INITIAL ANALYSIS OF THE ECONOMIC IMPACT OF WATER POLLUTION CONTROL COSTS UPON THE MOTOR VEHICLE MANUFACTURING INDUSTRY

The study is one of a series commissioned by the Environmental Protection Agency to provide an initial assessment of the economic impact of water pollution control costs upon industry, and to provide a framework for future industrial analysis.

For the purpose of this initial analysis, the water pollution control requirements were assumed to be those developed in 1972 as effluent limitation guidance by the EPA Office of Permit Programs. Costs were developed by the EPA Economic Analysis Division on the basis of treatment technologies assumed necessary to meet the effluent limitation guidance.

Because of the limitations of time and information available, these studies are not to be considered definitive. They were intended to provide an indication of the kinds of impacts to be expected, and to highlight possible problem areas.

This document is a preliminary draft. It has not been formally released by EPA and should not at this stage be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

Final Report

The Economic Impact of the Cost of Meeting Federal Water Quality Standards on the Motor Vehicle Manufacturing Industry

ENVIRONMENTAL PROTECTION AGENCY

Washington, D. C.

This report is of a proprietary nature and intended solely for the information of the client to whom it is addressed

January 19, 1973

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January 19, 1973

Mr. Lyman Clark
Environmental Protection Agency
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Room 3234-A
401 M Street, S. W.
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Subject: Study of the Economic Impact of the Cost of Meeting Federal Water Quality Standards on the Motor Vehicle Manufacturing Industry

Dear Mr. Clark:

We are pleased to submit our Final Report on the Economic Impact of the Motor Vehicle Manufacturing Industry of the cost of meeting Effluent Limitation Guidance standards for water pollution abatement. This volume is composed of an Executive Summary which covers the contents of Chapter I-VII of the Final Report, the Final Report itself, and Appendices which describe significant industry characteristics.

Very truly yours,

Booz, Allen
Public Administration Services, Inc.

EXECUTIVE SUMMARY

This study was initiated under contract with the Environmental Protection Agency to determine the impact of water pollution abatement costs on the six major automotive production steps conducted by the four major U.S. producers. The production steps considered in the analysis were:

- Casting
- Engine machinery and assembly
- Stamping
- Plating
- Frame manufacturing
- Body and final assembly

An initial attempt was made to segment the industry by production process and thereby identify the impact individually on each of the six processes. This procedure could not be carried through because of the high level of process integration in the industry and the unavailability of financial data to describe specific plants. These problems limited the comparative results and impact analysis to consideration of the six processes in total.

Water pollution costs were developed by applying cost information furnished by EPA to plant water flow data collected from the manufacturers. Water pollution control costs required to meet level A of the ELG standards were estimated for every plant using the six processes and operated by the four major automotive producers.

The major study findings and conclusions are:

- The total investment cost for water pollution abatement in the six automotive processes should not exceed $331.5 million. This investment requirement can probably be met by the industry.

- The price increases to cover pollution abatement costs should not exceed $20 per car. This increase is expected to have not effect on sales.

- No significant impact on production, plant operation, employment, communities or foreign trade is expected

The study results are limited and constrained by several factors, most severely by the lack of an industry verified water pollution abatement cost base; however, the conclusions reached as they apply to the four major automotive producers are probably valid.

The conclusions do not apply to industry suppliers and do not include consideration of abatement cost for production of components by processes other than the six previously mentioned.

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I. INTRODUCTION

I. INTRODUCTION

The study of the impact of water pollution abatement costs on the motor vehicle manufacturing industry was initiated on October 9, 1972, under contract with the Environmental Protection Agency (EPA). This chapter describes the objectives and scope of the study, along with the study approach.

1. THE OBJECTIVE OF THE STUDY WAS TO DETERMINE THE ECONOMIC IMPACT OF POLLUTION CONTROL

The fundamental objective of the study was to provide EPA an analytical framework for determining the economic impact of pollution control on the automotive industry, specifically with respect to industry compliance with water effluent standards. Several sub-objectives were included. Principal among these were definition of the financial effects and production effects of the costs of abating pollution in accordance with water effluent standards. With respect to production effects, two critical sub-objectives were to determine which plants might have to curtail production or cease production entirely as alternatives to pollution abatement expenditures, and to determine the resultant effects on the communities involved.

2. THE STUDY SCOPE INCLUDED SIX MANUFACTURING CATEGORIES

The economic impact analysis, as defined by the Environmental Protection Agency, was to encompass the motor vehicle industry in terms of six major manufacturing categories:

- Casting
- Engine machining and assembly
- Stamping and assembly
- Frame manufacturing
- Plating
- Body and vehicle assembly

Further, these six categories were defined as those covered by Standard Industrial Classification (SIC) numbers 3711, 3713, 3714 and 3465.

3. WATER POLLUTION ABATEMENT COST INFORMATION WAS FURNISHED BY EPA

The scope of the study excluded development of water pollution abatement costs. This cost information was supplied by EPA via the draft document "Water Pollution Abatement Costs, Motor Vehicles," which provided the abatement process cost data for the six plant types of interest (in terms of production rates, water use rates and effluent standards). The water effluent standards applicable to these plants were also furnished by EPA in the form of the ELG Standards* dated August 14, 1972. During the course of the study, additional cost data were furnished by EPA covering cost ranges for several treatment configurations and different water-flow volumes. These data are described in later chapters.

