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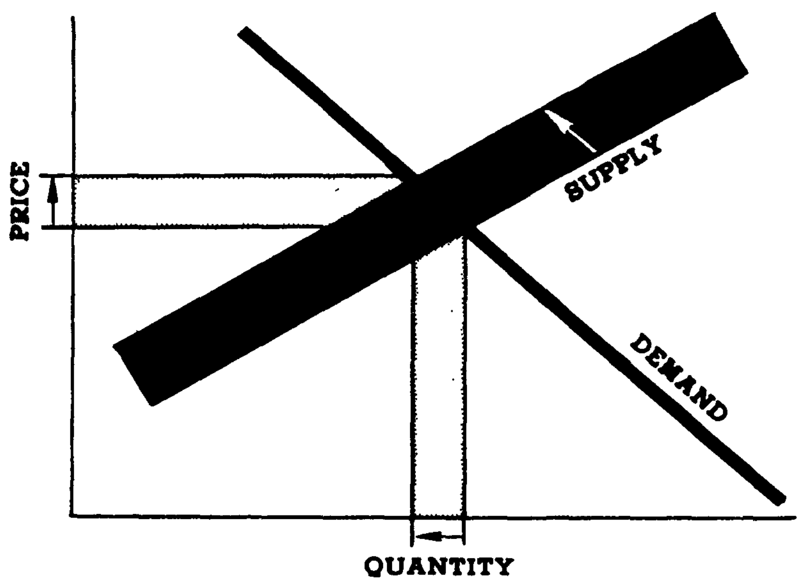
ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES

THE INTEGRATED IRON and STEEL INDUSTRY



U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Planning and Evaluation
Washington, D.C. 20460

ECONOMIC ANALYSIS
OF
THE PROPOSED EFFLUENT GUIDELINES
FOR
THE INTEGRATED IRON AND STEEL INDUSTRY

FINAL REPORT

FEBRUARY, 1974

OFFICE OF PLANNING AND EVALUATION
ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

CONTRACT NO. 68-01-1545

ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC ANALYSIS OF THE PROPOSED EFFLUENT GUIDELINES FOR THE INTEGRATED IRON AND STEEL INDUSTRY

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Analysis of the Ability of the U.S. Steel Industry to Finance Pollution Control Equipment -- Prepared by Booz, Allen & Hamilton, Inc.

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EXHIBITS

EPA REVIEW NOTICE

This report has been reviewed by the Office of Planning and Evaluation of EPA and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

PREFACE

The attached document is a contractors' study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports promulgation of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of produce price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68-01-1545 by A. T. Kearney, Inc. Work was completed as of February, 1974.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under sections 304(b) and 306 of the Act for the subject point source category. The study has not been reviewed by EPA and is not an official EPA publication. The study will be considered along with the information contained in the Development Document and any comments received by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

ENVIRONMENTAL PROTECTION AGENCY

ECONOMIC ANALYSIS OF THE PROPOSED EFFLUENT GUIDELINES FOR THE INTEGRATED IRON AND STEEL INDUSTRY

EXECUTIVE SUMMARY

INTRODUCTION

It was the objective of this study to determine the impact of the costs of water pollution abatement on the Integrated Iron and Steel Industry. The study was restricted in scope to an analysis of the primary operations only, including coke plant, blast furnace, steel production, sintering, degassing, casting and slagging.

We would like to acknowledge the participation of J. E. Allen & Associates in the technical aspects of this study, as well as the participation of Father William T. Hogan and the Industrial Economics Research Institute of Fordham University in the economic aspects of this study. Cooperation of the Environmental Committee of the American Iron and Steel Institute, as well as that of several steel companies, is also acknowledged with appreciation.

The supplementary section covering "Analysis of the U.S. Steel Industry to Finance Pollution Control Equipment" was prepared by Booz-Allen Public Administration Services, Inc., at the request of the Environmental Protection Agency.

THE STEEL INDUSTRY

The Iron and Steel Industry is one of the largest in the nation, comprising some 179 companies operating 420 plants. Total production was 133 million tons of raw steel and 92 million tons of steel products in 1972, and reached an all time peak of 150 million tons of raw steel in 1973. Employment is 636,000 making the industry one of the largest employers. Growth rate is expected to be at about 2½ percent annually, with total production of raw steel about 185 million tons by 1983, provided that industry expansion keeps up with demands for steel products.

Twenty-three of the steel companies operate 63 integrated steel plants, which were the subject of this study. The primary operations in the integrated steel plants account for about 90 percent of raw steel production, or about 120 million tons in 1972, and 135 million tons in 1973.

SEGMENTATION

No further segmentation of the Steel Industry was made in this study beyond that already made by the EPA in selecting the primary operations of the integrated steel plants for study.

FINANCIAL PROFILE

Financial data on individual plants of large companies were not available. However, the limited published data provide an estimated financial profile of the entire Steel Industry. The following table is based on 1972 sales and profitability, as reported by the American Iron and Steel Institute.

TABLE 1

Total Production-Raw Steel	133,102,000 Tons
Total Shipments-Finished Steel	91,805,000 Tons
Net Sales and Revenues	$22,157,000,000
Net Income After Taxes	$738,000,000
Net Income as Percent of Sales	3.33
Invested Capital	$17,078,000,000
Net Income as Percent of Investment	4.32
Capital Expenditures	$1,158,000,000

With an estimated after-tax profit on sales of 3.33%, the Steel Industry is under the return for all manufacturing firms in general.

STEEL PRICES

Prices for steel products have followed an established pattern of published base prices to which are added extras and from which are deducted discounts to arrive at actual selling prices for individual products. Composite price of finished steel has increased continuously since the War, with present composite about $221 per ton, an increase of over 100% in the past 20 years. This increase, since the early 1960's, has been effectively controlled by the federal government through both formal and informal means. These constraints have been a major factor in the industry's low profitability. During the peak demand of the past year's price controls, currency devaluation and world-wide demand for steel have created the anomaly of foreign steel selling in the U.S. above domestic prices and U.S. producers exporting scarce steel because it could be sold above the controlled price overseas.

METHODOLOGY OF IMPACT ASSESSMENT

The following methodology was used in assessing the economic impact of the cost of water pollution control on the Iron and Steel Industry.

1. The financial condition of the industry as a whole was measured in terms of the industry's average profit after taxes as a percent of sales and the average profit after taxes as a percent of total assets.

2. The impact on prices of steel was determined based on the projected costs of water pollution control for primary operations. This was done for a low estimated cost based on the Cyrus Wm. Rice report, and on a high estimate of cost based on the AISI survey data.*

3. Effect on capital requirements and debt structure of the Industry was assessed, and sources for capital for pollution control costs were analyzed. This information was obtained from AISI published data annual reports of individual companies, financial underwriters, and unpublished data from the files of Kearney and its consultants.

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* "Effluent Limitations Guidelines and New Source Performance Standards for Iron and Steel Industry," Cyrus Wm. Rice Division, June, July, and November, 1973.

"Survey of Water Pollution Control Costs in Iron and Steel Industry," American Iron & Steel Institute Environmental Committee.

4. The impact on product curtailment, plant closing, etc., was based on:

(a) Judgmental assessment of the expected financial impact.

(b) Interviews with industry sources.

COST OF WATER POLLUTION CONTROL

The estimated investment and annual operating and maintenance cost for effluent limitations for primary operations in the integrated steel plants were supplied by the Cyrus Wm. Rice Division of NUS Corporation. A second set of cost figures were received from the Environmental Committee of the American Iron & Steel Institute, based on data obtained from an Industry survey by AISI. Because of the wide spread between these estimates, they were used as low and high estimates, and cost impacts were developed for both as shown in Table 2 as follows:

TABLE 2
(Millions of Dollars)

	Low Estimate	High Estimate
DATA SOURCE:	Cyrus Wm. Rice	AISI
LEVEL I - Best Practicable Technology (BPT)- 1977		
Investment	$ 145	$ 500
Annual Operating Cost-1977	40	167
LEVEL II - Best Available Technology (BAT)- 1983		
Investment	122	1,100
Annual Operating Cost-1983	82	366
TOTAL LEVELS I and II		
Investment	267	1,600
Annual Operating Cost	82	533

IMPACT ANALYSIS

(a) Price Effects

The investment costs for water pollution control in primary operations in the Integrated Steel Industry required to meet the 1977 standards (BPT) have been estimated to range from a low figure of approximately $145 million to a high figure of approximately $500 million. The annual operating costs have been estimated to increase in the range of $ 40 million to $167 million by 1977. This has been projected to result in an increased cost per ton of finished steel from $0.43 to $1.80 by 1977. It has been assumed that this industry will attempt to recover these costs by increasing the price of steel.

The industry is projected to require an additional investment for water pollution control in the primary operations in integrated steel plants, to meet the 1983 standards (BAT) ranging from an estimated low figure of about $ 122 million to a high figure of about $850 million. The annual operating costs have been estimated to increase additionally in the range of from $82 million to $283 million by 1983. This results in a combined total increase for the period 1973-1983 of from $267 million to $1,350 million in capital costs, and an increase in operating costs ranging from $82 million to $450 million. This increase in operating costs will result in an increase in cost of production of a ton of finished steel of from \$0.88 to \$5.04 This increase has been projected to result in a similar increase in price of finished steel.

Those industries which use large quantities of steel in their products can be expected to pass on any major increase in cost of steel, in the form of a price increase in their products. Such industries as automotive, construction, appliances, farm equipment and containers are expected to be among those most affected.

(b) Financial Effects

The alternates for paying for increased costs for pollution control, which are open to the Steel Industry are: to hold prices constant by absorbing higher costs from earnings; to hold earnings constant by increasing prices to cover increased costs; or to increase earnings to pay for increased costs for pollution control, as well as to generate capital for investment costs for pollution control. The cost data in this study reflect the middle course, of raising prices sufficiently to cover the cost of pollution control.

The high degree of capitalization in the Steel Industry, combined with the high debt to assets ratio, and the low earnings to assets ratio have made raising of capital for expansion, modernization and replacement programs increasingly difficult and costly.

Since 1971, an increasing portion of pollution control costs have been financed through issuing of tax exempt pollution control revenue bonds. This method of financing offers lower interest rates and has been easier to arrange for than commercial financing, and is expected to be the principal source of pollution control financing in the future.

(c) Production Effects

Based on the data analyzed and interviews with steel manufacturers, it is believed that 11 of the 63 integrated steel plants are either in the process of having operations curtailed or of being closed, or are in danger of curtailment or closing. Although the total costs and problems of installing pollution controls may be the final event that results in the decision to close, the fact that these plants have, for various reasons, been marginal operations for many years is the basic cause for this action. These plants produce about 5 percent of raw steel and employ some 33,000 workers, or about 7 percent of the total industry employment. In view of the fact that overall production is expected to continue to increase despite these potential closings, it is believed that the tonnage being produced in these plants will largely be taken up by other mills which will be upgraded in capacity. This is expected to result in a re-employment in the industry up to half of the displaced workers, or their equivalent. While national use of raw materials, supplies and utilities is not expected to be diminished, there will be local departments where isolated mills close.

Because most of the mills which may be subject to curtailment or closure employ thousands of people, the impact on communities in which these plants are located may be severe. This will be particularly true where the mill is the only, or the principal industry in a small community, or where more than one mill in the same community may close.

If U.S. production of steel is curtailed, or even if normal growth is reduced, the result will be an increase in demand for imported steels to meet needs in this country. However, unless world steel capacities are raised beyond expected plans, foreign steel may not be available to bridge the gap between demand and production, which would result in an increasing shortage of steel in this country. If price relief is not granted to the U.S. Steel Industry, there may be an increasing trend toward exporting U.S. steel to foreign countries.

It must be noted that this industry is under economic pressure due to several other factors:

1. Total water pollution control costs for the entire industry are expected to ultimately amount to three to five times the costs for primary operations only.

2. Air pollution control costs are estimated to be almost as much as those for water pollution control.

3. The total impact of air and water pollution control costs by 1983, including costs already incurred, is expected to result in a total investment ranging from about $6 billion

to over $9 billion. This is expected to raise operating costs from $15.07 to $24.50 per ton by 1983. This includes costs of pollution control for estimated added steel capacity required by 1983.

