated in the description of the industry, and perform ancillary services such as polishing and buffing, degreasing and, in some instances, pickling services as well. In this category there are some multi-plant facilities with as many as three locations. The division into two or more plants is most often dictated by the availability of land for expansion at the original locations of these companies. The new plants tend to specialize in one kind of plating.

Among the larger facilities are plants which specialize in one type of plating such as bumper replating or plating on plastics. These are included in the general grouping of "large mixed plating".

The medium-sized plating shops are in the sales grouping of $250,000 to $500,000. They may have as many as 200 customers, do not offer a wide a variety of services, and tend to be physically closer to their customer. While the larger companies may seek out a market as far away as 100 miles, companies in this size category are mainly located in metropolitan areas and serve local markets. Exceptions are a few plants which have been set up to serve one or two specific customers in a smaller community.

The owner is usually active in all aspects of running the operation, with the assistance of a shop foreman.

The small mixed plating shops are scattered all across Canada in small and large communities. They are often started by people who have been foremen with larger companies and have a minimum of financing. Others have been started to serve a specific need at the request of a large company requiring a specific service. Some never intend to become large, others begin in this small way with used equipment and try to evolve into a larger, more viable operation as quickly as possible. The emphasis is on work that does not have too severe specification requirements. Business is usually acquired through low bids.

Exceptions in small plants to the above generalization are the precious metal platers and hardchrome platers. Although both of these operations are also carried out by large companies with captive facilities, there are a few of these smaller operations where the emphasis is on skill and technical knowledge and this is reflected in their selling prices.

Anodizing, which is the application of a hard oxide coating to aluminium by an electrochemical process, only occasionally uses any of the heavy metals and therefore has somewhat simpler problems in meeting the pollution control guidelines. By far the greatest volume of production is in captive operations such as the aircraft industry. Companies in this grouping are included with the electroplating companies in discussions of financial impact but are generally at the low end of cost spread for treatment in companies of a given size.

Even this very general review of the physical characteristics of the metal finishing industry illustrates its highly variable nature. This variation makes it impossible to define precisely the impact of guidelines for pollution control, but enough information has been collected to permit a reasonable measurement of their effect.

4. SUMMARY OF WATER POLLUTION CONTROL REQUIREMENTS

The objectives of the Federal Metal Finishing Liquid Effluent Guidelines published in the Canada Gazette, Part I, No. 45, Vol. III, dated November 5, 1977, can be summarized as follows:

a) Effluent: A composite sample should have a pH between 6.0 and 9.5 and other substances should be limited as specified below:

Substance	Maximum total concentration in mg/L
Total Suspended Matter	30
Cadmium	1.5
Chromium (total)	1.0
Copper	1.0
Lead	1.5
Zinc	2.0
Nickel	2.0
Cyanide (oxidizable)	0.1
Cyanide (total)	3.0

b) Concentrated residues containing emulsion cleaners and chlorinated hydrocarbons, and effluent treatment sludges should not be deposited with the effluent.

c) Other concentrated spent processing solutions and residues should be treated to meet the effluent objectives or should be stored and disposed of in a manner which the Minister may consider acceptable.

There are additional monitoring and reporting requirements. Special provisions are made for off-site treatment, municipal or centralized. They are based on the effectiveness of the off-site treatment in removing the contaminants and require interpretation.

5. COST OF MEETING THE GUIDELINES

The economic aspects examined in "Wastewater and Sludge Control in the Canadian Metal Finishing Industry"[1] have been re-examined in this report with emphasis on the following considerations:

a) The best practicable technology (BPT) remains the same as that described in the above document.
b) Capital costs increased by one-third in three years and operating costs increased in all categories, including labour, services and interest;
c) As in the previous study, the capital cost for achieving good housekeeping is included in the total cost, but it should be noted that there is a recovery of costs in the saving of water and chemicals.

Typical capital costs for waste treatment necessary to meet the Federal Guidelines are shown in Table 1. These costs do not include the cost of equipment for dewatering sludges, or of land or buildings.

In this analysis it has been assumed that compliance with all the objectives of the guidelines will be requested within three years.

Wastewater treatment costs presented in the previous report have been revised and separated into two charts. The revision reflects the increase in operating and capital costs between 1973 and 1976. Figure 1 shows the cost of meeting pollution control requirements to plants discharging directly to receiving waters. Figure 2 shows the cost of meeting requirements to plants now discharging to municipal systems where there is some off-site treatment of the wastewater (i.e., municipal sewage treatment plant).

The omission of capital costs for sludge dewatering equipment, land and buildings in this assessment caused some concern to members of the industry who participated in discussions. Liquid sludges have become a disposal problem, and dewatering facilities are anticipated to become a necessity, not an option. The capital costs of these items were omitted because they are highly variable. In many instances, it is still an economic decision whether a company buys dewatering equipment or chooses to send out liquid sludge for disposal. Land and building costs are variable across the country and can be best calculated by the individual company.

Table 1 includes the capital cost for a hardchrome plating operation, although it is not referred to again in any of the subsequent discussion. This cost was included because it illustrates a small operation using only one basic process solution on a wide range of product sizes, where special waste treatment equipment may be required.

TABLE 1. CAPITAL COSTS FOR TREATMENT SYSTEMS - 1976*

TYPE OF PLANT	Contaminants	Type of System	Water Consumption	Capital Cost To Sewer 1976	Capital Cost To Water Body - 1976
Hard Chrome Plating (Very Small)	Cr, pH, SS **	Chemical Batch	1,000 gpd	$32,000	$32,000
Anodizing	Cr, pH, SS**	Chemical Cr. Batch pH Auto	10,000 gpd	$52,000	$52,000
Nickel-Chrome (Small)	Cr, Ni, pH, SS	Chemical Automatic	25,000 gpd	$105,000	$133,000
Nickel-Chrome (Large)	Cr, Ni, pH, SS	Chemical Automatic	150,000 gpd	$160,000	$208,000
Copper-Nickel-Chrome (Large)	Cr, Ni, Cu, CN, pH, SS	Chemical Automatic	100,000 gpd	$208,000	$240,000
Mixed Plating (Small)	Cr, Metals, CN, Ph, SS	Chemical Batch	10,000 gpd	$52,000	$65,000

* Includes installation, engineering and provision for good housekeeping. Does not include dewatering of sludges or building.