4. THE STUDY COVERED ONLY THE FOUR LARGE INTEGRATED AUTOMOTIVE PRODUCERS

Because of the limited time, data and level of effort available to conduct the study and because the cost standards are limited to specific plant types, the study covered only passenger-automobile manufacturing by the four largest producers: General Motors, Ford, Chrysler and American Motors. These producers dominate the industry in terms of output and employment, but their facilities are not necessarily typical of the plant sizes and types of the highly diverse suppliers to the motor vehicle manufacturers. Hence, the conclusions reached regarding the major manufacturers cannot be extended to cover the automotive suppliers.

5. DATA WERE OBTAINED FROM THE FOUR AUTOMOTIVE MANUFACTURERS AND OTHER COGNIZANT SOURCES

The approach to the study consisted of collecting and reviewing published data describing the automotive industry, and direct contacts with cognizant industry and government representatives.

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* "Effluent Limitation Guidance, 1972," prepared by the Office of Permit Programs, EPA.

Data were collected from the following principal sources:

- Bureau of the Census
- Market Statistics, Inc., New York
- Motor Vehicle Manufacturers Association of the U.S. (MVMA) (formerly the Automobile Manufacturers Association, Inc.)
- Ward's Communications, Inc.
- Automobile companies

Concurrent with published data source identification and collection, a series of meetings were conducted with representatives of:

- Motor Vehicle Manufacturers Association of the U.S. (Washington and Detroit)
- Pollution control staffs of GM, Ford, Chrysler and American Motors (Detroit)
- National Industrial Pollution Control Council (Department of Commerce)

The initial meetings were held with representatives of MVMA, who established contact with automotive company staff personnel who were members of the Association's Industrial Pollution Control Committee.

Several rounds of meetings were held with the manufacturers and, as a result, production and water-flow data for all plants covering the six processes were obtained. These data were used in conjunction with the cost data supplied by EPA to determine the water pollution abatement economic impact.

II. INDUSTRY SEGMENTS

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The U.S. automotive industry is a vast manufacturing and distribution complex composed of thousands of production plants. These plants are owned by the vehicle manufacturers and also by manufacturing firms that supply materials and components to the vehicle manufacturers. The products include automobiles, trucks, specialty vehicles and literally thousands of different parts and materials. Accordingly, a thorough analysis of the total industry would require a complex and time-consuming study of pollution abatement along with cost standards for a wide range of manufacturing facilities.

1. GROUPING PLANTS BY PROCESS IS COMPLICATED BY A HIGH LEVEL OF PROCESS INTEGRATION

Automobile manufacturers frequently operate integrated multiproduct, multipurpose plants that perform several of the processes of interest as well as additional operations.

At some assembly plants which produce passenger cars, for example, light trucks and vans are assembled on the same production line as automobiles. In other plants trucks might be assembled in the same building but on adjacent lines.

At least three corporations have highly integrated plants. In addition to the six processes, these plants may have transmission manufacturing, forging, electrical assembly, cutting and sewing, and many other operations. In one plant, steel and glass are produced from raw materials.

Plating and frame manufacturing processes are in all cases combined with other operations. Processes at plating plants commonly include die casting, heavy stamping, injection molding and machining.

Frame manufacturing is generally subcontracted by automobile manufacturers. Ford produces frames in its Rouge plant, which is probably the most complex automotive production facility in the world. GM produces stub frames in a plant that also has stamping and engine machine and assembly operations. Except for these two plants, frame manufacturing is confined to outside suppliers.

In this study, plants conducting frame manufacturing and plating operations were grouped with other multiprocess plants in an integrated plant group.

2. A SINGLE-VALUED WASTE-WATER PARAMETER IS NOT PRACTICAL

An almost infinite variety of process combinations exist and generally there is no segregation of waste water by process. Accordingly, it is difficult to develop an analysis that covers the industry for the six plant types in a pure form. It therefore appears that it is not practical to establish a single-valued waste-water effluent parameter based on a single process identification for a given plant.

This does not preclude the use of absolute pollutant levels per production unit. However, it does require development of standards in much greater depth, to the point that all processes performed have established waste-water contaminant loads and concentration levels. Then more equitable standards for multiprocess plants could be developed by accumulating waste-water contaminant loads that correspond to the plants' processes and production levels.

3. POLLUTION CONTROL COSTS BY MANUFACTURING PROCESS COULD NOT BE DETERMINED FROM AVAILABLE DATA

An investment requirement and operating cost summary is shown in Exhibit I, following this page.* Three cost levels are shown, corresponding to the high and low figures in the cost range furnished by EPA and the expected cost within the range. Costs are shown here for plants having discrete processes and for integrated plants. The total cost of pollution control for each of the six processes suggested by EPA could not be determined because varying levels of each process are included in the integrated plant group.

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* See Chapter V for cost development procedure and Appendix A for cost detail by plant.

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III. PRICE EFFECTS

III. PRICE EFFECTS

This chapter discusses the manner in which prices are determined in the industry and the price changes that can be expected as a result of water pollution control requirements. Both points are highly complex and are related to profit objectives, competition, consumer demand and price controls. Moreover, the two- to three-year lag from planning to production in the industry may result in a change in pricing strategy to adjust to current conditions.

Accordingly, a prediction of price effects is highly speculative and, realistically, can only be expressed as a range of possible effects.

1. AN INCREASE IN AUTOMOBILE PRICES IS LIKELY TO DEPEND ON GM'S REACTION TO WATER POLLUTION CONTROL COSTS

General Motors is recognized as the price leader in the automotive industry. GM generally establishes the price in each model category and competing firms accept the price and compete among themselves and GM for the volume demanded at that price by the public. GM can be expected to determine the level of price increase due to water pollution control costs based on its pricing policies and profit objectives.