(d) New Source Standards

New source standard costs have been assumed to be the same as those for the 1983 standards. Separate costs have been estimated for this purpose for added steel industry capacity required to satisfy demands by 1983.

LIMITS OF THE ANALYSIS

(a) Accuracy

The accuracy of this study depends upon the accuracy of:

1. Published industry data.

2. Unpublished information supplied by knowledgeable industry personnel.

3. Cost data developed separately from this analysis by Cyrus Wm. Rice Division and the Iron and Steel Industry represented by AISI.

4. Estimates by A. T. Kearney consultants.

The wide range in costs estimated by the two sources resulted in presentation of two sets of economic figures, representing potential low and high costs for pollution control.

The limitation in scope, covering only water pollution control for the primary operations in the integrated steel plants, resulted in only a partial coverage of the actual costs and impact on the Steel Industry.

The only industry financial data which was available was overall company statistics for those steel companies which were not wholly owned by other corporations. No data on costs or profitability of individual plants was available, nor was data available for wholly owned steel companies.

(b) Critical Assumptions

The assumptions which directly affect the findings and conclusions of this study are listed below.

1. Cost estimates provided by Cyrus Wm. Rice Division, and by the AISI were used without modification.

2. It was assumed that the industry's average profitability as a percent of sales would continue to be equal to the average for the 1967-1972 period. This would require that cost increases for pollution control be passed on in the form of price increases.

(c) Impact on Individual Companies

Obviously the economic impact on individual companies or plants will not be equal. With a limited number of industry producers however, it is impossible to discuss these cases without disclosing information which was obtained under promise of confidentiality.

Even a general discussion of these companies would reveal the identities to knowledgeable industry personnel. Therefore, no discussion which contained data gathered from confidential sources and could identify individual firms was presented in this report.

I - INTRODUCTION

STATEMENT OF THE PROBLEM

The 1972 amendments to the Federal Water Pollution Control Act have required the Environmental Protection Agency to establish effluent limitations for most major industries which are sources of water pollution. Studies are now under way to establish these limitations in some 28 industries. These effluent limitations will apply to existing and new plants, and at legislated dates, progressively more restrictive limitations will be imposed. Specifically, by July, 1977, effluent requirements will be in effect that require application of the best practicable control technology currently available. By July, 1983, a more restrictive set of limitations will be enacted that require the application of the best available technology economically achievable; by 1985, if possible, techniques and systems that enable the industries to effect a zero level of discharge will come into effect.

The tremendous effort which has been expended by the EPA and its predecessor agencies in the technical development of the nature of the pollution problem and its solutions has resulted in a multiplicity of programs which have begun to bring the pollution problem under control. The establishment of timetables has put time parameters on these control efforts, requiring the expenditure of vast sums of money by all types and levels of industry to meet these deadlines by installation of pollution controls.

NATURE OF THE PROBLEM

In recent years a recognition of the potential economic problems facing industry in meeting the control requirements has resulted in study programs in which the economic impact of the costs of pollution control on American industry and on the economy in general has been analyzed. These culminated in the Economic Impact Studies sponsored by the Council for Environmental Quality, the Department of Commerce, and the EPA in 1971 and 1972, in which 11 industries were studied.

The EPA is now increasing the number of industries which are being studied and expanding the scope of previous studies by authorizing the current series of Economic Impact Studies which are specifically aimed at analyzing the economic impact of the costs of water pollution abatement requirements under the Federal Water Pollution Control Amendments of 1972.

SCOPE OF WORK

The industry which is covered by this study is the integrated Iron and Steel Industry as covered by SIC 3312. However, although this code includes all aspects of the industry, the scope of this study has been limited by the EPA to only the following processes: coke production, burden preparation, iron production, steel production, degassing, metal casting, and slagging.

The EPA has provided copies of prior studies, reports and analysis which give pollution abatement cost, technology information and economic data. This has enabled this study to build upon prior work. The Iron and Steel Industry has probably been more thoroughly studied with respect to all aspects of pollution control than any other industry. Technical studies of air and water pollution control have been made, and in 1971-72, a study of the Economic Impact of Pollution Control on the Iron and Steel Industry was prepared for the Council on Environmental Quality and the EPA. Although the technical studies were relatively thorough, the economic impact studies have generally been superficial due to lack of cost and financial data at the individual plant level.

Therefore, in view of the existence of these prior studies, the scope of work for this study was concentrated on the following tasks:

1. Review new cost and technology data to determine additional cost required to meet the proposed guidelines.

2. Assess the overall economics of the industry by reviewing the earlier study to confirm or modify the basic assumptions and conclusions.

3. To assess the possibility of plant closings, including an identification of situations where plant closings are possible.

4. Based on the data which is developed, to provide an impact analysis covering the viability of the industry and the question of possible plant closings.

The limitation in coverage of the industry resulted in only integrated steel companies being covered, that is companies with iron, coke and steel making capabilities. This has eliminated the non-integrated companies who only cold melt in open hearth or arc furnaces, and/or roll steel into shapes for sale. Another and more critical limitation was the coverage of only the primary part of the integrated plants, that is the coke, iron and steel producing facilities, leaving out at this time the rolling and finishing departments. This means that with only a few exceptions, only part of each of the plants is covered by the study. This limitation was imposed because the effluent guidelines study recently completed also covers only this portion of the industry.

This subject will be covered in greater detail in another section of the report, and the effect of these limitations, on the ability to analyze a major segment of the Iron and Steel Industry, will be discussed.

METHOD OF APPROACH

This study was conducted in three phases. Phase I developed a physical and financial profile of this industry. Phase II analyzed the economic impact of water pollution control costs on the industry, and Phase III was the preparation of the final report.

The method used in conducting this study is discussed in the following paragraphs.

(a) Phase I

1. Collected and reviewed all published data and information which could be found in trade journals, government sources and A. T. Kearney files.

2. Reviewed the data and information prepared for the study of air pollution in the Iron and Steel Industry.

3. Met with the following in order to gather any additional information:

(a) National Industrial Pollution Control Council, U.S. Department of Commerce

(b) Bureau of Competitive Assessment and Business Policy, U.S. Department of Commerce

(c) American Iron & Steel Inst.industry representative

(d) Cyrus Wm. Rice Division, NUS Corp.

(e) Environmental Protection Agency

4. Met with the Contracting Officer to redefine the scope of the study.

5. Conducted telephone interviews with each of the major steel companies to obtain additional necessary information. Twenty-two companies, operating 58 plants were contacted. Company executives interviewed included nine Vice Presidents and 13 General Managers and Department Heads.

6. Analyzed all of the data collected. A list of reference sources used in this study is given in Exhibit I-1.*

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* All exhibits are located at the end of the section in which they are discussed.

7. Prepared a draft report covering the findings of Phase I and reviewed Phase I findings and conclusions with the EPA.

(b) Phase II

1. Analyzed the data developed by Cyrus Wm. Rice Div. with respect to the projected costs of water pollution control.

2. Revised some of the data collected in Phase I due to the availability of additional and revised information.

3. Analyzed all data collected and developed conclusions based on this analysis.

4. Prepared a draft report covering the findings and conclusions of Phase II.

(c) Phase III

The draft reports covering the results of Phase I and Phase II were combined into a single report, finalized and submitted to the EPA.

LIST OF REFERENCE MATERIAL USED IN ECONOMIC IMPACT STUDY

STUDIES AND REPORTS

1. "A Study of the Economic Impact on the Steel Industry of the Costs of Meeting Federal Air and Water Pollution Abatement Requirements." Prepared for the Council on Environmental Quality by Booz, Allen and Hamilton, July, 1972.

2. "A Study of the Impact of Pollution Controls on Foreign Trade." (Chapter III - The Steel Industry) Prepared for the U.S. State Department by Booz, Allen and Hamilton, 1973.

3. "Industry Profile Study on Blast Furnace and Basic Steel Products." Prepared for the Environmental Protection Agency by Cyrus Wm. Rice Division, December, 1971.

4. "Effluent Limitations Guidelines and New Source Performance Standards - Iron and Steel Industry." Prepared for the Environmental Protection Agency by Cyrus Wm. Rice Division, June, 1973, and Nov., 1973.

5. "Environmental Steel." Prepared by The Council on Economic Priorities, 1973.

6. "Evaluation and Comments on Validity of Information in BAH Study and in Water Pollution Guidelines Study." Prepared for the Environmental Protection Agency by Goodson Associates, Inc., May, 1973.

7. "A Systems Analysis Study of the Integrated Iron and Steel Industry." Prepared for the National Air Pollution Control Agency by Battelle Memorial Institute, May, 1969.

8. "A Cost Analysis of Air-pollution Controls in the Integrated Iron and Steel Industry." Prepared for the National Air Pollution Control Agency by Battelle Memorial Institute, May, 1969.

9. "Improved Prospects for U.S. Steel in the 1970's." Prepared by Mitchell, Hutchins, Inc., November, 1972.

10. "Economic Impact of Pollution Control on the Iron and Steel Industry in Illinois." Prepared for the Illinois State Chamber of Commerce by A. T. Kearney, Inc., April, 1973.

PUBLISHED ARTICLES AND DATA

1. Directory of Iron and Steel Plants in the USA and Canada, American Iron and Steel Institute, 1970.

2. Annual Statistical Report of the Iron and Steel Industry, American Iron and Steel Institute, 1972.

3. Iron and Steel Plant Directory, Association of Iron and Steel Engineers, 1973.

4. Articles and Reference Data published by 33 Magazine

5. Articles and Reference Data published by Iron and Steel Engineer Magazine

6. Articles and Reference Data published by Iron Age Magazine

7. Articles and Reference Data published by Blast Furnace and Steel Plant Magazine

8. Articles and Reference Data provided by the American Iron and Steel Institute

9. Annual Reports published by the Steel Companies who operate integrated iron and steel plants.

10. Statistical Data published by the U.S. Dept. of Commerce.

OTHER

J. E. Allen & Associates, Inc.
Chicago, Illinois

Bureau of Competitive Assessment and Business Policy, U.S. Department of Commerce
Washington, D.C.

Cyrus Wm. Rice Division
Pittsburgh, Pennsylvania

Environmental Protection Agency, Effluent Guidelines Division
Washington, D.C.

American Iron and Steel Institute
Washington, D.C.

National Industrial Pollution Control Council, U.S. Department of Commerce
Washington, D.C.

Industrial Economics Research Institute
Fordham University
Bronx, New York

PERSONAL INTERVIEWS

(a) Manufacturers

Interviews with the major integrated iron and steel producers.

(b) Financial Organizations

Interviews with underwriters of industrial and pollution control revenue bonds.

II - THE IRON AND STEEL INDUSTRY

DISCUSSION OF THE INDUSTRY

The American Iron and Steel Industry is extremely large and complex. It is of interest to explore the make-up of the industry in terms of plants and companies, since this is the area which is investigated in this study. The following tabulation lists the number of companies and plants falling into the categories of integrated, non-integrated melting, and hot and cold working plants.

Table 3

Number of Companies	Integrated Plants	Non-Integrated Melting Plants	Non-Melting Hot and Cold Working Plants
23	63	20	73
59	-	76	32
97	-	-	156
179	63	96	261

Total Number of Plants - 420

These plants are located in almost every state, but the principal concentrations are in the northeast quadrant of the country in the steel states of Pennsylvania, Ohio, Indiana and Illinois. Some of the mills are very old, dating back to pre-World War I, while others, particularly the mini-mills, are new, having been built during the last decade.

In Exhibit II-1, a plant-by-plant tabulation of facilities of the integrated plants covered by this study is given. Most of these integrated plants are equipped with coke plants, blast furnaces, and either or both types of steel furnaces, open hearths and basic oxygen converters. Some are also equipped with sintering plants and all of those which produce steel are provided with ingot or continuous casting facilities. In a few cases only coke plants and blast furnaces are in operation. All of the plants which produce steel are also equipped with rolling mills and some type of finishing facilities.