** SS - suspended solids

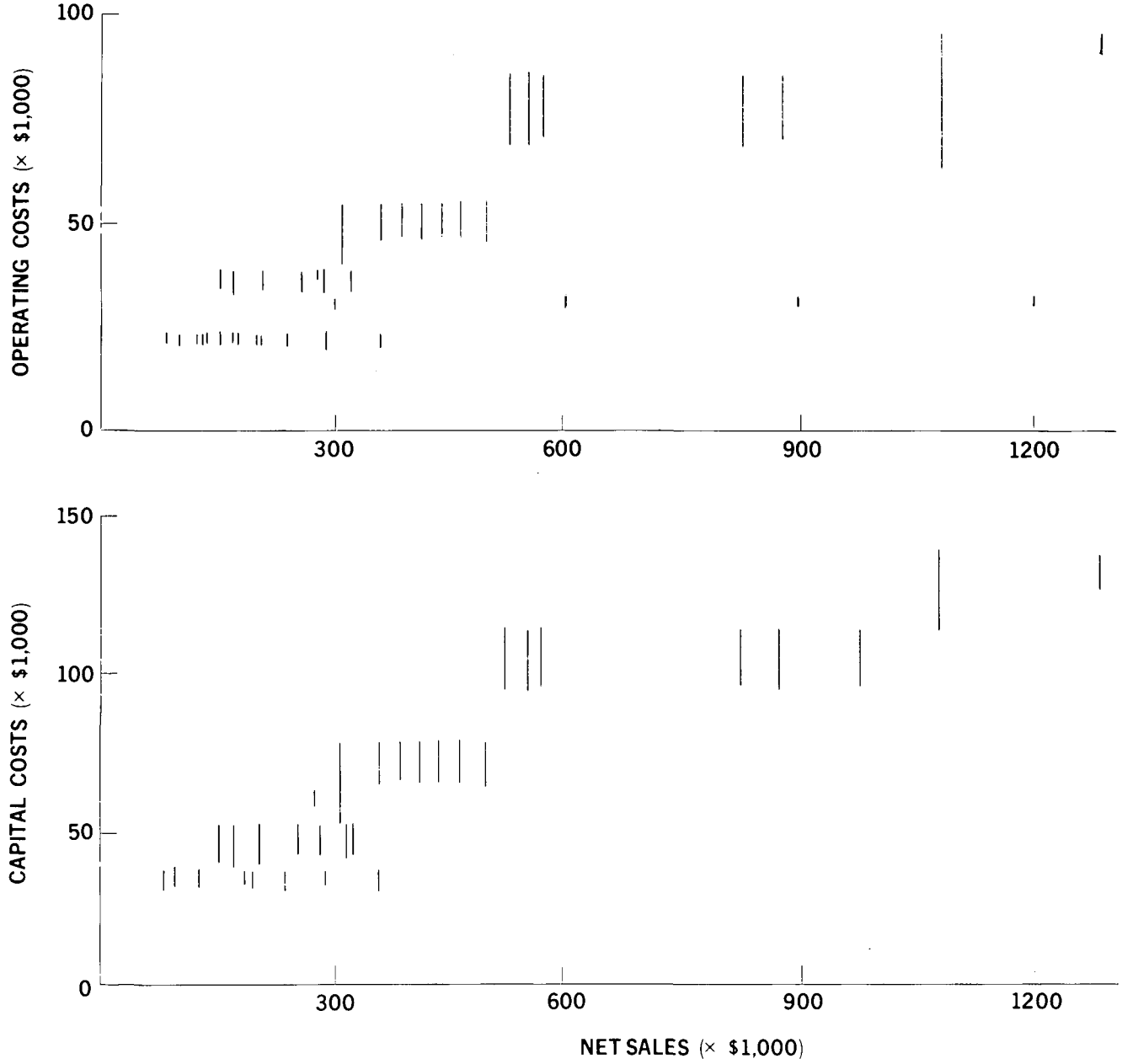

FIGURE 1. WASTEWATER TREATMENT COSTS VS NET SALES FOR PLANTS DISCHARGING TO RECEIVING WATERS (noncaptive operations, 1976 figures)