2. GM'S OBJECTIVE IN PRICING IS TO MAXIMIZE LONG-TERM CORPORATE RETURN ON INVESTMENT

Return on investment as a yardstick for evaluating the viability of operations was established by GM in 1925, and is still the predominant factor in pricing and investment decisions. GM can be seen as projecting its market share model for model over a number of years and, through an analysis of costs, prices, cross model elasticity, available capacity and return on assets employed, establishing standard model volumes and prices that will yield the maximum total corporate profit from the sale of automobiles.

3. THE COST OF WATER POLLUTION CONTROL WILL PROBABLY BE PASSED ON TO THE CONSUMER

The pricing practices and profit objectives in the industry make it relatively safe to assume that water pollution control costs will result in higher suggested retail prices.

No data are available either from the producers or from published sources to describe the percentage of increased costs that historically are passed on in the form of higher prices. In view of this data limitation, and assuming no price control, recovery of operating costs plus a nominal return on investment is the safest basis for developing unit price increases. This method results in the maximum price increase that could logically result from an increase in costs.

4. WATER POLLUTION CONTROL FOR THE SIX PRODUCTION PROCESSES IS ESTIMATED TO COST BETWEEN $5 AND $10 PER CAR

Application of cost data furnished by EPA to water usage and production data obtained from the manufacturers resulted in a probable range of annual operating costs of $46.7 million to $88.6 million with an expected cost of $69.3 million for water pollution control, as shown previously in Exhibit I.

Based on the 1971 production of about 8.5 million automobiles, the average cost per car would range from $5 to $10, with an expected unit cost of $8.

5. THE MAXIMUM PRICE INCREASE TO THE CUSTOMER IS ESTIMATED NOT TO EXCEED $20 PER CAR

Using the most extreme case--which is the top of the cost range plus 30 percent return on invested capital and 24 percent dealer markup--the suggested retail price would be increased by $19. Because the 30 percent is a profit objective which is not typically achieved and because dealers seldom obtain full markup, the actual cost to the customer probably will be approximately $10 to $12 per car.

An average price increase of $10 to $12 per unit (or even the maximum amount) is not expected to have a significant impact on automobile sales.

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IV. FINANCIAL PROFILES

IV. FINANCIAL PROFILES

This chapter presents financial profiles of major automotive producers.

1. FORD AND GENERAL MOTORS ARE THE DOMINANT PRODUCERS IN TERMS OF SALES AND PROFITABILITY

Exhibit II, following this page, is a five-year summary of financial highlights for each of the four major automotive producers. The figures shown relate to consolidated operations and thus include all operations of each company, both foreign and domestic.

As indicated on the Exhibit, Ford and GM are clearly dominant in terms of sales, profitability and return on investment. Chrysler and American Motors, from 1969-1971 have been only marginally profitable reflecting the greater vulnerability of the smaller producers to cyclical downturns in the economy. For 1972 sales and profits for all producers have shown marked improvement as economic growth has resumed. Continued improvement is forecast for all producers during 1973, barring serious automotive or teamsters strikes.

2. CHRYSLER AND AMERICAN MOTORS HAVE RELATIVELY HEAVY LONG TERM DEBT BURDENS

Long term debt as a percentage of shareholders equity in 1971 for each producer was as follows:

	$ Debt (million)	$ Equity (million)	Debt as % of Equity
General Motors	$616	$10,805	5.7%
Ford	802	5,547	14.5
Chrysler	818	2,269	36.1
American Motors	78	214	36.4

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To the extent that future earnings permit, it can be expected that Chrysler and American Motors will reduce reliance on long term borrowing in relation to equity. General Motors and Ford, on the other hand, have relatively little debt in their capital structures.

3. DATA NEEDED TO DEVELOP PLANT SPECIFIC FINANCIAL PROFILES ARE NOT AVAILABLE

No data are available to describe any financial parameter of specific plants or types of plants either from the manufacturers or from published sources. The manufacturers stated that this information was confidential and could not be released under any circumstances.

Because of the complexity of automotive manufacturing operations and the great variety of plant configurations found in the industry, the use of engineering factors to develop cost functions for "model" plants is not practical.

* * * *

V. POLLUTION CONTROL REQUIREMENTS

V. POLLUTION CONTROL REQUIREMENTS

The pollution control requirements and the related costs of investment and operation for treatment equipment for the study were furnished by EPA. This chapter describes that material.

1. POLLUTION CONTROL REQUIREMENTS AND COSTS ARE THOSE NECESSARY TO MEET SCHEDULE "A" OF THE ELG STANDARDS

The treatment configurations and their relative costs as they apply to the production processes as defined by EPA are those necessary to meet Schedule "A" of the ELG Standards of August 14, 1972. The effluent characteristics, absolute pollutant level and limits of process-water usage are shown on pages 7 and 8 of that document.

2. CAPITAL INVESTMENT ESTIMATES WERE PREPARED FOR FOUR LEVELS OF WATER TREATMENT REQUIREMENTS

Exhibit III, following this page, contains estimates of capital investment needs for water treatment equipment assuming the following treatment requirements.

- Moderate requirements for surface discharge
- Moderate requirements for municipal discharge
- Severe requirements for surface discharge
- Severe requirements for municipal discharge

The manufacturing processes to which each requirement is applicable and the treatment configurations (treatment steps) are as indicated by the (X)'s. It should be noted that the cost estimates shown do not apply to combinations of plants. Thus, under Moderate Surface Discharge Requirements, the capital investment range of $0.5 - $1.9 million for a plant with a one MGD water flow would apply to a casting plant or a stamping plant or a body and final assembly plant.