The integrated plants represent all of the coke making and iron making capacity which is associated with the steel industry, and about 90 percent of the steel making capacity. The balance of the steel making capacity is represented by the non-integrated steel producers, many of which are classed as mini-mills.

A detailed description of the coke, iron and steel processes and of the individual plants is not given in this study since it has already been covered in prior studies referenced in Exhibit I-1. Additional data regarding the steel plants is given in the Appendix of this study.

PRODUCTION AND PRODUCTIVE CAPACITY

Although the year-to-year production of raw steel has fluctuated widely as shown in Exhibits II-2 and II-4, the average rate of growth during the past 15 years has been about

2.5 percent per year. This has been accomplished by the Iron and Steel Industry with a very modest establishment of new integrated steel plants since World War II, although many of the non-integrated "mini-mills" have been built. Most of the increase in capacity has been accomplished by upgrading capacities of existing steel plants, building larger blast furnaces, and replacement of open hearths with basic oxygen furnaces (BOF).

Normally the actual productive output of raw steel is well uner the rated productive capacity, generally in the range of 60 to 70 percent. This was particularly true when open hearth furnaces accounted for the bulk of raw steel production. In recent years, however, the actual output has moved closer to the rated capacity, being about 74 percent in 1972, and about 83 percent in 1973 based on estimated raw steel capacity of 180 million tons. This 1973 production level can be considered as 100% Industry capacity, as evidenced by the fact that shipments included tonnage taken from inventories to meet demands. Exhibit II-3 shows the company-by-company rated capacities versus actual production in 1972. One factor which somewhat distorts rated capacities is the fact that many steel plants have open hearth shops still installed, but not operating. Although these are listed as "stand-by" facilities, the lack of air and water pollution controls actually prevents them from being put into service under present pollution control regulations. For all practical purposes the Industry operated at full capacity in 1973, a record which is not expected to be sustained in 1974.

PROJECTED DEMANDS AND CAPACITY

Industry sources have projected steel production at an average rate of increase of 2 to 3 % per year. This is shown on Exhibit II-4, with past production shown for comparison. Production has been estimated to increase from the 1972 figure of 133 million tons to 183 million tons by 1983, based on an assumed average growth rate of 2.5 percent per year, and assuming that industry growth will keep up with increased demands.

However, as shown on Exhibits II-5 and II-6, this is not expected to keep up with average steel demands, and will have to be supplemented by imports which have averaged 14 million tons per year for the past 10 years, and almost 18 million tons per year for the last five years. Due to limitations of world steel capacity, net imports of steel are expected to level off at approximately 14 million tons per year. Due to the demand, both foreign and domestic, the production growth rate which has been only about 1 percent, will have to increase dramatically to the 2-1/3 percent level to compensate for the lack of availability of foreign steel.

INDUSTRY SEGMENTATION

The American Iron and Steel Industry has been previously described as consisting of 179 companies operating 420 plants. Of these, only 63 plants operated by 23 companies were identified as being integrated, having coke, iron and steel producing facilities, as well as rolling and finishing facilities. These

63 integrated plants were the subject of study for this investigation. The scope of work further segmented the plants into primary facilities and finishing facilities. The primary facilities which were to be covered by this study included all operations from raw materials through casting of ingots or continuous cast products. This included coke plants, blast furnaces, sintering plants, steel production, degassing and continuous casting. Not included were fugitive run-offs from raw materials stockpiles such as coal, iron ore, limestone and slag dumps. This segmentation resulted from the fact that the first phase study for effluent guidelines, prepared by Cyrus Wm. Rice Division, was also limited to this portion of the industry.

ALTERNATIVE APPROACHES TO INDUSTRY SEGMENTATION

The principal segmentation of the industry, into integrated and nonintegrated plants, has already been done as part of the scope of this study. A further segmentation into primary and rolling-finishing operations has also been specified, with this study covering only the primary operations involving coke, iron and steelmaking operations in integrated plants.

Consideration has been given to further segmentation into such areas as:

1. Level of integration.
2. Size of plant.
3. Type of processes.
4. Production technology.

5. Age of facilities.
6. Efficiency of operation.
7. Current level of pollution control.
8. Geographic location.
9. Level of production.
10. Profitability of operation.

There was no attempt in the prior studies by Booz, Allen and Hamilton, and by Cyrus Wm. Rice Division, to segment the industry into any of these areas. It is believed that for the part of the industry being considered for this study, the areas of most importance probably involve the following:

(3 and 4) - Types of processes and production technology. This involves such considerations as use of beehive coke ovens, use of small blast furnaces, use of small open-hearth furnaces, and continuing the use of the open-hearth and ingot casting practices when basic oxygen convertors and continuous casting are commonly utilized for the steels and products involved. Only one steel plant still operates beehive coke ovens, and these are scheduled for eventual shutdown. Eleven plants operate with small blast furnaces 22 feet in diameter or less, and 14 additional plants have one or more of their blast furnaces under 22 feet in diameter. Ten plants operate entirely on open hearth furnaces, while 13 others have part of their steel produced in open hearths. Only 14 of the integrated plants are provided with continuous casting, and 15 are equipped with vacuum degassing.

(9 and 10) - Level of production and profitability of operation. Data regarding these items were not possible to obtain, but were estimated to provide a good index to the viability of continued operation of an individual plant. Approximately one-sixth of the integrated steel plants were considered to be sufficiently marginal in their profitability or their facilities to make them potential candidates for curtailment of operations or even actual shutdown. Although the reasons for this are not directly involved with problems and costs of pollution control, the actual decision, when it is made, will take into account the high capital costs and increased operating costs for this purpose.

(8) - Geographic location. Plants which were located for strategic reasons in remote areas, or near former sources of raw materials, may now be economically unsound, and may be candidates for a phasing out of operations. These plants now are located remotely from markets, and in some cases are no longer near good sources of raw materials. At least two plants now fall into this category.

In Appendix I is given a plant profile sheet for each of the 63 integrated plants covered by this study. Such important information as equipment in use, sizes and productive capacities, and other data are tabulated.

STEEL INDUSTRY EMPLOYMENT

Total employment in the Steel Industry, as reported by the American Iron and Steel Institute, was 636,549 in 1972, of which 75 percent were hourly workers and 25 percent were salaried. Approximately 85 percent of these were employed by the integrated steel companies, and approximately 75 percent or 406,000 are employed in the plants covered by this report, averaging approximately 6,500 employees per plant. Employment in the individual steel plants ranges from under 1,000 to over 15,000.

Total employment in the Steel Industry has been declining somewhat in recent years, from the high of 735,000 in 1966, to 637,000 in 1972. Since steel production was relatively uniform during that period, the decline represented an increase in productivity per worker, at an average increase of about two percent annually.

Although a survey of employment within the industry by job classification has not been made, it was possible to classify workers in the industry by wage levels, and to convert this to an index of job skills. This tabulation is given in Exhibit II-7, and identifies one-third of the wage earners as unskilled, one-third as semi-skilled, and one-third as skilled.

INTEGRATED IRON AND STEEL COMPANIES SHOWING PLANTS AND PRIMARY FACILITIES

Company	Plant Location	Coke Plant	Blast Furnace	Steelmaking Facilities: Open Hearth	Steelmaking Facilities: BOF	Steelmaking Facilities: Electric Arc	Sintering	Degassing	Continuous Casting	Other
Allegheny-Ludlum	Brackenridge, Pennsylvania				X	X				Cupola
Armco	Ashland, Kentucky		X		X		X			
	Middletown, Ohio	X	X	X	X		X	X	X	
	Houston, Texas	X	X			X	X	X	X	
Bethlehem	Bethlehem, Pennsylvania	X	X		X	X	X	X	X	
	Burns Harbor, Indiana	X	X		X		X			
	Sparrows Point, Maryland	X	X	X	X		X			
	Lackawanna, New York	X	X	X	X		X	X		
	Johnstown, Pennsylvania	X	X	X			X		X	
C F & I	Pueblo, Colorado	X	X	X	X	X	X			
Crucible	Midland, Pennsylvania	X	X		X		X	X	X	
Cyclops	Portsmouth, Ohio	X	X	X						
Donner-Hanna Coke	Buffalo, New York	X	X							
Ford Motor	Dearborn, Michigan	X	X		X		X			
Inland	Indiana Harbor, Indiana	X	X	X	X	X	X		X	
Interlake	Chicago, Illinois	X	X		X		X			
	Erie, Pennsylvania	X	X							BF Idle
	Toledo, Ohio	X	X				X			
International Harvester	Chicago, Illinois	X	X		X		X	X	X	
J & L	Aliquippa, Pennsylvania	X	X		X		X		X	
	Cleveland, Ohio		X		X	X	X			
	Pittsburgh, Pennsylvania	X	X	X				X		
Kaiser	Fontana, California	X	X	X	X		X			
Lykes-Youngstown	Youngstown, Ohio	X	X	X				X		
	Campbell, Ohio	X	X	X			X			
	East Chicago, Indiana	X	X	X	X		X			
McLouth	Detroit, Michigan		X		X	X	X		X	
National Steel	Granite City, Illinois	X	X		X		X			
	Ecorse, Michigan	X	X		X	X	X		X	
	Buffalo, New York		X							
	Weirton, West Virginia	X	X		X		X	X	X	
Lone Star	Lone Star, Texas	X	X	X			X			

INTEGRATED IRON AND STEEL COMPANIES SHOWING PLANTS AND PRIMARY FACILITIES

Company	Plant Location	Coke Plant	Blast Furnace	Steelmaking Facilities			Sintering	Degassing	Continuous Casting	Other
				Open Hearth	BOF	Electric Arc				
Republic	Birmingham, Alabama	X	X							BF Idle
	Buffalo, New York		X		X					
	Canton, Ohio		X			X		X	X	
	Chicago, Illinois	X	X	X		X	X	X		
	Cleveland, Ohio	X	X	X	X		X			
	Gadsden, Alabama	X	X		X		X			
	Massillon, Ohio	X	X							
	Warren, Ohio	X	X		X	X	X			
	Youngstown, Ohio	X	X		X	X	X			
Sharon	Fairmont, West Virginia	X								
	Farrel, Pennsylvania		X		X	X	X	X		
Shenango	Pittsburgh, Pennsylvania	X	X							
	Sharpsville, Pennsylvania		X							BF Idle
U. S. Pipe and Foundry	Birmingham, Alabama	X	X							
U. S. Steel	Braddock, Pennsylvania		X	X	X		X			
	Clairton, Pennsylvania	X	X							
	McKeesport, Pennsylvania		X		X	X		X		BF Idle
	Fairless, Pennsylvania	X	X	X		X	X	X		
	Ensley, Alabama	X	X	X	X		X			
	Gary, Indiana	X	X	X	X		X		X	
	Geneva, Utah	X	X	X			X			
	Homestead, Pennsylvania		X	X			X			
	Lorain, Ohio	X	X		X		X			
	Chicago, Illinois		X	X	X	X	X	X	X	
	Youngstown, Ohio		X	X			X			BF Idle
	Cleveland, Ohio		X							
	Duluth, Minnesota	X	X	X						Idle
Wheeling-Pittsburgh	Steubenville, Ohio	X	X	X	X		X			OH Idle
	Monessen, Pennsylvania	X	X	X	X		X			
Woodward	Woodward, Alabama	X	X							BF Idle
	Chattanooga, Tennessee	X								

Source: AISI Steel Plant Directory

EXHIBIT II-
Page 2 of 2

PRODUCTION OF PRIMARY IRON AND STEEL PRODUCTS (Thousands of Net Tons)

Year	Coke	Iron	Steel	Finished Steel*
1959	48,486	60,829	93,446	69,377
1960	50,181	67,320	99,282	71,149
1961	45,721	65,295	98,014	66,126
1962	46,125	66,291	98,328	70,552
1963	47,925	72,375	109,261	75,555
1964	54,859	86,212	127,076	84,945
1965	58,618	88,859	131,462	92,666
1966	59,649	92,150	134,101	89,995
1967	57,465	87,647	127,213	83,897
1968	56,990	89,333	131,462	91,856
1969	58,205	95,480	141,262	93,877
1970	59,777	91,816	131,514	90,798
1971	51,476	81,692	120,443	87,038
1972	53,184	89,400	133,241	91,805
1973**			150,000	104,000

* Finished steel shipments. (Does not include shipments from inventory in 1973.)