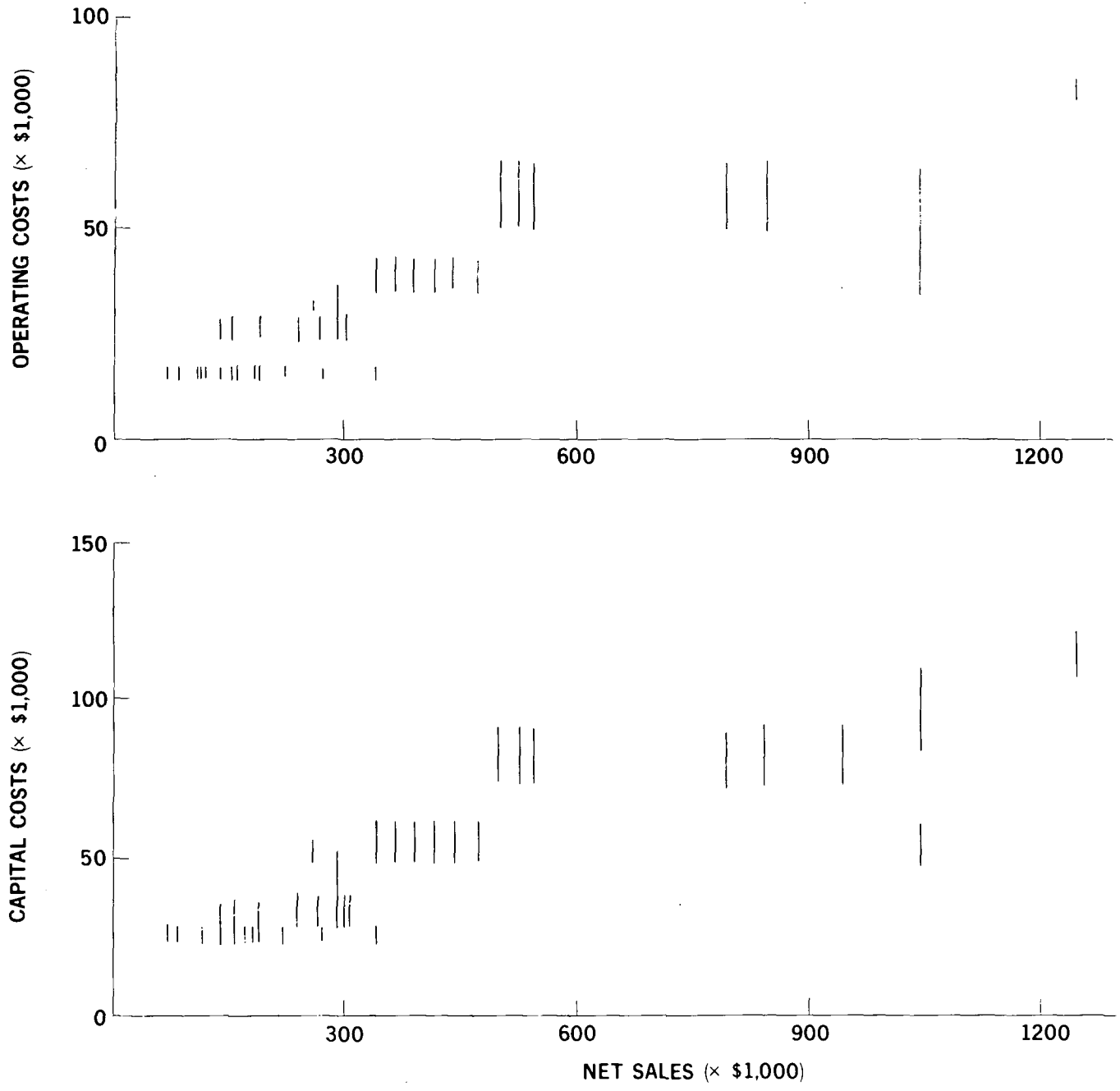

FIGURE 2. WASTEWATER TREATMENT COSTS VS NET SALES FOR PLANTS DISCHARGING TO AN OFF-SITE TREATMENT FACILITY (noncaptive operations, 1976 figures)

6. FINANCIAL IMPACT

As a basis for determining the ability of metal finishing companies to pay for waste treatment, pro forma profit and loss statements were drawn up that were felt to represent fairly the earning ability of four categories of the industry. These included an anodizing company with sales of $500,000, and three plating companies with sales of $140,000, $375,000 and $1,100,000, respectively. These sales figures represented average sales for a group of companies in each category for which information on sales, net worth and number of employees was available.

An operating cost for waste treatment was also drawn up for a typical company in the group with average sales of $375,000. This cost schedule is shown in Table 2. The pro forma profit and loss statements for the four representative companies are shown in Tables 3 to 6, inclusive.

These statements were presented to representatives of a cross-section of the metal finishing industry, excluding anodizing companies. The same information was sent to an accounting firm for its assessment of the ability of companies represented by these statements to raise capital and continue to operate successfully.

The consensus from the industry representatives was that the pro forma profit and loss statements reasonably represented the performance of companies of the size indicated. When asked if they had increased their prices in the last three years, they agreed that on average they had raised their prices about 15% during that time.

These further comments also met with agreement:

1) Small companies such as the 22 companies making up the category shown in Table 4 would be unable to raise the necessary capital for pollution control on the strength of the companies' borrowing power alone. Some capital might be raised on existing capital equipment and personal guarantees. Waste treatment equipment has very little market value once installed. That market value might be as low as 10% of the installed cost. The conclusion of the group was that companies in this size category would be

unable to raise the capital funds even if the program were spread over three years. They felt that their only hope of survival would be government assistance.

2) The medium-sized companies represented in Table 5 would have to extend their borrowing to the limit even over a three-year period since, with the exception of the larger ones, they would be borrowing amounts greater than their net worth. Some processes could be discontinued to reduce the contaminant load. Those companies that succeed in raising capital funds would have to raise their prices by 15% to 20% to maintain some profit. Both this size of company and the smaller sized group would likely have space difficulties in accommodating pollution control equipment and might not be able to continue at their present locations.

3) The larger companies represented in Tables 3 (anodizing) and 6 are likely to have the ability to meet the pollution control capital requirements but would have to increase prices about 10% to retain profit. Borrowing for this purpose as of December 1976 would cost 14%.

While reviewing the financial aspects of the pollution control requirements, representatives of the metal finishing industry expressed the following concerns:

a) Government assistance should be available to help finance pollution control equipment at less than commercial rates.

b) Controls must be applied equally throughout the industry. The necessity for control was recognized but its lack of uniform application in the past has caused hardship to some companies.

c) The figures used in this study should have included a factor for the cost of land and buildings required for waste treatment.

d) New jobbing plants in the medium-sized category or smaller would be discouraged by the capital costs of waste treatment indicated.

e) Alternatives to metal finishing, such as powder plastics or stainless steel, would not seriously affect their ability to increase prices to cover the cost of waste treatment.

f) There has been one instance in the Toronto area where the cost for waste treatment was given as the reason for closing out an operation in the smaller size category.

The "Code of Good Housekeeping Practice" included in the Guidelines [4] published by the Federal Government is a practical document and useful to the industry.

The accounting firm's review of the pro forma profit loss statements (including water pollution control equipment) agreed to a large extent with that of the industry representatives. The smaller companies were not considered capable of raising the necessary capital for waste treatment. Even if the capital could be raised, the resulting necessity for price increases would place these companies out of competition with larger operations.

Treatment processes such as evaporative recovery or reverse osmosis have shown a potential for reducing either the capital cost or the operating cost. Their development has been slow, however, and they could not be used by companies with less than a million dollars in sales. Standard chemical treatment remains the best practical technology for the entire industry.