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The range of estimates for each treatment requirement reflects the following cost related factors:

- The low costs correspond to engineering estimates for the actual cost of treatment facilities with a nominal allowance for installation

- The high costs are primarily based on industry estimates and include a greater allowance for factors such as installation, in-plant modifications, flow segregation and collection, and general cost overruns.

Separate estimates were prepared for varying assumed levels of plant water usage, as indicated.

3. FOUR FACTORS WERE USED TO ESTIMATE ANNUAL COSTS

(1) A Depreciation Rate of 8 Percent of Total Investment Is Included in the Annual Operating Cost

A depreciation rate of 8 percent was described by a manufacturer as reflecting its experience for water treatment facilities. This rate was accepted by EPA and was used as a factor in the operating cost calculations.

(2) A Capital Cost of 10 Percent on Total Investment Is Included in the Annual Operating Cost

A capital cost of 10 percent was calculated based on General Motors' financial data. This cost approximates a weighted average cost of capital based on GM's present debt-equity ratio. The 10 percent factor was used in the operating cost calculations.

(3) Annual Operating and Maintenance Costs Were Estimated To Be 20 Percent of Investments in Pollution Control Equipment, Excluding Extraordinary Installation Costs

A cost of 20 percent of investment was described by a manufacturer as reflecting its experience for operation and maintenance of waste treatment facilities. This factor was accepted by EPA with the condition that it be applied only to the cost of treatment equipment and facilities and not the cost of in-plant changes, etc.; (i.e., applied to the low points in the investment cost range.)

(4) A Surcharge of $0.20 Per 1,000 Gallons Was Estimated for Municipal Discharges

A municipal discharge surcharge estimate of $0.20/1,000 gallons was supplied by EPA. This cost was included in the estimates in addition to other operating costs for plants with municipal discharge of process water.

4. EPA COSTS WERE APPLIED TO MANUFACTURERS' PLANT DATA

Manufacturers were interviewed and descriptive plant data were collected for all plants performing the six processes of interest. The data collected included:

- Plant location
- Plant products/processes
- Employment level
- Daily water flow
- Percent municipal discharge
- Production level

The costs furnished by EPA were applied to develop individual plant costs. Within each treatment configuration group, costs for each plant were calculated based on water-flow volume. Three costs were calculated:

- Highest cost--corresponding to the top of the range
- Lowest cost--corresponding to the bottom of the range
- Expected cost--estimate based on actual plant information when possible and on the relationship of water flow to standard water volumes

The investment and operating cost estimates, production level, water use and employment level of each plant are shown in Appendix A.

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VI. IMPACT ANALYSIS

VI. IMPACT ANALYSIS

The original objective of the impact analysis was to determine the effect of water pollution control costs on each segment of the industry. As stated previously, financial data were not available on a plant-by-plant basis. For this reason and because process segregation was not possible in integrated operations, the impact analysis was restricted to consideration of the six processes in total.

The remainder of this chapter describes the impact of pollution control within the six processes on the four major producers.

1. WATER POLLUTION CONTROL INVESTMENT REQUIREMENTS CAN PROBABLY BE MET BY THE INDUSTRY

The maximum projected investment requirement is $331.5 million.* Assuming this investment could be made over a five-year period, the average annual investment requirement is $66.3 million. This level of investment is less than 4 percent of total industry capital expenditures in 1971. The annual investment of $66.3 million is probably no greater than the amounts contained in industry future budgets for pollution control. Total budget figures are not available, but GM's projected expenditures for waste treatment facilities in 1972 was $42 million. This amount, even after removal of the costs for non-automotive operations, should cover GM's share of a $66 million annual requirement.

GM's $42 million expenditure in 1972 is for water treatment only and does not include costs for air pollution abatement. Large investments to reduce air pollution have been made by the industry, particularly in the foundry operation and generally for powerhouses and heating plants. Investments in air pollution facilities through 1972, in GM's case, have been approximately 19 percent greater than investments in water pollution facilities.

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* This investment level represents the cost required to go from no treatment to ELG level "A" and includes an undetermined amount of treatment investments that already have been made.

2. IT IS LIKELY THAT INCREASED COSTS CAN BE PASSED ON TO THE BUYER WITHOUT AFFECTING SALES

The maximum price increase is projected to be less than $20 per unit, including full dealer markup and a 30 percent (before taxes) return on manufacturer's investment. Even at this level, which is certainly higher than the average price increase, no reduction in sales is expected.

This conclusion is largely intuitive but is supported by a quantitative analysis made by Chase Econometric Associates, Inc. on the economic impact of meeting exhaust emission standards.* In that analysis the price increase was approximately 10 percent (water treatment increase is less than 0.6 percent) and projected sales loss was approximately 3 percent.

3. THE COST OF WATER POLLUTION CONTROL IS NOT EXPECTED TO AFFECT PRODUCTION OR PLANT OPERATION

The incremental unit-cost change and investment requirements, while not insignificant, are not of a magnitude that should affect operations. The management of each of the four manufacturers stated that no plants would close because of the cost of water treatment. There may be a very few cases where physical conditions, particularly lack of expansion area, may make meeting a treatment requirement physically impossible. In these cases the plant probably would be converted to a process which would require less water and less rigid treatment requirements.

4. NO IMPACT ON EMPLOYMENT OR COMMUNITIES IS EXPECTED

As discussed previously, no change in production or plant operation is expected. Therefore there would be no effect on employment or on community economic situations. Even if a plant's operations were changed because of physical limitations, and again this is a possibility that is not expected to occur, there would be little impact because:

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* "Phase II of the Economic Impacts of Meeting Exhaust Emission Standards 1971-1980, Part III, the economic impact of pollution abatement," Chase Econometric Associates, Inc., December 1971.