** Projected.

Source: American Iron and Steel Institute Statistical Report.

RAW STEEL CAPACITY VERSUS 1972 PRODUCTION FOR INTEGRATED STEEL COMPANIES

Company	Oxygen Furnaces	Electric Furnaces	Open Hearth Furnaces	Total Capacity	Actual Production 1972	Percent of Capacity 1972
United States Steel Corp.	19,000,000	2,510,000	24,850,000	46,360,000	30,743,055	65.2%
Bethlehem Steel Corp.	15,900,000	2,850,000	10,500,000	29,250,000	18,334,000	61.5
Armco Steel Corp.	4,000,000	3,980,000	1,500,000	9,480,000	8,507,000	89.7
National Steel Corp.	11,300,000	500,000	-	11,800,000	9,843,700	83.4
Republic Steel Corp.	8,300,000	3,050,000	2,800,000	14,150,000	10,399,584	73.4
Inland Steel Co.	5,700,000	500,000	3,000,000	9,200,000	7,771,000	84.5
Jones & Laughlin Steel Corp.	6,000,000	960,000	2,500,000	9,460,000	7,344,000	77.5
Youngstown Sheet & Tube Co.	3,000,000	-	6,500,000	9,500,000	5,547,200	58.3
Wheeling-Pittsburgh Steel Corp.	5,000,000	-	-	5,000,000	4,099,000	82.0
Allegheny-Ludlum Ind., Inc.	500,000	750,000	-	1,250,000	903,485	72.2
Kaiser Steel Corp.	1,800,000	-	2,000,000	3,800,000	2,430,000	64.0
Cyclops Corp.	-	370,000	2,000,000	2,370,000	1,595,141	67.3
Interlake, Inc.	800,000	330,000	300,000	1,430,000	1,249,977	87.4
Sharon Steel Corp.	1,600,000	400,000	-	2,000,000	1,343,698	67.2
McLouth Steel Corp.	2,800,000	600,000	-	3,400,000	2,046,000	60.4
CF & I Steel Corp.	1,200,000	560,000	-	1,760,000	1,786,000	101.3
Alan Wood Steel Co.	2,000,000	-	-	2,000,000	897,463	44.9
Phoenix Steel Corp.	-	500,000	400,000	900,000	544,015	60.4
Ford Motor Co.*	3,000,000	-	-	3,000,000	NA	
Crucible, Inc.*	1,000,000	500,000	-	1,500,000	NA	
Lone Star Steel Co.*	-	-	1,500,000	1,500,000	NA	
International Harvester Co.*	1,200,000	-	-	1,200,000	NA	

Note: *Wholly owned subsidiary companies not reporting.

Source: AISI and private estimates.

EXHIBIT II-3

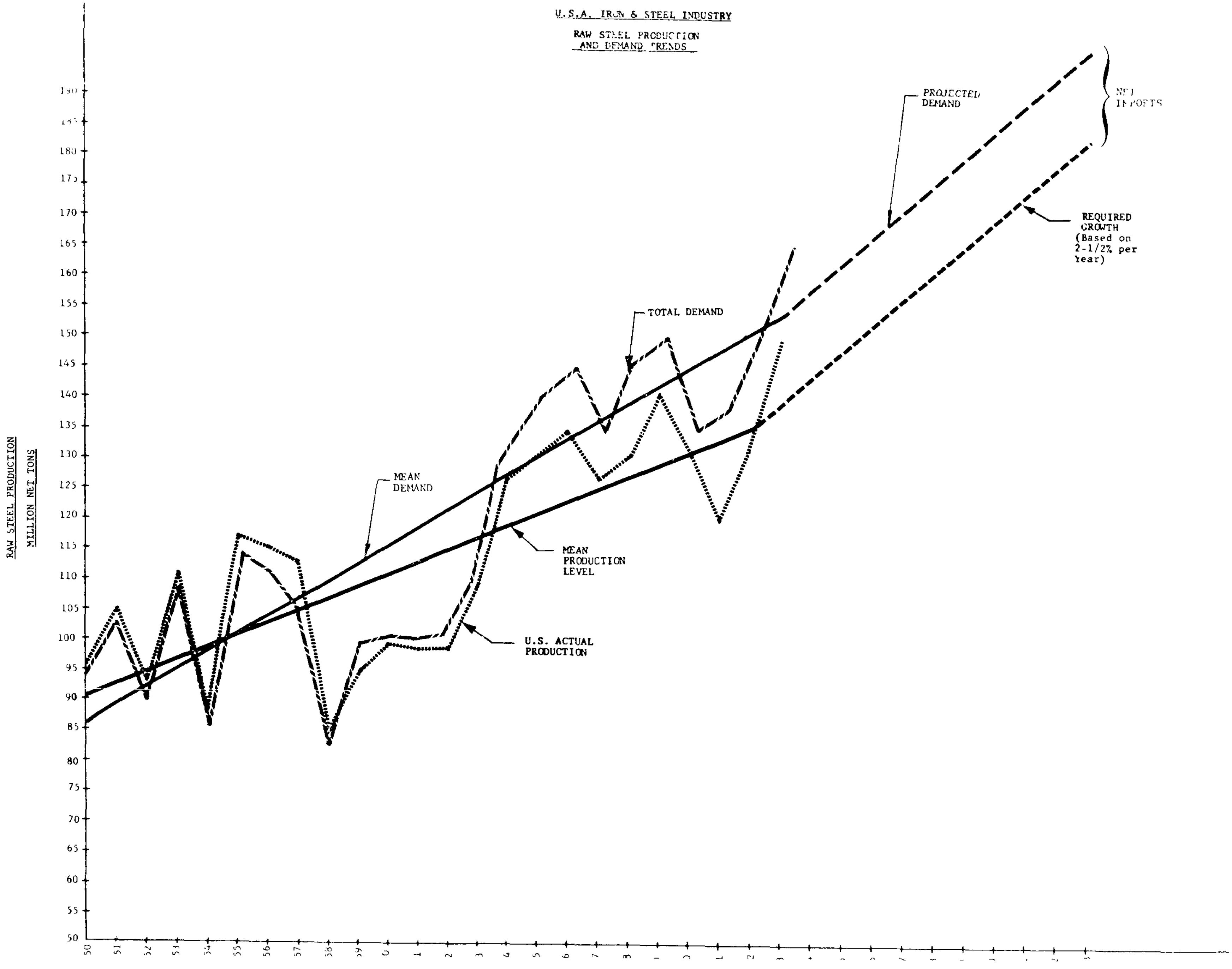
U.S.A. IRON & STEEL INDUSTRY
RAW STEEL PRODUCTION AND DEMAND TRENDS
RAW STEEL PRODUCTION
MILLION NET TONS
PROJECTED DEMAND
REQUIRED GROWTH (Based on 2-1/2% per Year)
TOTAL DEMAND
MEAN DEMAND
MEAN PRODUCTION LEVEL
U.S. ACTUAL PRODUCTION
190
180
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50

EXHIBIT II-

EXHIBIT II-5

FINISHED STEEL IMPORTS AND EXPORTS
(Thousands of Net Tons)

Year	Steel Exports	Steel Imports	Net Imports
1963	2,846	6,522	3,676
1964	4,266	7,701	3,435
1965	3,089	11,964	8,875
1966	2,278	12,778	10,500
1967	2,168	12,813	10,645
1968	2,782	19,563	16,781
1969	5,939	15,444	9,505
1970	8,140	14,609	6,469
1971	3,547	19,611	16,064
1972	3,606	19,559	15,953
10-Year Average	3,866	14,059	10,190
5-Year Average	4,823	17,757	12,954

Source: American Iron and Steel Institute Statistical Report.

CURRENT BEST ESTIMATES OF FINISHED STEEL AND RAW STEEL DEMANDS IN THE U.S. FOR THE PERIOD 1973-1983 (MILLIONS OF TONS)

	Estimated Demands		Estimated Net Imports	Estimated U.S. Production Raw Steel	
	Finished Steel	Raw Steel	Finished Steel	Finished Steel	Raw Steel
1973	119	173	13	*106	150
1974	113	164	13	100	145
1975	116	168	13	103	149
1976	120	174	14	106	154
1977	122	177	14	108	157
1978	126	183	14	112	163
1979	128	186	14	114	165
1980	132	192	14	118	171
1981	134	194	14	120	174
1982	138	200	14	124	180
1983	142	206	14	128	185

Note * - 1973 finished steel shipments includes three million tons from inventories.

EXHIBIT II-6

CLASSIFICATION OF IRON AND STEEL INDUSTRY WORKERS BY JOB SKILLS (1972)

Job Skill	Wage Range	Total Workers	Percent
Common Labor	Under $3.65	21,000	4.3
Unskilled	$3.65 - 4.40	130,000	27.2
Semi-Skilled	4.40 - 5.10	140,000	29.2
Skilled	5.10 - 5.85	107,000	22.3
Highly Skilled	5.85 - 7.35	67,000	14.3
Speciality	Over $7.35	13,000	2.7
		478,000	

Adapted from "Industry Wage Survey"
"Basic Iron and Steel - 1967"
U. S. Department of Labor

III - FINANCIAL PROFILES

INDUSTRY PERFORMANCE

With few exceptions, the 23 integrated steel companies covered by this study operate more than one plant, some of them many steel plants as well as other types of operations. Although overall company financial and other operating information is published in annual reports, individual plant statistics are not available. Operating and financial information covering 29 steel companies is given in Exhibit III-1. Included are data from 19 of the 23 companies covered in this study. The remaining four companies are subsidiaries of large corporations who do not report separately on their steel divisions.

The Steel Industry, one of the largest in the United States has long been characterized by high capitalization and relatively low return on sales and investment. Industry financial statistics for the past 10 years are summarized in Exhibit III-2. By comparison the average of all manufacturing companies has had a better performance as illustrated in the tabulation on the following page. In an analysis of all basic manufacturing industries with combined revenus of more than $2 billion in 1971, the Steel Industry ranked 36 in return on equity, and 28 in return on sales, as shown in Exhibit III-3.

Table 4

Performance of Industry

	1972	1971	1970
Return on Sales			
Steel Industry	3.4%	2.8%	2.8%
All Industry	4.8%	4.5%	4.5%
Return on Equity			
Steel Industry	5.7%	4.3%	4.1%
All Industry	10.5%	9.0%	8.6%

	Steel Industry	
Period	Return on Revenues	Return on Equity
1970-1972	3.0%	4.7%
1968-1972	3.7%	5.8%
1963-1972	4.7%	6.9%
1963-1969 (Best Period)	5.6%	7.9%

The very low comparative return on equity is an outgrowth of the high capitalization of the Steel Industry by comparison with all industries, while the lower return on sales has been characteristic of the Steel Industry. The decline in earnings is illustrated by comparing the average rate of return for different periods during the past decade. From a high during the middle Sixties, the rate of return on revenues has declined from an average of 5.6% to 3%, and return on equity from 7.9% to 4.7%

1973 represented the Steel Industry's top production year, with raw steel production of 150 million tons, and finished steel shipments of over 108 million tons, including shipments from inventories. Estimated financial performance improved in 1973, with return on sales increasing to 4.3 percent, and return on equity to 8.4 percent. However, in spite of this the Industry still ranked well below the average of all industries.

FINANCIAL EFFECTS

The continued decline in net earnings in relation to sales and equity, combined with continued steady payment of dividends and, until 1970, continued high capital expenditures, has resulted in an increasing degree of deficit operation, in which cash outlays have exceeded internally generated cash flows. In their "Study of Economic Impact on the Steel Industry of Costs of Air and Water Pollution Requirements," Booz, Allen and Hamilton pointed out that the Steel Industry's long-term debt has increased steadily from a low of 19.7 percent of invested capital in 1963, to a high of 28.6 percent in 1970. By 1972 this had increased to 30.9 percent.