TABLE 2. TYPICAL DATA AND WASTE TREATMENT OPERATING AND CAPITAL COSTS FOR A METAL FINISHING PLANT DISCHARGING TO A WATER BODY AND COMPLYING WITH THE FEDERAL GUIDELINES

Sales:	$375,000/year
Replacement value of plating equipment:	$180,000
Present net profit:	$ 25,000/year
Number of employees in plating:	17
Effluent pollutants: cyanide, cadmium, copper, zinc, suspended solids, nickel, chromium	
Capital cost* of waste treatment (automatic system) installed including engineering but excluding filtering equipment:	$108,000

Operating Costs

Labour	$14,000/year
Chemicals	14,000 "
Interest	12,000 "
Depreciation	10,000 "
Sludge Disposal	5,000 "
Maintenance	2,500 "
Utilities	3,000 "
TOTAL	$61,000/year

* Included in capital cost: reduction of water consumption and chemical loss; curbing tanks and waterproofing floors; tanks for batch dumps; treatment tanks; valves, controllers and meter recorders; pumps and mixers; polishing filter; tanks for treatment chemicals; engineering; installation (20% of total cost).

TABLE 3. PRO FORMA PROFIT AND LOSS STATEMENT: ANODIZING PLANTS

No. of companies in sample	5
Sales Average	$500,000/year
Net Worth	$130,000
Employees Average	31
Waste Treatment Capital Cost	$ 50,000
% of Canadian metal finishing industry sales in sample	1%
% of Canadian metal finishing industry employment in sample	2%

Pro Forma Profit and Loss Statement

Sales	$500,000/year
Factory Costs	
Labour - direct	125,000/year
- indirect	25,000 "
- employee benefits	22,000 "
Materials	71,900 "
Rent	13,000 "
Utilities	30,000 "
Repair and Maintenance	15,000 "
Shipping	10,000 "
Depreciation	7,000 "
Other	12,000 "
TOTAL FACTORY COST	$330,000/year
Sales Costs	
Salaries	$ 9,000/year
Other	9,000 "
TOTAL SALES COST	$18,000/year
General Expenses	
Executive Salaries	$47,000/year
Office and General Admin.	36,500 "
TOTAL GENERAL COSTS	$83,500/year
TOTAL EXPENSES	$431,500/year
PROFIT	$ 68,500/year
PROFIT AFTER TAXES	$ 47,950/year

TABLE 4. PRO FORMA PROFIT AND LOSS STATEMENT: SMALL MIXED JOB PLANT

No. of companies in sample	22
Sales Average	$140,000/year
Net Worth	$ 30,000
Total employees	7
Waste Treatment Capital Cost	$ 50,000
% of Canadian metal finishing industry sales in sample	2%
% of Canadian metal finishing industry employment in sample	2%

Pro Forma Profit and Loss Statement

Sales	$140,000/year
Factory Costs	
Labour - direct	33,800/year
- indirect	5,600 "
Employee benefits	2,500 "
Materials	28,000 "
Rent	6,000 "
Utilities	7,300 "
Repair and Maintenance	3,000 "
Shipping	2,800 "
Depreciation	1,000 "
Other	4,500 "
TOTAL FACTORY COST	$94,500/year
Sales Costs	
Salaries	$2,500/year
Other	2,540 "
TOTAL SALES COST	$5,040/year
General and Administration Costs	
Executive Salaries	$13,160/year
Office Salaries	4,600 "
Gen. Office and Admin.	8,370 "
TOTAL GEN. AND ADMIN.	$26,130/year
TOTAL COSTS	$125,000/year
GROSS PROFIT	$ 14,000/year
NET PROFIT	$ 10,000/year

TABLE 5. PRO FORMA PROFIT AND LOSS STATEMENT: MEDIUM-SIZED MIXED JOB PLATING PLANT

No. of Companies	13
Sales Average	$375,000/year
Net Worth	$ 85,000
Employee Average	18
Waste Treatment Capital Costs	$105,000
% of Canadian metal finishing industry sales in sample	3.2%
% of Canadian metal finishing industry employment in sample	2%

Pro Forma Profit and Loss Statement

Sales	$375,000/year
Factory Costs	
Labour - direct	$ 90,000/year
- indirect	15,000 "
Employee benefits	6,750 "
Materials	82,500 "
Rent	15,750 "
Utilities	19,500 "
Repair and Maintenance	7,875 "
Shipping	7,500 "
Depreciation	5,000 "
Other	10,000 "
TOTAL FACTORY COST	$259,875/year
Sales Costs	
Salaries	$ 6,750/year
Other	5,750 "
TOTAL SALES COST	$ 12,500/year
General and Administration Costs	
Executive Salaries	$ 35,250/year
Office Salaries	12,000 "
Off. and Admin. Esp.	26,800 "
TOTAL GEN. AND ADMIN.	$ 74,050/year
TOTAL COST	$346,425/year
GROSS PROFIT	28,575/year
NET PROFIT	20,000/year

TABLE 6. PRO FORMA PROFIT AND LOSS STATEMENT: LARGE MIXED JOB PLATING PLANT

No. of Companies in sample	23
Sales Average	$1,161,000/year
Net Worth	$ 160,000
Employees average	45
Waste Treatment Capital Cost	208,000
% of Canadian metal finishing industry sales in sample	17%
% of Canadian metal finishing industry employment in sample	19%

Pro Forma Profit and Loss Statement

Sales	$1,100,000/year
Factory Costs	
Labour - direct	$225,000/year
- indirect	36,000 "
Employee Benefits	35,000 "
Materials	264,000 "
Rent	46,200 "
Utilities	60,000 "
Repair and Maintenance	23,100 "
Shipping	22,000 "
Depreciation	12,000 "
Other	25,000 "
TOTAL FACTORY COST	$748,300/year
Sales Costs	
Salaries	$20,000/year
Other	17,000 "
TOTAL SALES COST	$37,000/year
General and Administration Costs	
Executive Salaries	$103,400/year
Office Salaries	36,300 "
Off. and Admin. Expense	70,000 "
TOTAL GEN. AND ADMIN.	$209,700/year
TOTAL COST	$995,000/year
GROSS PROFIT	$105,000/year
NET PROFIT	$ 73,400/year

7. PLANT CLOSURES

The possibility was considered that some plants would discontinue operation because of an economic inability to meet the Federal Metal Finishing Industry Liquid Effluent Guidelines over a three-year period. The following factors were taken into account:

1) the financial resources of the companies, including:
   a) the profitability of the companies,
   b) the net worth,
   c) sources for borrowing,
   d) cost of borrowing money and repayment terms;
2) the capital cost of treatment equipment to control specific company effluent discharges;
3) the operating cost for the system required in 2);
4) the availability of off-site treatment (such as sewage treatment plants) to provide some treatment;
5) municipal requirements for preliminary effluent treatment at the company's plant;
6) the ability of the companies to raise prices to cover:
   a) increased operating cost,
   b) interest on borrowed capital,
   c) repayment of loans.