- The older plants where this possibility exists are located in areas of high automotive activity.

- The union contracts provide area seniority, which protects the jobs of the older and established members of the community.

- The plant would be converted to another use.

5. NO IMPACT ON BALANCE OF PAYMENTS IS EXPECTED

The maximum price increase of approximately $19 is not expected to affect automotive sales and is below the level that would affect an individual's decision to purchase a foreign car. There similarly would be no effect expected on the competitive position of U.S.-produced automobiles in foreign markets. The factors affecting the purchase of foreign cars and the position of U.S. products in foreign markets is discussed in Appendix B.

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VII. LIMITS OF THE ANALYSIS

VII. LIMITS OF THE ANALYSIS

Analysis of the economic impact of water pollution control on the automotive industry was limited or constrained by several factors. The following paragraphs discuss these factors and their effect on the accuracy of the data presented and conclusions reached.

1. WATER POLLUTION CONTROL COSTS WERE NOT VERIFIED

Water pollution requirements by process and the associated costs were furnished by EPA. The scope and time available for the study did not permit more than a cursory verification of these data. While the cost ranges furnished generally included the limited amount of actual cost information that was obtained, there were some cases when it did not. A specific example of cost outside the range is the engine machining and assembly plant at Trenton, Michigan. The maximum investment cost for this plant from EPA data is $1.5 million, while the plant records indicate a previous expenditure of $2.8 million and an anticipated additional expenditure requirement to reach level "A" of $250,000.

This may or may not be an isolated example, but it does illustrate that atypical physical and operational conditions can exist which will result in costs that exceed reasonable expectations.

It is hoped that the costs used accurately reflect normal actual costs and that in the aggregate will be correct, but no independent basis for this judgment was developed.

2. INVESTMENT LEVELS DESCRIBED INCLUDE INVESTMENTS THAT HAVE ALREADY BEEN MADE

The investment costs furnished by EPA describe the cost of going from no treatment to the treatment level required to meet level "A" of the ELG Standards. All of the producers have made investments in treatment facilities and in many cases already meet level "B" treatment requirements. The amount of these prior investments could not be determined.

3. THE ANALYSIS DOES NOT INCLUDE ALL PLANTS OF THE AUTOMOTIVE INDUSTRY

Because of the limited time, data and level of effort available for the study, the study team focused its research efforts on passenger-automobile manufacturing by the four major producers. While it is true that in terms of output and employment these firms dominate the industry, their plants probably are not typical of those of the highly diverse suppliers to the industry.

It is highly probable that the four major producers, because of their size and financial resources, will be better able to meet water pollution abatement capital requirements than smaller, less financially entrenched component and vehicle producers. Because of this, caution must be observed in generalizing conclusions regarding the four major producers to encompass the total industry. In view of the highly diverse nature of smaller producers and an almost total lack of usable single-source data regarding their plant types and financial characteristics, a comprehensive analysis of this industry segment was not possible within the scope of this study.

4. THE ANALYSIS DOES NOT INCLUDE THE MANUFACTURE OF ALL AUTOMOTIVE COMPONENTS

Limiting the analysis to the six primary processes used in automotive manufacturing ignores up to 30 percent of automotive water pollution costs for the large integrated producers. General Motors plants which are included in the analysis use 70 percent of the total water used by all GM automotive plants. Components produced by other plants include:

- Transmissions
- Steering components
- Suspension systems, springs, axles
- Carburetors
- Seat and fabric assemblies
- Wheels
- Electrical motors, generators
- Lamps
- Ignition components
- Brake systems
- Plastic parts

5. COSTS ARE NOT LIMITED TO THE SIX PROCESSES

Application of EPA cost data resulted in inflated costs because:

- Integrated plants conduct operations outside the scope of the study, such as transmission manufacture, forging axles, springs and suspension components, etc. Cost estimates were based on total water flow in these plants because water use could not be related to specific processes.

- Some plants included in the analysis produce trucks and truck components as well as automobiles. Since water streams could not be separated between autos and trucks, costs were based on total water flow. The truck production included in the analysis is estimated to be less than 2 percent of total production.

- When possible, only process waste-water was considered, but in many plants, particularly those with 100 percent municipal discharge, waste streams included sanitary and utility water. In plants where waste-stream components could not be identified, cost estimates were based on total water flow.

6. LOCATION OF SPECIFIC PLANT COSTS WITHIN THE COST RANGE SPECIFIED BY EPA WAS NOT PRECISE

The cost figures furnished by EPA covered a wide range; e.g., the investment cost used for integrated plants at a water flow of 12 million gallons per day ranged from a low of $3 million to a high of $10 million. Location of expected costs in a few cases were based on knowledge of actual plant conditions. In other cases, cost estimates were based on water usage rates relative to the rates described in the ELG Standards and in other cases, particularly integrated plants where no basis for placement in the range was available, expected costs were set in the upper-middle portion of the cost range.

7. THE CONCLUSIONS REACHED AS THEY APPLY TO THE FOUR MAJOR PRODUCERS ARE PROBABLY VALID

While the development of data used in the analysis leaves substantial room for error, the conclusions reached are thought to be correct. Even if

the projected costs were doubled, there would be little impact on plant operation or on vehicle sales.

The conclusions reached do not apply to industry suppliers. A much more comprehensive study is necessary to assess the impact on these plants.