The capital expenditures for the industry have fallen off from the high of $2.3 billion in 1968, to under $1.2 billion in 1972. As a result, the long term debt increased relatively slowly from 1970 to 1972. Although this tends to reduce the rate of growth of the debt to investment ratio, it does have other long term effects which will create serious problems for the industry in the future, (Exhibit II-3).

Steel demands in the U.S. as well as worldwide, have continued to rise, and have bee projected to continue to do so for the foreseeable future. However, growth of capacity has not been keeping up with demands, and unless an acceleration in growth of capacity is forthcoming, there could well be a shortage of steel which will be worldwide, as well as in the U.S. Expenditures, which have been made in recent years have principally been for replacement, modernization and pollution control, with relatively little being spent to increase capacity. Except for several small mini-mills, no significant new steel plant capacity has been added for several years, and none is contemplated in the U.S. at present.

The expenditures required to increase capacity will range from about \$250-\$350 per annual ton of capacity for increased production in existing mills, to up to \$500 per ton for new plant construction. Thus, to increase capacity to provide for 128 million tons per year of finished steel production in the U.S. by 1983 (Exhibit II-5), an increase of about 25-30 million tons per year of capacity will be required. A total expenditure of approximately \$2-\$5 billion will be required for new plants and increases to existing plants. This is in addition to normal replacement and modernization costs, and does not include pollution control costs for existing facilities. This subject is discussed further in Section VI, in which requirements for financing pollution control costs is discussed.

STEEL INDUSTRY REVENUES AND PROFITS
1962 - 1972
(Millions of Dollars)

Year	Revenue	Net Income	Percent Return on Revenues	Percent Return on Equity
1962	$13,980.6	$ 566.4	4.1%	5.3%
1963	14,612.6	782.0	5.4	7.1
1964	16,357.1	992.3	6.1	8.7
1965	17,971.7	1,069.3	5.9	8.9
1966	18,288.4	1,075.3	5.9	8.9
1967	16,880.4	829.8	4.9	6.8
1968	18,679.6	992.2	5.3	7.9
1969	19,231.0	879.4	4.6	6.9
1970	19,269.5	531.6	2.8	4.1
1971	20,126.2	566.2	2.8	4.3
1972	22,471.5	772.1	3.4	5.7

Source: AISI Annual Statistical Report

Data represents estimated 90% of steel production.

COMPARISON OF REVENUES AND PROFITS
FOR YEAR 1971 OF 51 INDUSTRIES WITH
REVENUES OF $2 BILLION AND OVER

Industry	SIC No.	Revenue (Millions)	Net Income (Millions)	Percent Return on Revenue	Rank No.	Percent Return on Equity	Rank No.
Crude Petroleum and Natural Gas	131	$ 4,303.9	$ 300.2	5.7	5	.3	42
Oil and Gas Field Service	138	2,670.0	230.2	6.6	3	6.1	26
Meat Products	201	11,493.1	107.5	1.0	40	6.4	24
Dairy Products	202	11,016.4	283.9	2.1	31	6.8	18
Canned, Cured and Frozen Foods	203	7,562.0	219.9	-2.1	47	5.7	30
Grain and Mill Products	204	9,960.9	296.9	1.2	39	5.7	29
Bakery Products	205	3,544.6	72.0	.7	41	-.1	44
Sugar	206	2,150.8	55.4	-1.3	46	.1	43
Beverages	208	10,641.0	526.0	3.5	13	11.6	6
Food and Kindred Products	209	7,900.7	232.4	3.0	14	11.7	5
Cigarettes	211	7,367.3	416.5	5.3	7	13.9	2
Weaving Mills Cotton	221	6,437.0	159.5	2.4	26	5.9	28
Mens and Boys Furnishings	232	2,320.5	67.0	2.0	32	9.1	10
Women's and Children's Undergarments	234	2,926.6	63.6	2.8	18	8.5	13
Sawmills and Planting Mills	242	3,748.5	197.8	5.3	8	7.1	16
Millwork, Plywood and Related Products	243	3,787.8	130.4	-2.6	48	-3.1	47
Paper Mills except Building Paper	262	7,664.5	269.2	2.9	17	4.5	34
Paperboard Mills	263	2,068.3	51.6	.2	44	-3.1	48
Newspapers	271	2,372.5	142.8	7.1	2	13.2	3
Industrial Chemicals	281	20,427.9	1,115.0	3.7	11	8.3	14
Drugs	283	11,939.1	1,134.0	7.3	1	16.1	1
Soap, Cleaners and Toilet Goods	284	8,798.2	555.1	2.1	30	6.8	19
Paints and Allied Products	285	2,058.3	67.0	2.7	20	6.4	25
Miscellaneous Chemical Products	289	3,773.9	144.4	5.6	6	12.2	4
Petroleum Refining	291	79,258.5	5,738.1	3.7	12	9.5	9
Tires and Inner Tubes	301	9,072.3	275.8	2.9	16	7.1	17
Footware except Rubber	314	2,807.5	101.1	2.2	27	6.5	20
Flat Glass	321	4,166.3	163 2	2 1	29	4.9	32
Miscellaneous Nonmetalic Mineral Products	329	2,634.5	110.3	4.1	9	8.9	12
Blast Furnace and Basic Steel Products	331	21,215.7	536.8	2.2	28	3.9	36
Primary Nonferrous Metals	333	11,888.8	866	2.5	23	3.6	37
Metal Cans	341	4,884.8	191.4	3.8	10	11.0	7
Fabricated Structural Metal Products	344	3,555.8	98.3	1.5	35	5.3	31
Farm and Equipment Machinery	352	8,722.6	314.5	1.9	34	4.5	33
Construction and Related Machinery	353	4,876.7	210.8	2.7	19	6.5	21
Metal Working Machinery	354	2,672.3	102.7	1.3	37	3.4	38
Special Industrial Machinery	355	2,284.1	64.0	1.4	36	2.7	39
General Industrial Machinery	356	4,433.4	118.5	2.7	22	6.4	23
Office and Computing Machinery	357	15,925.1	1,386.8	-6.2	51	-3.4	49
Service Industry Machinery	358	2,148.4	87.7	2.7	21	6.1	27
Electric Test and Distributing Equipment	361	17,741.8	671.6	3.0	15	7.3	15
Electrical Industrial Apparatus	362	3,468.1	92.1	5.9	4	9.5	8
Radio and TV Receiving Equipment	365	7,149.6	171.8	1.1	38	1.4	41
Communication Equipment	366	14,536.5	564.6	-4.3	49	-3.9	50
Electronic Components and Accessories	367	4,417.3	8.9	-4.6	50	-2.8	46
Miscellaneous Electric Equipment and Supplies	369	2,102.9	79.5	1.9	33	4.4	35
Motor Vehicles and Equipment	371	49,180.7	1,228.8	2.5	24	6.5	22
Aircraft and Parts	372	21,910.9	233.6	.2	43	1.6	40
Mechanical Measuring and Control Devices	382	3,864.2	100.1	.4	42	-1.5	45
Medical Instruments and Supplies	384	3,082.7	201.3	2.4	25	9.0	11
Photographic Equipment and Supplies	386	3,766.1	478.1	-.1	45	-3.9	51

CAPITAL EXPENDITURES BY IRON AND STEEL INDUSTRY

(Millions of Dollars)

Year	Amount	Net Fixed Assets	Expenditures as Percent of Assets
1963	$1,040.0	$ 8,843.4	11.8
1964	1,599.5	9,304.8	17.2
1965	1,822.5	9,972.7	18.3
1966	1,952.7	10,678.4	18.3
1967	2,145.7	11,371.9	18.9
1968	2,307.3	12,703.6	18.2
1969	2,046.6	13,411.0	15.2
1970	1,736.2	14,145.1	12.3
1971	1,425.0	14,462.0	9.9
1972	1,164.2	14,379.0	8.1
1973 (In Progress)	1,837.1	NA	-

Source: American Iron & Steel Institute Statistical Review

IV - COSTS AND PRICES

COSTS

Production costs, as reported by the American Iron and Steel Institute for 91 percent of the Steel Industry are given in Exhibit IV-1. The percentages for various elements of costs have not varied greatly in recent years, and have averaged as follows:

Materials, Supplies, Services	-	49.0%
Employment Costs	-	40.0%
Depreciation, Depletion, Amortization	-	5.5%
Interest and Charges	-	1.5%
Taxes (Federal, State, Local)	-	4.0%

While the relationship of these cost elements to total costs has not varied greatly, the relationship of total costs to total sales has changed, as shown in Exhibit III-2, with the results that earnings as a percent of revenues have declined steadily for the past decade.

STEEL PRICES

Steel prices have increased steadily for many years, as illustrated by the composite price for all steel shown in Exhibits IV-2 and IV-3 for the past 20 years. In recent years the rate of increase of steel prices has been below the average price increases for all products with exception of 1969 and 1970. These years were not sufficient however, to enable steel prices to catch up to prices of all products. Although prices quoted by individual companies may vary somewhat from the industry norm, as built up from base prices by adding extras and deducting discounts, the general trend in the Steel Industry has been for all companies to reasonably follow the established price index. Increases in costs such as labor and raw materials have generally been reflected in increases in published steel prices.

The steel basing price system had its origins in the early days of the Steel Industry, and has continued, with some extensions and modifications, to the present time. A typical steel price sheet as printed in Iron Age Magazine, and other publications, is given in Exhibit IV-3. The established base prices are used by all companies within a district, with only a few exceptions, and provide the means of building up actual prices for steel orders by adding extras or subtracting discounts.

Until very recently, steel producers charged approximately the same price for a specified product. While this may seem strange, it really is not, since producers produce their product from the same raw material, on the same kind of equipment using about the same power factors, incurring the same freight rates, etc. Each product, therefore, has a cost per ton arrived at by adding the cost of labor, raw materials, power, and all other services. The number of man-hours per ton for a specified product will vary surprisingly rather little, plant by plant. The plant with the newest equipment, that employs the most efficient use of manpower, that buys raw materials properly, will have the best costs and usually makes the greater profit. The most efficient and profitable producer is not necessarily the largest. It should be mentioned here, also, that each plant has a slightly different product mix. Each plant learns over the years which products they can produce most profitably, and which products they should stay away from. However, customer demands many times dictate the necessity of producing some low profit items as well as just the profitable ones.

If the above can be used to set the stage, the following procedure has been used by the Steel Industry to determine price increases up to the beginning of Phase I of price control in the United States on August 15, 1971.

Each producer publishes a price book which its sales organization uses to sell their products. Management continually keeps track of increased costs of raw materials, labor, freight, and services, and at some point finds that it can no longer absorb these costs in the existing pricing framework. In other words, its return on investment and/or its return on sales goes below a preprescribed percentage which management must watch to satisfy the profit requirements of the company for equipment replacement, for future expansion reasons, for stockholder acceptance, etc.

These accumulated costs are converted into a incremental increase to be applied to the sales prices that will bring the return on sales back to the desired level. Sales management and general management must then decide whether it is practical to announce a price increase. Such factors as customer acceptance, the general level of business, and obviously, will a price increase be met in the marketplace by competition must be considered. Since conversations between producers on the subject of changing prices are illegal, the mechanism is as follows.

A producer determines that he needs a price increase. Regardless of his size as a producer, he may send an announcement to the principal trade journals and newspapers that, effective on an established date, the price that he will charge for his product will be up X%. The announcement usually explains the reason for the increase stating the exact price of the new base price or the new extra charges, or some other basis.

Since he is leading a price increase, he must have some experience as to what competition will do. As explained above, with steel made on similar equipment, from the same raw materials, at the same labor rates, the leader knows that his competition probably needs relief as badly as he does. The leader can make his announced increase immediate, or he can space it out, which would allow competition time to follow. If his price change is not met immediately or in a reasonable length of time, he then must decide to leave it in, and perhaps lose some business or announce a retraction of the price increase.

Governmental price controls came at a particularly poor time for the Steel Industry. The present wave of inflation started in the mid-sixty's driving the cost of raw materials, services, and labor upward on a steep curve. Also, the recession of the late 1960's and early 1970's reduced the requirements for steel. Combined with this was a tremendous increase in low priced imported steel. We had, therefore, rapidly increasing costs for the industry at a time when steel demand was low. Price increases were frowned upon by the Government, and competitive actions resulting from the above mentioned factors prevented adequate price increases.