The categories used to illustrate the financial status of the independant metal finishing installations represented the most significant components of the industry. A further breakdown within the categories would also have a bearing on the industry's ability to finance waste treatment. This breakdown is based on the receiving system for waste discharges as follows:

- Group 1 discharges directly to water bodies.
- Group 2 discharges indirectly to water bodies.
- Group 3 discharges to sewer systems with municipal sewage treatment plants.

An example of Group 2 would be a plant discharging to a municipal sewer system without sewage treatment.

These factors and the specific information supplied by the representative group of plating jobbers, the independant accounting firm (Appendix), and other Canadian and American sources were used to project the result of required compliance with the Federal Metal Finishing Industry Liquid Effluent Guidelines. The number of closures that may occur within the groups described above if compliance were to be required within three years is shown in Table 7.

As much as 50% of the employees affected by the closures could be hired by the larger surviving companies. This would leave 230 employees permanently laid off, or approximately 6% of those employed in the jobbing portion of the industry, and 3% in the total industry.

It is unlikely that the customers of this part of the industry would be significantly affected, but the cost of acquiring the services lost due to closures would be higher.

The market value of the equipment owned by the 48 companies that could be closed would be approximately $600,000 and sales would be in the vicinity of $10,000,000. Most of these sales would be absorbed by the surviving companies. These companies would have been able to handle the work with their available capacity in 1976, without appreciable capital investment.

The major capital and operating costs of compliance with the Metal Finishing Industry Liquid Effluent Guidelines are associated with the treatment required to achieve the specified final effluent quality. Major decreases in the discharge of pollutants can also be achieved by the elimination of dumps and the introduction of good housekeeping practices, as outlined in the Guidelines.

It has been determined from this study that the major impact of the Federal Guidelines would be felt by companies with sales of less than $250,000 per year. Most of these companies discharge to municipal sewer systems, with some kind of treatment. Elimination of dumps and adoption of good housekeeping practices, would, in many instances, reduce such discharges to minor environmental problems.

Serious consideration should be given to a schedule of compliance with the Guidelines which allows both a longer period of time, and a gradual achievement of the objectives. Further improvement can be expected as treatment of municipal wastewater is introduced by municipalities currently without it.

TABLE 7. EFFECT OF REQUIRED COMPLIANCE WITH FEDERAL GUIDELINES OVER A THREE-YEAR PERIOD

Group*	Sales	Jobbing Companies Number	Jobbing Companies Employees	Possible Plant Closures Number	Possible Plant Closures Employees
1.	Less than $250,000	16	110	10	70
	$250,000 - $500,000	5	105	3	45
	$500,000 plus	9	450	2	60
Sub Total		30	665	15	175
2.	Less than $250,000	16	110	8	56
	$250,000 - $500,000	5	105	2	30
	$500,000 plus	9	450	1	30
Sub Total		30	665	11	116
3.	Less than $250,000	53	370	20	140
	$250,000 - $500,000	15	315	2	30
	$500,000 plus	27	1340	0	0
Sub Total		95	2025	22	170
Total all groups		155	3355	48	461

*Group 1 - Discharging directly to water bodies.
Group 2 - Discharging indirectly to water bodies.
Group 3 - Discharging to sewer systems with municipal waste treatment plants.

REFERENCES

1. "Wastewater and Sludge Control in the Canadian Metal Finishing Industry", Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Report No. EPS 3-WP-76-10, Ottawa, December 1976.

2. "Cost of Waste Treatment Systems" by W.H. Safranek, L.E. Vaaler, C.H. Layer and J.A. Gurklis. Work carried for the United States Environmental Protection Agency under contract no. 68-01-0592.

3. "Review of the Canadian Metal Finishing Industry", Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Report No. EPS 3-WP-75-2, Ottawa, March 1975.

4. "Metal Finishing Liquid Effluent Guidelines", Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Report No. EPS 1-WP-77-3, Ottawa, November 1977.

5. "Economic analysis of Proposed Effluent Guidelines, The Electroplating Industry", U.S. Environmental Protection Agency. Report No. EPA 230/1-73-007, September 1973.

6. "Centralised Treatment Facilities: Ten Years of Experience in the Ruhr Valley", by N. Roesler, Waste Handling, Disposal and Recovery in the Metal Finishing Industry, proceedings of a seminar held in Toronto, November 12-13, 1975. Jointly sponsored by Environment Canada, the Automotive Parts Manufacturers' Association (Canada) and American Electroplaters' Society. Environmental Protection Service Report No. EPS 3-WP-77-3, March 1977.

APPENDIX

IMPACT OF POLLUTION CONTROL ENGAGEMENT ON SMALL PLATING JOBBERS

Winspear, Higgins, Stevenson and Company
Financial Consultants

APPENDIX

IMPACT OF POLLUTION CONTROL ENGAGEMENT ON SMALL PLATING JOBBERS

Terms of Reference

Based on information provided for three size-groups of typical companies engaged in the metal-finishing industry providing job-plating services, we were requested to assess the economic impact of the enforcement of pollution control regulations. Specifically, it was requested that we address ourselves to the following questions, based on a profile of the operating statements of the three groups of companies separately:

1. What is the ability of each group to raise the necessary capital for pollution control equipment?
2. If they can raise the capital, what source is likely to be available to them and what will the cost of such capital be?
3. Regardless of the change in competitive situation with other products, what is the likelihood of this industry raising its prices in excess of inflationary increases in any short period of time?
4. How much would each group have to raise its prices to remain a viable operation?
5. In each of the above instances what would the situation be if the (implementation) program were phased over three years with roughly equal payments in each year?

Operating Statements (Tables A-1, A-2 and A-3)

We elected to modify the operating statements prepared by EPS to accommodate:

a) An increase in fringe benefits, proportional to the stated increased operating costs of labour.

b) An increase in depreciation allowance for the new capital cost to 20% from 10%, in accordance with Schedule B of the Tax Act.