* * * *

APPENDIX A

INDIVIDUAL PLANT DATA

Employment, Production Level, Water Flow,
Pollution Control Cost

LIST OF APPENDIX A EXHIBITS

A-I CASTING PLANTS

A-II ENGINE MACHINING AND ASSEMBLY PLANTS

A-III STAMPING PLANTS

A-IV BODY AND FINAL ASSEMBLY PLANTS

A-V INTEGRATED PLANTS

A-VI PRODUCTION, EMPLOYMENT AND WATER USE DATA FOR U. S. AUTOMOTIVE PRODUCTION FACILITIES

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APPENDIX B

INDUSTRY DESCRIPTION

LIST OF APPENDIX B EXHIBITS

B-I AUTOMOBILE CLASSES AND REPRESENTATIVE EXAMPLES

B-II PERCENT OF TOTAL SALES OF 1970 AND 1971 U.S. CAR PRODUCTION IN $100 PRICE GROUPS

B-III PERCENT OF MOTOR VEHICLE REGISTRATIONS BY STATE IN 1971

B-IV PERCENT OF TLTAL SALES BY MARKET CLASS FOR 1967-1971

B-V USE OF RAW MATERIALS BY THE AUTOMOTIVE INDUSTRY

INDUSTRY DESCRIPTION

Passenger automobiles are the basic method of personal transportation in the United States, and as such are functionally a single product. However, the product-line presented to the consumer is large and varied. Even in this age of mass production, it is possible that no two cars produced are exact duplicates. This is due to the wide range of choices in make, model, body color, body style, fabrics, trim, engines, transmissions and, of course, the almost unlimited list of extra-cost, convenience, safety, performance and personal-comfort options.

Based primarily on sales price, passenger cars can be grouped in six mutually exclusive market classes. The classes and representative examples are described in Exhibit B-I, following this page.

The relative share of sales for U.S. production by $100 price groups in 1970 and 1971 is shown graphically in Exhibit B-II, following Exhibit B-I.

1. FOREIGN MARKET POTENTIAL FOR U.S. AUTOMOTIVE PRODUCTS IS LOW

In 1971 the United States produced 6 million passenger cars with a total retail value of over $21 billion. Export sales are somewhat erratic, but have been holding at over $1 billion since 1963. In 1971 automotive exports totaled $1.3 billion. The major factors which tend to reduce the foreign market potential for U.S.-manufactured vehicles are the imposition of high tariffs by other nations and discriminatory devices such as progressive registration fees for vehicles of larger engine capacity.

Other factors which have contributed to a hard foreign market include:

- Low income levels, limited purchasing power
- High gasoline taxes
- High shipping costs
- Development of manufacturing and assembly industries in foreign countries
- Low labor and raw materials costs in foreign countries

EXHIBIT B-I

Environmental Protection Agency

AUTOMOBILE CLASSES AND REPRESENTATIVE EXAMPLES

Class	Representative Models
Luxury	Cadillac, Lincoln, Imperial
Medium Price	Polara, Pontiac, Oldsmobile, Buick, Mercury, Chrysler
Regular	Chevrolet, Ford, Fury, Ambassador
Intermediate	Matador/Rebel, Satellite, Coronet/Charger, Fairlane/Torino, Montego, Comet, Skylark, Chevelle, C85/Cutlass, LeMans
Compact	Ventura II, Chevy II/Nova, Falcon, Valiant, Dart, Hornet, Maverick, Comet
Subcompact	Vega, Pinto, Gremlin
Specialty/Sports	Javelin, Continental, Barracuda, Mustang, Cougar, Thunderbird, Riviera, Eldorado, Camaro, Corvette, Toronado, Firebird, Monte Carlo, Grand Prix

PAGE NOT

AVAILABLE

DIGITALLY

2. U.S. CORPORATIONS ARE EXPANDING OVERSEAS MARKETS TO GAIN A BETTER POSITION IN THE WORLD MARKET

While the United States is still the largest producer of automobiles in the world, its world-market share has dropped from 76 percent in 1950 to 32 percent in 1971. This trend is expected to continue with the world market increasing at a faster rate than the U.S. market. Since automotive products produced in the United States cannot compete effectively in foreign markets, U. S. manufacturers have moved production overseas.

- Between 1966 and 1971, Ford added 24 million square feet in foreign plants compared to 23 million square feet added to U.S. plants.
- Ford's 1972 expansion plans are 60 percent foreign and 40 percent domestic.
- GM purchased a share of Isuzu Motors of Japan in 1971.
- Chrysler purchased a share of Mitsubishi of Japan in 1971.

3. IMPORTS CONTINUE TO PENETRATE THE U.S. MARKET

Import sales hit an all-time high in 1971 when 1.5 million units were delivered, a 19.9 percent increase over 1970. Import sales in 1971 were 15.3 percent of total car sales. There were indications early in 1972 that the flood of import cars had been stemmed. The 10 percent surtax imposed by the President in August 1971 and the subsequent devaluation of the dollar (the surtax was dropped at this point) resulted in slightly higher prices for imports. Import sales were also reduced, and probably to a greater extent, by the dock strike late in 1971. Even so, import sales in the first nine months of 1972 were only 3 percent below 1971, and appeared to be swinging upward. Import sales in August and September 1972 were higher than the same months in 1971.

Many of the factors which limit the export potential of U.S. products make imports popular here, but these factors are related to price and price is not the only consideration. The primary consideration is the belief that foreign cars are better than domestic products. Also, foreign producers are innovators. In recent years they have pioneered three-point seat belts, dual brake systems, disc brakes, front-wheel drive, mid- and rear-engine cars, radial tires and, most recently, the Wankel engine. An additional attraction of the foreign car is the longer retention of basic style and appearance. There

is a widespread belief that U.S. manufacturers change styles in order to promote frequent new purchases. Import buyers are not concerned with their car going out of style in a few years.