August 15, 1971 saw the beginning of price controls creating additional problems for increasing prices. Without detailing the steps of Phase I through IV, the Steel Industry went into this period of controls with inadequately priced products, and continued to lose ground during each phase.

The Cost of Living Council and the general public must not look only at the improvement in earnings of the Steel Industry 1972 over 1971, and 1973 over 1972. The return on investment must be analyzed, and it will be found to be extremely poor. The Steel Industry ranks 41st out of the 41 major industries in earnings. If cost controls continue, and non-productive expenses for pollution control equipment and OSHA controls are pushed too fast, the United States will have a badly weakened steel industry. New production equipment must be bought, not only to replace obsolete and worn out equipment, but to expand the output to meet 1980 and 1985 forecasts. As of January, 1974, the Steel Industry does not have the money to spend for equipment, nor should it. Steel Industry management can be severely criticized by its stockholders if the cash flow generated is not put into some diversification that can show a better return on investment than the Steel Industry itself can show.

Although the increase in composite steel prices has approximately equalled the increase in average costs per ton during the past decade, this relatively stationary relationship has not been adequate to cover the increased capital requirements, resulting in an increase in debt to investment ratio as previously reported. This situation has not provided for a build-up of capital necessary to provide for projected expenditures for pollution control, for replacement and obsolescence, for increase of industry capacity, and for other purposes, as covered further in Section VI.

The relatively modest increases in prices for steel products have been the result of price controls imposed on both a formal and an informal basis for several years. Price increases averaged 7.2 percent in 1971, 5.6 percent in 1972, and 3.2 percent in 1973, while labor and material costs increased 8 percent and 5 percent respectively in 1971, 7 percent and 5 percent in 1972, and 7 percent and 7 percent in 1973. By comparison, foreign steel prices have increased sharply as shown by the comparative figures in Exhibit IV-5. Reports from financial analysts (Peter F. Marcus, Mitchell, Hutchins, Inc., October 12, 1973), have estimated that steel prices would be at least 10 percent higher if it were not for artificial price controls. Although such a price increase would not be sufficient to generate the 10 percent return on equity which is believed necessary to justify a new round of expansion programs, it would go far in providing capital for spending requirements for such purposes as replacement, environmental and OSHA control, and some expansion of capacity.

EFFECT ON SMALLER PRODUCERS

Later discussions will concentrate on industry-wide costs of pollution control, and their potential impact on steel prices. From this the reader may infer that pollution control costs, expressed in terms of cost per ton of product, are the same for all producers. Actually evidence from the Industry indicates that this is not true, and that size of plant has a direct effect on unit costs of pollution control. Smaller plants incur proportionately higher unit costs.

Price increases in the Steel Industry, until 1962, were initiated across the board for all tonnage mill products, and were led by the largest steel producers. After 1962, due principally to strong government persuasion, selective steel price increases were made on parts of the total product line, also initiated by the larger producers. There have been exceptions to this, notably the lower prices charged by the mini-mills for carbon steel reinforcing bar and light structural steel shapes, where until scrap prices increased drastically early in 1973, these mills were selling for under the domestic market price. Since then, with increased demands for these steel products, and the extremely high scrap prices which currently exist, these mills have been selling for somewhat above the current domestic market price. However, in the absence of a strong sellers' market, the smaller producers generally follow the lead of the large mills in setting prices.

Assuming normal conditions in the market place, the price increases, which will include the costs for pollution control, will be initiated by the larger companies, with the smaller companies following the same pattern. If these price increases are calculated to recover increased costs for the large producers, they well may not be adequate to cover higher unit costs for pollution control by the small producers. This situation, if it occurs, could result in added burden on the smaller companies, requiring relief which may not be able to be met by price increases alone.

IRON AND STEEL INDUSTRY

PRODUCTION COST DATA
(FOR COMPANIES REPRESENTING 91% OF TOTAL PRODUCTION)
(MILLIONS OF DOLLARS)

Element of Cost	1972		1971		1970		1969		1968	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Materials, Supplies, Freight and Other Services	$10,659.2	49.1	$ 9,936.8	50.3	$ 9,160.9	48.9	$ 8,764.6	47.7	$ 8,587.0	48.5
Employment Costs	8,699.6	40.1	7,794.0	39.3	7,685.5	41.0	7,495.7	41.0	7,040.1	39.8
Depreciation, Depletion and Amortization	1,168.1	5.4	1,076.9	5.4	1,044.2	5.6	1,042.4	5.7	965.8	5.5
Interest and Charges on Long Term Debt	323.3	1.5	332.1	1.7	288.5	1.5	245.7	1.3	224.5	1.3
State, Local and Federal Taxes	849.2	3.9	655.2	3.3	558.8	3.0	803.2	4.3	870.0	4.9
Total Costs	$21,699.4	100.0	$19,795.0	100.0	$18,737.9	100.0	$18,351.6	100.0	$17,687.4	100.0
Total Revenue	$22,471.5		$20,357.8		$19,269.5		$19,231.0		$18,679.6	
Net Income	772.1		562.8		531.6		879.4		992.2	
Present Return on Revenue		3.4		2.8		2.8		4.6		5.3

Source: American Iron and Steel Institute Statistical Report.

EXHIBIT IV-1

COMPOSITE FINISHED STEEL PRICES

Annual Averages of
Composite Finished Carbon Steel Prices
as Computed by
AMERICAN METAL MARKET
in Cents Per Pound

Year	Price
1953	5.12
1954	5.33
1955	5.61
1956	6.00
1957	6.55
1958	6.86
1959-1962	6.98
1963	7.05
1964	*8.370
1965	*8.373
1966	*8.422
1967	*8.505
1968	8.729
1969	9.165
1970	10.143
1971	10.886
1972	11.090

*Retroactive to new basis of compilations started January 1, 1966.

COMPOSITE PRICE OF FINISHED STEEL
1953-1973

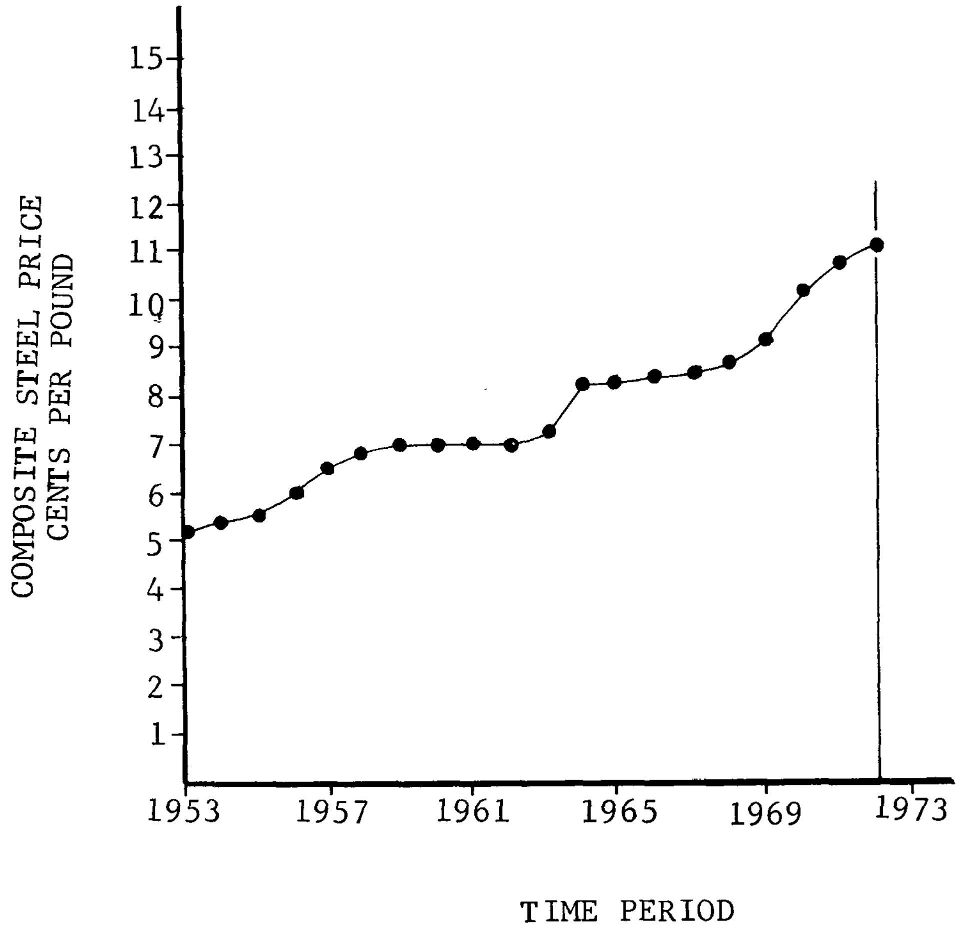

EXHIBIT IV-3

Steel Prices

(Code identify Producers listed in the key on the following page. Prices are quoted in cents per pound unless otherwise noted.)

Billets, Blooms, Slabs

Carbon Rerolling, East	
F5	$132.00
R5	$132.00
Midwest	
R6	$132.00
G5, N4, W5, Y1(3)	$132.00
K2	$131.00
L1	$135.00
West	
N5	$132.50
Carbon Forging, East	
S15	$153.50
B3(2), R3	$153.50
Midwest	
G3	$153.50
C10, C11, W5, R3(2), S1, U1(4), W8, Y1	$153.50
R5(2)	$153.50
L1	$156.50
West	
B3(1)	$153.50
B3(1), K1, N6	$153.50
South	
A7	$153.50
Alloy, East	
B3(3), R3, S15	$156.00
A2	$184.00
Midwest	
C10, C11, W5, R3(1), S1, 15, U1(4), W8, Y1	$186.00
West	
B3(2), K1	$186.00
South	
A7	$186.00

Piling Sheet Steel

East (cents per lb)	
B3, U1	9.25
Midwest	
I3, U1(2), W3, Y1	9.25

Structurals

Carbon, East	
B3(3), P2	8.50
Midwest	
A7, C20, J3, I3, N4, P13, U1(3), W3, W8, Y1(3)	8.50
West	
B3(1), C6, C8, K1, N6, O2, U1	8.60
South	
A8	7.80
A7, C16, R3, U1	8.50
High Strength, Low Alloy, East	
B3	11.35
Midwest	
J3, Y1	9.80
I3, N4, U1(3), W3, W8, Y1	8.50*
West	
A7, U1	8.50*
K1	8.60
South	
A7, U1	8.50
Wide Flange, Carbon, East	
B3(3), P2	8.50
Midwest	
I3, N4, U1(2)	8.50*
W3	8.50
West	
C6	8.65
South	
A7	8.50

Strip

Hot Rolled, Carbon, Cut & Mill Edge—all widths, East	
A2, B3(3)	8.15
Midwest	
B3, A7, D1, G3, I3, M2, N6, W5(2), P7, R3, S1, U(2), W3, W5, Y1(2)	8.15
I4	8.10
F2, G2	8.40
N4	8.40
N4	8.50
N6	8.15
T5	7.90
West	
K1	8.25
B3(2), N6	8.90
C6	7.45
O2	9.55
South	
A8	7.75
A11, C16, R3, U1	7.75
Cold Rolled, Carbon Max 25%, East	
B4, F2, F4, G6, M8, R7	11.00
D1	11.15
P15	9.925
I8	9.075
I8	9.225
A12, S7, S10	11.00
R6	10.40
S7	11.15
G4	11.00
N7	9.425
C6	10.275
Midwest	
T5	9.475
B9, I, G4, I4, M8(2), P11, P16, R3, R5(2), S1, T3, T4, U1, W5, Y1	11.40
J3	9.975
D1	11.00
West	
C1, J3	10.45
High-Strength, Hot Rolled, Low Alloy, Cut Edge & Mill Edge—all widths, East	
A2, B3(3)	5.70*
Midwest	
L1	7.90*
W8	7.95
A7, R3	8.15*
G3(2), I3, M2, R3, S1, W3, Y1(2)	9.75
U1	8.15*
N4	9.125
West	
K1	8.25*
B3(2)	6.25*
U1	8.15*
South	
U1	8.15*
High-Strength, Cold-Rolled, Low Alloy, Mill Edge, East	
F4	12.10
R7	14.45
Midwest	
L1	8.30*
G4, R3, S1(2), Y1(2)	12.55
Alloy, Hot-Rolled, Midwest	
I4, S1, U1(2), Y1(2)	10.50
Alloy, Cold-Rolled, East	
C11, F4, M8	16.30
T8(2)	16.65
R7	18.80
N7, T8(2)	16.90
Midwest	
M8, R5, R8	16.30
R5	18.40
I4, J3, P16, S1, U1	17.50
J3	16.65
G4	18.80
West	
C1, I3, J3	18.80