TABLE A-1. "GROUP A" COMPANIES - PROFILE OF PROFIT-LOSS STATEMENT

No. of Companies in Group Sample	22	Average Sales	$ 140,000	Capital Cost of Waste Treatment	
				Municipal System -	$ 50,000
Average No. Employees	8	Average Net Worth	30,000	Water Body	$ -
				Operating Cost of Waste Treatment	
		Average Market Values of Equipment		Municipal System -	$ 33,600
				Water Body	- $ -

	Current - Without Pollution Control		With Pollution Control		
Sales		$ 140,000			$ 140,000
Production Expense					
Labour	$ 43,300		$ 52,300		
Fringe Benefits					
Materials and Chemicals	22,600		24,100	($ 3,000 saving in chemicals)	
Rent	3,600		3,600		
Utilities	7,300		8,300		
Maintenance	4,000		5,000		
Shipping	2,800		2,800		
Depreciation	9,500		19,500		
Other					
Sludge Disposal	-		2,500		
Total	$ 93,500		$ 118,100		
Sales Expense					
Salaries	$ 2,500		$ 2,500		
Other	2,540		2,540		
Total	$ 5,040		$ 5,040		
General & Admin. Expense					
Exec. Salaries	$ 13,160		$ 13,160		
Office Salaries	4,600		4,600		
Gen. Office & Admin.	9,370		9,370		
Interest	-		6,000		
Total	$ 27,130		$ 33,130		
Total Expense		$ 125,670			$ 156,270
Profit before Taxes		$ 14,330			($ 16,270)
Net Profit		$ 10,000			($ 16,270)
Increase in Sales to generate current Profit before Taxes					$ 30,600
Or, Increase in Prices at current throughput to generate current Profit before Taxes			= 30,600 / 140,000 x 100%	=	21.9%

TABLE A-2. "GROUP B" COMPANIES - PROFILE OF PROFIT-LOSS STATEMENT

No. of Companies in Group Sample	11	Average Sales	$ 375,000	Capital Cost of Waste Treatment - Municipal System	- $ 40,000
Average No. Employees	21	Average Net Worth	$ 85,000	- Water Body	- $ 105,000
		Average Market Values of Equipment	$ 50,000	Operating Cost of Waste Treatment - Municipal System	- $ 64,300
				- Water Body	- $ 74,300

	Current - Without Pollution Control		With Pollution Control Discharging to Municipal System		With Pollution Control Discharging to Water Body	
Sales		$ 375,000		$ 375,000		$ 375,000
Production Expense						
Labour	$ 118,850		$ 130,850		$ 132,850	
Fringe Benefits	17,700		19,500		19,800	
Materials and Chemicals	60,500		67,500	($ 5,000 saving in chemicals)	69,500	($ 5,000 saving in chemicals)
Rent	9,750		9,750		9,750	
Utilities	19,700		22,700		22,700	
Maintenance	10,500		13,000		13,000	
Shipping	7,500		7,500		7,500	
Depreciation	5,000		23,000		26,000	
Other	10,000		10,000		10,600	
Sludge Disposal	-		4,200		5,000	
Total	$ 259,500		$ 308,000		$ 316,100	
Sales Expense						
Salaries	$ 6,750		$ 6,750		$ 6,750	
Other	5,750		5,750		5,750	
	$ 12,500		$ 12,500		$ 12,500	
Gen. and Admin. Expense						
Exec. Salaries	$ 35,250		$ 35,250		$ 35,250	
Office Salaries	12,000		12,000		12,000	
Gen. Office and Admin.	27,375		27,375		27,375	
Interest	-		10,800		12,600	
	$ 74,625		$ 85,425		$ 87,225	
Total Expense		$ 346,625		$ 405,925		$ 415,825
Profit before Taxes		$ 28,575		($ 30,925)		($ 40,825)
Net Profit		$ 20,000		($ 30,925)		($ 40,825)
Increase in Sales to generate current Profit before Taxes				$ 59,500		$ 69,400
Or, Increase in Prices at current throughput to generate current Profit before Taxes				$\frac{59,500}{375,000} \times 100\%$		$\frac{69,400}{375,000} \times 100\%$
				15.9%		18.5%

TABLE A-3. "GROUP C" COMPANIES - PROFILE OF PROFIT-LOSS STATEMENT

No. of Companies in Group Sample	21	Average Sales	$ 1,100,000	Capital Cost of Waste Treatment	
				Municipal System - $ 209,000	
Average No. of Employees	60	Average Net Worth	$ 160,000	Water Body - $ -	
				Operating Cost of Waste Treatment	
		Average Market Values of Equipment	$ 140,000	Municipal System - $ 141,000	
				Water Body - $ -	

	Current - Without Pollution Control		With Pollution Control	
Sales		$ 1,100,000		$ 1,100,000
Production Expense				
Labour	$ 330,000		$ 354,000	
Fringe Benefits	47,000		50,500	
Materials and Chemicals	178,000		189,500	($ 8,500 saving in chemicals)
Rent	28,600		28,600	
Utilities	57,200		65,200	
Maintenance	33,000		40,000	
Shipping	22,000		22,000	
Depreciation	14,000		55,600	
Other	25,000		25,000	
Sludge Disposal	-		12,000	
Total	$ 734,000		$ 842,400	
Sales Expense				
Salaries	$ 20,000		$ 20,000	
Other	19,000		19,000	
Total	$ 39,000		$ 39,000	
Gen. & Admin. Expense				
Exec. Salaries	$ 103,400		$ 103,400	
Office Salaries	36,300		36,300	
Gen. Office & Admin.	79,360		79,360	
Interest	-		24,900	
Total	$ 219,060		$ 243,960	
Total Expense		$ 992,860		$ 1,125,360
Profit before Taxes		$ 107,140		($ 25,360)
Net Profit		$ 75,000		($ 25,360)
Increase in Sales to generate current Profits before Taxes				$ 132,500
Or, Increase in Prices of current throughput to generate current Profits before Taxes			$\frac{132,500}{1,100,000}$ x 100%	12.0%

(NOTE: The Capital Cost Allowance provision of the Tax Act provides for a two-year write off of pollution control equipment as an 'immediate' tax deferment benefit. Unfortunately, none of the three groups of companies would benefit from this because the statements in each case project an operating loss.)

c) The increased operating costs of $30,000 associated with the installation of pollution control equipment in the Group A companies has been distributed, on a rational basis, to the separate expense accounts, in similar fashion to other two company Groups.