For whatever the reasons, imports are here to stay; and unless safety and emission regulations price them out of the market, will probably maintain or increase their share of the U.S. market. U.S. makers have appeared to have adapted to the situation as captive import sales in 1971 were up 68 percent over 1970 to almost 14 percent of total import sales.

4. THE DOMESTIC MARKET FOR U. S. AUTOMOTIVE PRODUCTS IS NATIONWIDE

U.S.-produced cars are distributed through 26 thousand franchised dealers representing 39 thousand franchises. Dealer location and sales are related to population density. Exhibit B-III, following this page, shows the percent of automotive registrations by state in 1971.

5. THE POPULARITY OF SMALL CARS HAS INCREASED DOMESTIC SALES IN THE COMPACT AND SUBCOMPACT CLASSES AND REDUCED SALES IN OTHER CLASSES

The introduction of the Gremlin, Vega and Pinto in 1970 resulted in sales of 148 thousand units. Sales in 1971 jumped 420 percent to 722 thousand units. A part of the increase is due to late introduction in 1970, but the increase is expected to continue and may reach 12 to 15 percent of total sales in 1973. Also, sales in the compact class have increased from 6.7 percent of total sales in 1967 to 12.1 percent of total sales in 1971. The primary market target for these classes, particularly the subcompacts, was foreign cars; but they seem to have missed the mark and have impacted on the sale of more expensive American cars without affecting the sale of foreign cars. The percent of total sales for each market class from 1967 to 1971 is shown in Exhibit B-14, following Exhibit B-III.

6. AUTOMOBILE PRODUCTION IS A MAJOR CONSUMER OF THE NATION'S RAW MATERIALS

The automotive industry is the nation's largest user of metals and rubber materials. The automotive consumption and the percent of total U.S. consumption is shown in Exhibit B-V, following Exhibit B-IV.