Sheets

Hot-Rolled, Carbon (18 Ga & Hvyr), East	
A2, B3(2), U1	8.35
Midwest	
A7, D1, F2, B2, G2, I3, I4(2), J3(2), M2, M11, P7, R3(2), S1, U1(5), W3, W5, Y1(2)	8.35
I1	7.90
West	
U1(2)	8.15
K1	8.45
South	
R3, U1	8.35
Cold Rolled, East	
A2	10.075
B3(2), U1	10.075
Midwest	
A7, B3, D1, F2, F3, G2, G3, I3, I1, J3(2), M2, M11, P7, R3(2), S1, U1(2), W3, W5, Y1	10.075
West	
U1	10.075
K1	10.175
South	
R3, U1	10.075
Galvanized (hot dipped), East	
B3(2)	10.525
Midwest	
A7(2), F2, I3, J3(2), M11, R1, R3(2), S1, U1(2), W3, W5, Y1	10.525
G2	10.875
West	
K1	10.625
R3, U1	10.525
South	
R3, U1	10.525
Electro-Galvanized, East	
B3	10.50
Midwest	
C19, F8, L5, R3, S1, T9	10.55
C19	11.00
W3	10.55
G4	11.00
Enameling, East	
B3(2)	10.675
Midwest	
A7(2), I3, M11, R3, U1(2), Y1	10.675
Long Terne, Midwest	
A7, R3, U1(2), W5	11.60
High-Strength, Low Alloy, Hot-Rolled, East	
B3(2)	5.85*
A2, U1, W3	8.35*
Midwest	
B3(2)	5.85*
A7, I3, I4, J3(2), M2, M11, R3(2), S1, U1(4), W3, W8, Y1(2)	8.35*
G4	8.95
L1	7.90*
West	
K1, U1	8.45*
South	
U1	10.35
High-Strength, Low Alloy, Cold-Rolled, East	
B3(2)	7.20
B3	7.20*
Midwest	
G3(2), J3(2), M2, R3(2), S1, U1, W3, Y1(2)	9.30*
L1	7.90
West	
K1	10.175

Wire Rod

East	
B3(2), C6, U1	9.15
S15	8.675
Midwest	
J3, L1, W5, P7, R3, U1(5), Y1	9.15
C9, K2	9.25
N4	9.25
West	
C6, A7	9.15
B3, U1	9.15
South	
R3, U1	9.15

Tinplate

Electrolytic Tinplate (10 lb coating. Add 25¢ for 25 lb., 90¢ for 50 lb., and $1.70 for 75 lb.)	
Single Reduced (55 lb. to 75 lb.)	
East	**per base box**
B3, U1	$9.35
Midwest	
B3, I3, J3, M11, R3, U1(2), W3, W5, Y1	$9.35
West	
K1, U1	$9.45
South	
U1	$9.35
Double Reduced (55 lb.)	
East	
Midwest	
B3, U1	$8.20
B3, I3, J3, M11, U1(2), W3, W5, Y1	$8.20
West	
K1, U1	$8.30
South	
U1	$8.20
Black Plate	
Single Reduced (55 lb. to 75 lb.)	
East	
B3, U1	$8.15
Midwest	
G2, I3, J3, M11, R3, U1, W3, W5, Y1	$8.15
West	
K1, U1	$8.25
South	
U1	$8.15
Double Reduced (55 lb.)	
East	
B3, U1	$6.60
Midwest	
J3, M11, R3, U1, W3, W5, Y1	$6.60
West	
U1	$6.70
South	
U1	$6.60
Hollowware Enameling Black Plate	
G2, J3, W5, Y1	$9.35

Bars

Carbon Steel, Hot-Rolled (Merchant quality—special quality $2.00 higher)	
East	
B3(2), R3, U1, M7	8.375
S15	8.375
(Special quality)	9.00
Midwest	
C20, R3(2), I3, I4, J3, L1, N1, P11, R3(2), U1(5), W8	8.375
Y1(3)	8.375
G5	7.975
N4	8.375
N10	8.15
C10, R3 (spec. qual.)	8.775
C11 (spec. qual.)	8.425
West	
B3(1)	8.275
B3(2), K1, U1	8.375
N6	8.075
O2	8.475
A7	8.375
C6	8.375
A7, C16, R3, U1	8.375
South	
A7, A11, C16, R3, U1	8.375
A8	8.375
Cold-Finished Carbon, East	
B5	12.20
C21	11.65
A11, J1	11.75
K4	11.90
P10, W10	12.05
R3	9.70
C14, W10	12.15
B5	9.70
Midwest	
B4, B5(3), B10, C8, C10, C11, C13, F2, H2, J3(2), L2, M9, N9, P16, R2, R3(2), U1(2), W8(2), W10(2), W13(2), Y1	11.50
B5	12.20
West	
B5(2), C8, P14, R3	12.35
South	
B5, P3, P8	11.75
C16	12.55
S16	12.05
Alloy, Hot-Rolled, East	
B3(3), M7, R3	10.10
S15	9.85
Midwest	
C10, C11, G3, G5, I3, J3, R3(3), R5, S1, T5, U1(5), W8, Y1	10.10
West	
B3(1)	10.20
B3(1), K1, U1	10.10
South	
A7	10.10
Alloy, Cold Drawn, East	
K4	13.475
P10	13.85
A11, C14, J3, R3, W10	13.75
W10	13.65
P16	13.85
Midwest	
B5(3), B10, C8, C10, C11, C13, F2, H2, J3, L2, M4, M9, N9, P3, P8, R2(2), R3(2), R5, T5, U1(2), W8(2), W10(2), W13(2), Y1(2)	13.30
W10	13.50
West	
B5(2), C8, P14	14.32
South	
S16	13.85
High-Strength, Hot-Rolled, Low Alloy, East	
U1	8.425*
B3	8.425
Midwest	
L1	8.425*
N4	8.375
I3, W8	10.25
U1(2), Y1(2)	8.425*
G3	8.975
J3, R3(2)	9.00
West	
B1(1)	6.725
K1	8.425
B3(2)	6.525
A7	8.425*
South	
U1	8.425*
A7	8.425*

Plates

Carbon Steel, East	
A2, B3(3), L4, P2, U1	8.50
Midwest	
A7, B3, F2, G2, G3, I3, I4, J3(2), N4(2), R3(3), S1, U1(4), W8, Y1(3)	8.50
L1	8.60
West	
U1	8.60
B3, C6, K1, O2	8.60
South	
A7, R3, U1	8.50
Alloy, East	
A2, B3, L4, P2	13.15
Midwest	
G3	13.15
B3, J3, S1, U1(3), W8, Y1	13.15
I4	13.25
West	
B3	13.25
K1	13.25
South	
A7	13.15
High-Strength, Low Alloy, East	
A2, P2, U1	8.50*
L1	8.60*
B3(3)	7.40*
Midwest	
G3, I3, J3(2), R3(2), S1, U1(3), Y1(2)	8.50*
B3	7.40*
G4	8.70
A7, W8	8.50*
L1	7.50*
West	
B3, K1, O2, U1	8.60*
C6	9.10
South	
A7	8.50*
U1	8.50*

Wire

Manufacturers Bright, East	
A11, B3(2), C6(2), L1	10.00
F5	9.80
S15	10.35
Midwest	
C13, J3, W5, P7, R3, U1(4), W1, W7, W13, Y1	10.35
C9, K2, L1, M4	10.00
L1, N4	10.00
South	
R3, U1	10.35
A8	9.05
West	
A7	10.35

*Plus grade extras

Rough Comparisons of International Steel Prices from January 1969 to October 1973
(U.S. dollars per metric ton)

	Cold Reduced Sheets						Merchant Bars					
	1/69	1/70	1/71	1/72	9/72	10/73	1/69	1/70	1/71	1/72	9/72	10/73
USA*	159	167	197	210	222	222	140	147	157	185	157	185
Japan#	129	150	124	153	154	396	79	155	114	106	107	362
Germany*	143	168	177	197	206	287	103	116	130	145	147	228
France*	132	137	149	167	175	225	96	106	116	129	132	202
U.K.*	133	135	156	174	176	197	107	114	134	154	154	176
EEC Export Price	118	170	129	128	154	291	80	130	106	112	121	246

	Heavy Plates						Heavy Structurals					
	1/69	1/70	1/71	1/72	9/72	10/73	1/69	1/70	1/71	1/72	9/72	10/73
USA*	134	142	150	180	180	187	137	144	132	179	179	187
Japan#	94	140	106	127	140	350	142	160	147	167	157	226
Germany*	110	149	149	165	177	279	100	130	136	151	163	236
France*	110	134	142	150	168	245	99	116	125	138	148	213
U.K.*	105	115	134	155	155	174	100	107	125	140	142	162
EEC Export Price	100	158	130	128	128	278	81	155	122	122	130	241

Source: Various trade publications.
These figures can be inaccurate for a variety of reasons including changes in definitions, discounts from list prices, etc.
*List price
#Japanese price is "market price" quoted for small users and is not representative during shortage periods of the prices paid by large users. Large users in Japan may currently purchase steel at the lowest price levels in the world.

V - REVIEW OF COST AND CONTROL TECHNOLOGY DATA

DATA SOURCES

Valid determination of the economic impact of pollution control was contingent upon prior identification of the capital investment and operating costs to be incurred. Data regarding these costs for the Iron and Steel Industry were provided by the Environmental Protection Agency. The scope of work for this study included review of these cost and control technology data to determine additional capital investments and operating costs required to meet the proposed water effluent guidelines. This was to be done at the plant, company and industry levels, to the extent that necessary data were available.

For the primary operations being considered in this study, the problems and costs of air and water pollution control are generally closely associated. With the exception of coke quenching, and the coke by-products plants, water is not used for processing, but is principally used for cooling, and for cleaning of gases where wet cleaning systems are used. Therefore, with the exceptions noted, water pollution control and costs must be related to air pollution control and costs in any discussion of economics.

The prior studies covering air pollution control and water pollution control in the Iron and Steel Industry gave control technology and cost data for each major operation. Relatively little new technology or data has been added since these reports were released, with the principal exception of the new air pollution control systems being tried out in several coke plants, and sulfur dioxide control where high sulfur fuels are used. Definitive data regarding these new processes are not yet available

The EPA provided two primary sources of data regarding capital investments and operating costs to meet pollution control requirements in the Iron and Steel Industry. Air pollution control data were provided in a report prepared by Battelle Memorial Institute for EPA: "A Cost Analysis of Air Pollution Controls in the Integrated Iron and Steel Industry," May 15, 1969. Cost data regarding water pollution control requirements were provided in a report prepared by Cyrus Wm. Rice Division of NUS Corporation for EPA: "Development Document for Effluent Limitations Guidelines and New Sources Performance Standards, Iron and Steel Industry, Supplement A Cost Information," June, 1973, and revised in July and November, 1973.

EPA provided a third source of data which covers both air and water pollution control cost estimates for the entire Iron and Steel Industry. This source, "A Study of the Economic Impact on the Steel Industry of the Costs of Meeting Federal Air and Water Pollution Abatement Requirements," was prepared for the Council on Environmental Quality by Booz, Allen and Hamilton (BAH) in 1971. The BAH report provides estimates of the incremental capital investments and annual operating costs based on an undefined assumption regarding the level of pollution control existing in 1971. Exhibit V-1 lists the coverage of these prior studies.