It should be noted that no provision is made in the pro forma operating statements for repayment of the capital cost loan. Under the most favourable conditions of, say, repayment over a ten-year period, the operations will need to generate a substantial increase in working capital which can only be provided by further inflating selling prices, beyond the figures shown as necessary to offset the increased operating costs. (See Table A-4.)

Sources of Capital Funds

The two principal sources of finance available for the purchase and installation of pollution control equipment are:

a) Small Business Loans - Federal Government
b) Ontario Development Corporation (Ontario Companies)

1. Under the Small Business Loans Act, provision is made for companies with sales not exceeding $1 million to obtain loans to a maximum of $50,000 covering 80% of the capital cost ($62,500) of equipment and its installation. The $50,000 relates to the maximum amount of loans that may be outstanding at any time, which suggests that projects having costs in excess of $62,500 may be funded on a piece-meal basis with separate consecutive loans - provided that it is feasible to generate the working capital from a piece-meal installation to pay off each loan before the additional funding is required. Loans under this Federal Government program are advanced by the chartered banks or by credit unions, but it is a requirement of the Act that loans advanced under this program be secured.

TABLE A-4. INCREASED CASH FLOW REQUIREMENTS

Group	Capital Cost	Increased Operating Cost*	Annual Repayment			Additional Cash Requirement			Required Price Increase		
			5 yrs	7 yrs	10 yrs	5 yrs	7 yrs	10 yrs	5 yrs	7 yrs	10 yrs
A	50,000	14,600	13,500	10,000	8,000	28,100	24,600	22,600	20.0%	17.5%	16.1%
B Municipal	90,000	30,500	24,500	18,200	14,100	55,000	48,700	44,600	14.6%	13.0%	11.9%
B Water body	105,000	35,600	28,000	21,250	16,400	63,600	56,850	52,000	17.0%	15.2%	13.8%
C	208,000	66,000	56,000	42,000	32,500	122,000	108,000	98,500	11.1%	9.8%	9.0%

* Does not include depreciation cost of waste treatment equipment or interest on capital required for purchase of the the equipment.

Tables A-1, A-2 and A-3 show the reduced profit resulting from the installation of a waste treatment system. The profit and loss statements include depreciation and interest on the capital borrowed to purchase waste treatment equipment. The decision to include such a depreciation and the amount of it is an arbitrary decision on the part of management. The rate selected is consistent with the known life of such equipment.

The cash flow requirements represent the absolute minimum funds that must be raised to maintain the company's cash position. These cash flow requirements are shown in the table above.

If the capital could be repaid over 10 years, there would be some relief in terms of required price increases, but this is not possible for the independent jobbers since lending institutions are not inclined to go beyond 5-6 years on this kind of investment.

Consequently, price increases of approximately the same magnitude as those based on maintaining profit levels are required to maintain the same cash position.

This security takes the form, initially, of a lien on the purchased equipment, but since the resale value of this type of equipment falls off rapidly after installation, it would be necessary to take a chattel mortgage to provide further loan security.
Interest on these loans will fluctuate with the bond market, but for general purposes of calculation a figure of 12% should be used.

2. The Ontario Development Corporation (ODC) will provide financial assistance to existing Companies for the installation of pollution control equipment, under the provisions of The Environmental Protection Act, 1971, of the Ontario Government.

   Loans to a maximum amount of $250,000 may be advanced, and the loan may cover up to 100% of the capital cost of equipment and installation. Repayment of such loans would be on a 5 to 10 year period, provided the period does not exceed the 'life' of the equipment.

   Loan security is similar to that required by the chartered banks, and it is probable that additional collateral to that represented by the purchased equipment will be required.

   Current interest rates were quoted at 11.75% so again a figure of 12% is realistic for present calculations.

   A significant requirement of ODC is that a Certificate of Approval (of the effectiveness of the installation) must be furnished by the Director, Environment Approval Branch, Ministry of the Environment, Ontario, before the loan can be advanced. (This represents compliance with Section 8 of the Environment Protection Act.) It has been stated by Ministry officials that it would probably take 60 days to issue a Certificate of Approval, following the date of installation.

Ability to Raise Capital

The upper limit of $50,000 imposed by the Small Business Loans Act eliminates this as a viable source of funding. The option available to apply for additional loans for a phased, piece-meal installation is not a viable alternative because to complete the total installation in a reasonable time frame would impose extreme problems in the repayment of the incremental loans. Furthermore, there is the question of whether the

Ministry of Environment's Certificate of Approval could be issued for a phased installation.

Ontario Development Corporation would appear to offer the best solution to the raising of capital, but there remains the question of the ability of the typical companies in the Groups sampled to provide adequate collateral to secure a loan. Only in Group B does the average net worth approach the capital cost, and hence provide adequate collateral. In the cases of Groups A and C, the average net worth is only 50% of the capital cost, and having regard for the limited value placed on the new equipment as security, it would probably be necessary for the principals to provide personal guarantees against a loan.

ODC would probably be more lenient in negotiating loans than would be the chartered banks or other lending institutes, and for this reason these non-government sources of funds have not been considered further.

Ability to Generate Working Capital Through Increased Pricing

In the pro forma statements prepared for the three Groups of companies sampled, it is shown that to recover the costs of operating pollution control facilities would require the following increases in selling prices:

Group A - 21.9%
Group B - 15.9% to 18.9%
Group C - 12.0%

As previously stated, these increases do not allow for the repayment of the loan principal. Assuming repayment of the loan over ten years, the companies will need to generate the following increased revenues from further 'hikes' in prices:

Group A - $ 5,000 per year
Group B - $ 9,000 to $10,500 per year
Group C - $20,800 per year

Based on maintaining current production throughput, and combining the repayment of the loan and the increased operating costs, it can be shown that it would be necessary to introduce the following increases in the present selling prices:

Group A - 25.5%
Group B - 18.3% to 21.0%
Group C - 13.9%

The expectation of any of the companies being able to introduce price increases of the magnitudes stated must be considered in the light of the following factors:

1. The plating industry is fiercely competitive in its pricing policies. This is true of the larger companies in the industry servicing the automotive market, and perhaps more so in the case of those companies in the less sophisticated jobbing industry.
2. It is one thing to expect the jobbing platers to increase their prices substantially in relation to those companies servicing the automotive market, but it is much more critical for companies in the jobbing industry to increase their prices substantially over other companies in the same industry (Group A at 25.5%, over Group C at 13.9%).
3. Depending on the location of the individual companies, and the sewerage facilities made available by the local municipal jurisdiction, they may or may not be required to install pollution control equipment. Thus, those who are required to install this equipment are further disadvantaged relative to their direct competition in other localities, with the possibility in the extreme case of imposing a 25% disparity in pricing.