EXHIBIT B-III

Environmental Protection Agency

PERCENT OF MOTOR VEHICLE
REGISTRATIONS BY STATE IN 1971

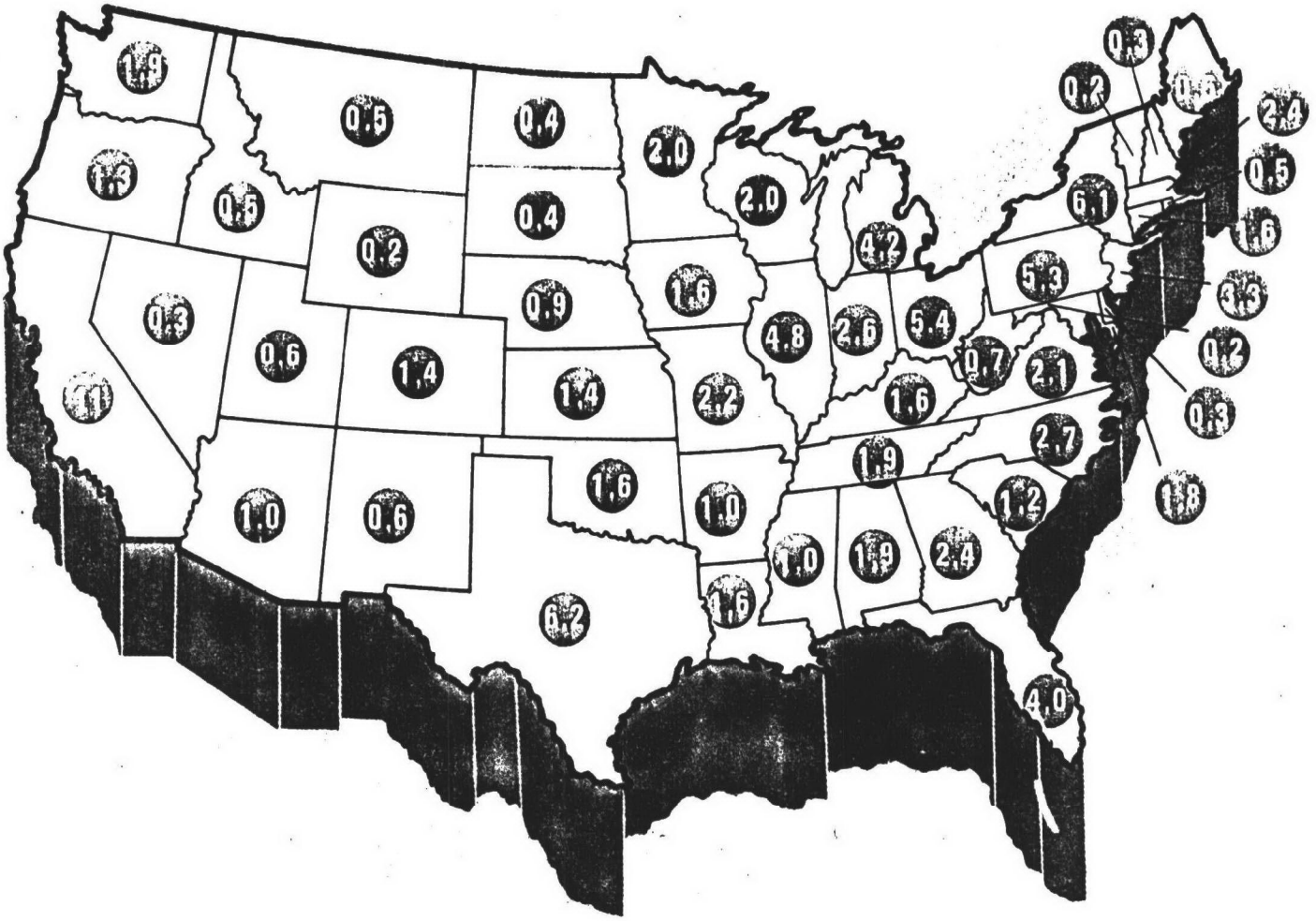

EXHIBIT B-IV

Environmental Protection Agency

PERCENT OF TOTAL SALES BY
MARKET CLASS FOR 1967 - 1971

Class	Percent of Total Sales				
	1967	1968	1969	1970	1971
Luxury	2.9	2.6	2.9	2.3	2.7
Medium Price	17.8	17.0	16.8	13.7	15.1
Regular	28.6	27.0	25.9	22.5	20.9
Intermediate	21.8	24.0	22.2	21.0	18.1
Compact	6.7	7.1	9.8	13.8	12.1
Subcompact	--	--	--	1.6	7.4
Specialty/Sports	12.8	11.7	11.1	10.3	8.6
Foreign	9.3	10.5	11.2	14.7	15.1

EXHIBIT B-V

Environmental Protection Agency

USE OF RAW MATERIALS BY
THE AUTOMOTIVE INDUSTRY

Raw Material	Automotive Consumption	Percent of Total U. S. Consumption
Steel	14,475,207 tons	15.9
Aluminum	368,500 tons	8.2
Copper	225,000 tons	7.8
Cotton	38,932 tons	1.9
Iron	351,591 tons	41.2
Nickel	20,300 tons	11.3
Natural Rubber	386,817 long tons	69.2
Reclaimed Rubber	115,493 long tons	57.9
Synthetic Rubber	1,190,779 long tons	62.1
Zinc	398,750 tons	29.0

7. AUTOMOTIVE PRODUCTION IS A NATIONWIDE BUSINESS

The production of automotive components and parts is spread throughout the country. Final assembly of automobiles is made in 17 states. The plants owned by the four U.S. producers which perform processes covered by the study are shown in Appendix A-VI. Appendix A-VI also describes for each plant location the products produced by process, the production volume, the employment level and the water usage.

8. CHANGES IN AUTOMOTIVE DESIGN ARE TIED TO EMISSION AND SAFETY REGULATIONS

The requirement to reduce automotive emissions has led manufacturers to search for an alternative to the conventional internal-combustion engine. The most prominent alternative is the Wankel engine. While the Wankel in its basic form is not necessarily a cleaner engine than present items, it may be easier to clean up and with less degredation of engine performance and economy. General Motors is expected to offer a Wankel-powered car by 1975. Further in the future but also under development is the gas turbine.

Other changes in the foreseeable future include:

- Heavier bumpers
- Passive restraint devices
- Catalytic exhaust converters
- Metallic brake linings
- Honeycomb steel construction
- Physiological anti-theft and anti-drunk devices
- Periscopic and CCTV rear-vision devices
- Digital readout of computerized monitoring of vehicle operation and performance

These changes, many of which are demanded by regulations, will increase the price of automobiles and the labor requirement in the automotive industry.

9. PRODUCTION DEVELOPMENTS ARE RELATED TO ENVIRONMENTAL PROTECTION REGULATIONS

The traditional method used for melting iron in automotive foundries is the cupola, which belches black smoke that is almost impossible to control. To reduce the potential for air pollution, foundries use wet scrubbers in the cupola stacks, which results in large volumes of water polluted with solids and phenols. New foundries use electric-arc furnaces, which melt cleanly with dry dust-collection systems to reduce air pollution.

A second technological improvement is the use of dry-particle electrostatic painting. In this process, dry electrically-charged particles are sprayed on electrically-charged auto bodies. Electrical energy holds the particles in place until the vehicle enters a heated chamber where the particles melt and flow to give a smooth finish. This process eliminates the need for water-curtain spray booths and their resulting water pollution.

10. SAFETY AND EMISSION REGULATIONS WILL INCREASE AUTOMOBILE PRICES AND HAVE LITTLE EFFECT ON SALES: THE NET RESULT WILL BE INCREASED LABOR DEMANDS BY THE AUTOMOTIVE INDUSTRY

The accumulated effect of safety and emission-control requirements on car prices has been projected to reach $1,200 per unit by 1975. Even with this price increase, automotive producers are projecting a 25 to 30 percent increase in unit sales by 1980. Since the added cost items require labor to produce, the net effect will be an increase in labor requirements which could be 50 percent above the present level by 1980.

11. THE ARRIVAL OF THE FOUR-DAY WEEK MAY ALSO BOOST THE NUMBER OF PEOPLE EMPLOYED IN THE AUTOMOTIVE INDUSTRY

The shorter workweek is expected to be a major goal of the UAW-Big Three contract negotiations in 1973. The attitude and resistance of manufacturers is uncertain, but several factors make a positive decision at least possible:

- The UAW is one of the strongest unions in the country.
- The manufacturers recognize the monotony of assembly-line work and are interested in steps to reduce the problem.

- The problems of low productivity and excessive absenteeism on Mondays and Fridays are increasing to an intolerable level.

- Manufacturers may look upon the four-day week as an opportunity to fulfill their social responsibility.

The four-day week may not come in 1973, but will very likely be a reality before 1980. When it happens, an additional increase in labor demands for the automotive industry may occur.