The net result would probably be the closing down at the smaller companies and, at best, extreme hardhsip for the larger companies.

Alternative of a Phased Installation Program

Further consideration has been given to a phased installation over a period of three years. For the purpose of this exercise, it is estimated that the capital cost distribution and the annual increased operating costs will be:

	Capital Cost (% of total)	Operating Cost (% of total for complete installation)
Year 1	35%	15%
Year 2	45% (80%)	55%
Year 3	20% (100%)	100%

These combined figures represent additional cash flow requirements, as follows, based on the premise that the funding can be similarly phased by re-negotiating the loan each year (years 1, 2 and 3) so that payments against principal and interest are minimized (see Tables A-5, A-6, and A-7):

	Group A $	Group B $	Group C $
Year 1	7,000	12,425	28,650
Year 2	22,150	41,195	86,200
Year 3-10	35,400	65,700	136,500

Based on current sales in each Group, the equivalent increases in prices required to generate this additional cash flow would be as follows:

	Group A %	Group B %	Group C %
Year 1	5.0	3.0	2.6
Year 2	15.8	11.0	7.8
Year 3-10	25.3	17.5	12.5

From the standpoint of remaining competitive and maintaining a share of market, the small increases in the first year are not critical, but in the second, third and following years the increases would seriously dimish the competitive position of all Groups. In effect, the phased installation merely defers the problem for one year, and we do not therefore regard it as a viable alternative.

Furthermore, it must be recognized that until the third year phase of installation is complete, the company is not in full compliance with pollution control requirements.

Finally, the Ministry's requirement that all installations be approved, and ODC's stipulation that a loan will not be advanced until a Certificate of Approval is furnished, would seem to preclude the phased installation approach.

Conclusion and Recommendation

Any company of the size covered by the sample Groups will suffer extreme hardship if, by enforcement of pollution control regulations, they are required to install appropriate equipment. It is unrealistic to assume that they can increase their selling prices to generate the level of increased earnings and cash flow necessary to finance the capital cost and ongoing operating costs, and it is doubtful that any lending institute would be prepared to advance a loan against such risks. Consequently, any of the companies in the Groups sampled which are forced to install pollution control equipment face the prospect of closing down their business operations.

Recommendation:

In view of the many programs created by the Federal and Provincial (Ontario) Governments to assist various aspects of growth and development of industry, to provide employment opportunity, and to improve technology, it would be most appropriate that a further program be instituted to assist an industry which by the enforcement of government-imposed controls faces the prospect of economic failure for many companies.

Such a program should provide grants (forgivable loans) to fund capital cost projects for the purchase and installation of pollution control equipment.

In view of the increased employment opportunities associated with the installation of pollution control equipment (and the boost to the latter industry itself) plus the social benefits to be accrued in terms of protecting the environment, we would envisage both levels of Government according a high priority to such a program.

TABLE A-5. PHASED PROGRAM OF INSTALLATION, GROUP A

Group A - Capital Costs $50,000
Operating Costs $30,000

	Year 1 $	Year 2 $	Year 3+ $
Apportionment of Capital Cost	$17,500	$22,500	$10,000
a) Operating Costs	4,500	16,500	30,000
Repayment of Principal over 10 years	1,750	3,825	4,450
b) Interest at 12%	2,100	4,600	5,300
c) Depreciation at 10%	1,750	3,825	4,450
Other Operating costs [a - (b +c)]	650	8,075	20,250
Add Inc. Depreciation to 20% (10%)	1,750	3,825	4,450
Total Additional Cash Flow to be Generated	$ 8,000	$24,150	$38,900
Less Saving in Chemicals (say)	1,000	2,000	3,500
	$ 7,000	$22,150	$35,400
Equivalent Increase in Price on Sales of $140,000	5.0%	15.8%	25.3%

TABLE A-6. PHASED PROGRAM OF INSTALLATION, GROUP B

Group B - Capital Costs $90,000
Operating Costs $54,000

	Year 1 $	Year 2 $	Year 3 $
Apportionment of Capital Cost ($105,000)	$36,750	$47,200	$21,000
a) Operating Costs	8,100	29,750	54,000
Repayment of Principal over 10 years	3,675	7,725	8,350
b) Interest at 12%	4,400	9,250	10,000
c) Depreciation at 10%	3,675	7,725	8,350
Other Operating costs [a - (b +c)]	-	12,775	35,650
Add Inc. Depreciation to 20% (+10%)	3,675	7,725	8,350
Total Additional Cash Flow to be Generated	$15,425	$45,195	$70,700
Less Saving in Chemicals (say)	3,000	4,000	5,000
	$12,425	$41,195	$65,700
Equivalent Increase in Price on Sales of $375,000	3.3%	11.0%	17.5%

TABLE A-7. PHASED PROGRAM OF INSTALLATION, GROUP C

Group C - Capital Costs $208,000
Operating Costs $108,000

	Year 1 $	Year 2 $	Year 3 $
Apportionment of Capital Cost	$73,000	$93,400	$ 41,600
a) Operating Costs	16,200	59,400	108,000
Repayment of Principal over 10 years	7,300	15,900	18,500
b) Interest at 12%	8,750	19,000	22,200
c) Depreciation at 10%	7,300	15,900	18,500
Other Operating costs a - (b c)	-	24,500	67,300
Add Inc. Depreciation to 20% (10%)	7,300	15,900	18,500
Total Additional Cash Flow to be Generated	$30,650	$91,200	$145,000
Less Saving in Chemicals (say)	2,000	5,000	8,500
	$28,650	$86,200	$136,500
Equivalent Increase in Price on Sales of $1,100,000	2.6%	6.8%	12.5%