In addition to the reports which were provided by the EPA, other sources of air and water pollution control costs were reviewed and compared with the official data. These included information gathered from steel companies by the American Iron and Steel Institute regarding costs incurred by the Industry prior to 1973, and a recent survey which summarized water pollution control costs required to reach Levels I and II control technology. McGraw-Hill Publishing Co. has prepared annual surveys of pollution control costs for major industries, including iron and steel, based on surveys conducted within each industry.

COMPARISONS OF POLLUTION CONTROL COST ESTIMATES

A major problem in assessing the economic impact of pollution control costs on the Iron and Steel Industry has been to arrive at a reasonable estimate of the costs of implementing control regulations. Probably the fact that many studies have been made, officially for the EPA, and unofficially by Industry and private groups, has resulted in a wide divergence of cost data. Even costs prior to 1973, which should be a matter of historical record, vary, as shown in Exhibit V-2, which compares AISI data and McGraw-Hill data. Almost 1.5 billion dollars was reported by the AISI as having been spent through 1972, for air and water pollution control, about 45 percent of which was for water pollution control, and 55 percent for air pollution control.

The official water pollution control cost data provided by EPA was that prepared by Cyrus Rice, and published in June, July and November, 1973, for the primary operations only in the integrated steel plants. The capital and operating costs for Levels I and II were developed in this study for coke plants, blast furnaces, sintering plants, steelmaking plants, degassing and continuous casting operations, but not for fugitive run-offs from coal, stone and ore piles and from slag pits. The revised costs as reported by Rice are summarized in Exhibit V-3 and are further summarized in the following table:

Table 5
Operating and Capital Costs Reported in Rice Report (November, 1973)

	Level I	Level II
Initial Capital Investment	$145,272,000	$122,310,000
Annual Capital and Operating Costs	39,963,000	82,405,000

It is beyond the scope of this study to evaluate the guidelines proposed in the Rice report. However, because the Iron and Steel Industry as represented by the Environmental Committee of the American Iron and Steel Institute has prepared their own figures of estimates of capital costs to achieve Best Practicable Technology (Level A), and Zero Discharge Technology (Level B), these figures are analyzed in this study and compared to those prepared by Rice for EPA. The Steel Industry's cost estimates were prepared by accumulating estimates submitted by individual steel companies, and adjusting the total to cover those companies who did not submit estimates. The Industry's estimates were presented as totals to achieve each level of control, with an estimate for separation into primary and finishing costs for Level A. Their best estimate is that approximately 36 percent of the costs will apply to primary operations, and 64 percent to finishing operations. No costs were estimated for operating of pollution control equipment. However, we have estimated that annual operating and capital costs will approximate one third of the total capital investment costs.* The following tabulation gives the Industry's estimates, adjusted for primary operation separation, and for operating costs:

Table 6

Operating and Capital Costs Based on Steel Industry Survey Data

	Level I	Level II
Total Initial Capital Investment	$1,349,000,000	$3,117,000,000
Estimated Capital Investment for Primary Operations	486,000,000	1,122,000,000
Estimated Capital and Operating Costs for Primary Operations	162,000,000	374,000,000

Note* - Annual costs consist of: direct operation cost - 12%, Depreciation - 10%, Interest -8%, Replacement - 3%, Total - 33%.

A comparison of the Rice and the Industry estimates shows a wide divergence, particularly in achieving Level II control technology. Industry figures are 3.5 and 9.5 times the Rice figures for Levels I and II capital investment respectively, and similarly higher for operating costs. While the Rice estimates have been considered by Industry and other knowledgeable sources to be low, it is likely that the Industry estimates are high, particularly for Level II. It is known that the need for installing pollution controls in existing and often old installations results in additional costs for premature replacement of facilities, which are not economically feasible to alter to receive control equipment. The Industry estimates undoubtedly contain allowances for this type of cost, which was not covered in the Rice estimates. The two sets of numbers can, therefore, be considered as low and high estimates of capital and operating costs, and are treated in this manner in our economic analysis.

It is of interest to note that a detailed plant-by-plant survey is being made by A.D.Little, Inc. under AISI sponsorship, to determine actual pollution control needs and costs. This study is expected to be completed in the Fall of 1974.

COSTS FOR ADDED INDUSTRY CAPACITY

In Exhibit II-5, the Iron and Steel Industry capacity was projected to increase to 185 million tons of raw steel, and 128 million tons of finished steel by 1983, an increase of 25 million tons of finished steel, or about 24 percent, provided that capacity is added to keep up with demands for steel. Industry sources have estimated that the cost of a new, integrated mill producing finished steel products, will be about $500 per ton of annual capacity, based on technology and pollution control as they exist today. Although no estimates have been made regarding the costs of pollution control for new source standards, for a new steel mill a figure of $50 per ton of annual capacity, or about 10 percent of the total mill cost, appears to be a reasonable estimate. Based on this figure, the added cost for air and water pollution control for new steel mill capacity by 1983 is estimated to be approximately $1,180 million. As shown in Exhibit V-4, this additional costs will increase the estimated pollution control total capital cost by 1983, resulting in a low of $6 billion to a high of over $9 billion, of which only $1.4 billion has been already expended.

OTHER INDUSTRY COSTS

The scope of this study was limited to consideration of water pollution control costs for the primary operations in integrated iron and steel plants. However, it should be noted that this represents only a small portion of the total cost which the Industry will be required to make. Other areas which have been, or will be covered by other studies include: water pollution control costs for finishing operations in integrated steel plants; water pollution control costs for operations in non-integrated steel plants; air pollution control costs for all steel plants. Additionally, the Industry will soon be faced with the necessity for complying with the requirements of the Occupational Safety and Health Act (OSHA) which in other industries has cost as much as air and water pollution control combined, and with expenditures to achieve reductions in energy usage, or substitutions of available energy supplies for scarce energy items such as petroleum products.

Although it is beyond the scope of this study to consider and estimate these additional costs, the facts should not be ignored that the costs reported in this study probably represent only about one tenth of the total potential costs for all aspects of environmental and OSHA controls. Finally, the aspect of premature obsolescence due to requirements of installing these controls will undoubtedly add to the financial burden which must be borne in the next decade.

Exhibit V-4 gives a projection of total air and water pollution control costs for the industry, as gathered from various sources. Total costs have been projected to range from a low figure of about \$6 billion to a high figure of over \$9 billion, of which under \$1.4 billion has been already spent.

SCOPE AND COVERAGE OF PRIOR ANALYSES OF THE ECONOMIC IMPACT OF POLLUTION CONTROL ON THE IRON AND STEEL INDUSTRY

Performing Organization	Date of Analysis	Impact Period Analyzed	Principal Level of Impact Analyses	Industry Segments Covered	Pollution Abatement Coverage
Battelle Memorial Institute (1)	1968-1969	Not Specified	Production Procees and Model Plant	All	Federal Air Quality Act of 1967
Booz, Allen & Hamilton (2)	1971-1972	1972-1976	Industry	All	EPA Air Quality Standard Guidelines for States; Secondary Treatment Technology for Water Pollution Control
Booz, Allen & Hamilton (3)	1972-1973	1973-1978	Industry	All	" " "
The Council on Economic Priorities (4)		1972-1976	Company	7 Companies	
Cyrus Wm. Rice Division, NUS Corporation (5)	1973	1973-1983	Manufacturing Process	7 Manufacturing Processes	Water Pollution Control at Levels I, II and III

1. "A Cost Integrated Analysis of Air Pollution Controls in the Integrated Iron and Steel Industry", May 15, 1969. Conducted for EPA by Battelle Memorial Institute.

2. "A Study of the Economic Impact on the Steel Industry of the Costs of Meeting Federal Air and Water Pollution Abatement Requirements, July 27, 1972. Conducted for the Council on Enviornmental Quality by Booz, Allen & Hamilton.

3. "A study of the Impact of Pollution Controls on Foreign Trade," 1973, conducted by Booz, Allen & Hamilton for the Department of State.

4. "Enviornmental Steel, Pollution in the Iron and Steel Industry," conducted by staff of the Council on Economic Priorities.

5. "Development Document for Effluent Limitations Guidelines and New Source Performance Standards, Iron and Steel," Nov., 1973. Prepared by Cyrus Wm. Rice Devison of NUS Corporation for EPA.

EXHIBIT V-2

ESTIMATED POLLUTION CONTROL CAPITAL INVESTMENTS BY THE IRON AND STEEL INDUSTRY
(Millions of Dollars)

Year	American Iron and Steel Institute Estimate*			McGraw-Hill Estimate**		
	Air	Water	Total	Air	Water	Total
Prior to 1966	209	239	448			
1966	19	37	56			
1967	55	39	94			
1968	61	40	101			
1969	71	67	138			
1970	97	69	166	110	96	206
1971	88	74	162	112	105	217
1972	145	57	201	104	89	193
1973	↓	↓	↓	146	130	276
1974	201	135	336			
1975				450	420	870
1976				327	190	241

*AISI News Release, March 12, 1973.

**Annual McGraw-Hill Survey of Pollution Control Expenditures.

IRON AND STEELMAKING OPERATIONS

PROJECTED WATER POLLUTION CONTROL COSTS FOR RELATED CATEGORIES

Category	1972 Annual Production (Millions of Net Tons)	Number of Plants	Level I (1977) Annual Capital and Operating Cost	Level I (1977) Initial Capital Investment	Level II (1983) Annual Capital and Operating Cost	Level II (1983) Initial Capital Investment	New Source
Coke Making							
By Product	64.2	66	$10,034,000	$ 11,118,000	$23,537,000	$ 61,725,000	Not Estimated
Beehive	0.8	3	38,000	152,000	0	0	
Subtotal	65.0		$10,072,000	$ 11,270,000	$23,537,000	$ 61,725,000	
Burden Preparation							
Sintering	6.5	6	$ 408,000	$ 1,910,000	$ 814,000	$ 1,765,000	Not Estimated
Iron Making							
Blast Furnace - (Fe)	82.1	68	$20,169,000	$100,414,000	$40,021,000	$ 28,086,000	Not Estimated
Blast Furnace - (FeMn)	0.9	3	1,059,000	5,177,000	2,629,000	963,000	
Subtotal	83.0		$21,228,000	$105,591,000	$42,650,000	$ 29,049,000	
Steelmaking							
Basic Oxygen Furnace (BOF)	64.9	27	$ 4,274,000	$ 9,770,000	$ 5,676,000	$ 6,175,000	Not Estimated
Open Hearth (OH)	13.5	5	746,000	2,665,000	2,290,000	7,837,000	
Electric Furnace (EF)	6.5	10	400,000	1,776,000	877,000	2,289,000	
Subtotal	84.9		$ 5,420,000	$ 14,211,000	$ 8,843,000	$ 16,301,000	
Steel Operations							
Degassing	5.5	29	$ 2,840,000	$ 12,290,000	$ 5,297,000	$ 8,908,000	Not Estimated
Continuous Casting	18.0	46	0	0	226,000	4,562,000	
Subtotal	23.5		$ 2,840,000	$ 12,290,000	$ 6,523,000	$ 13,470,000	
Fugitive Runoffs*							
Coal Pile	-		$ 0	$ 0	$ 0	$ 0	Not Estimated
Stone Pile	-		0	0	0	0	
Ore Pile	-		0	0	0	0	
Slag Quench Pit	-		0	0	0	0	
Subtotal	-		$ 0	$ 0	$ 0	$ 0	
Total - All Items			$39,963,000	$145,272,000	$ 82,405,000	$122,310,000	Not Estimated

Note: *Fugitive Runoffs will be included in Phase II study by Cyrus Wm. Rice.

Source: Adapted from final revision - Cyrus Wm. Rice Report - November, 1973.

EXHIBIT V-3

PROJECTED TOTAL POLLUTION CONTROL
INVESTMENT COSTS FOR IRON & STEEL INDUSTRY
(Millions of 1973 Dollars)

Area of Control	Low Estimate	High Estimate
Air and Water Pollution Control Costs Prior to 1973 as reported by AISI	$1,365	$1,365
Water Pollution Control Costs 1973-1983 for Primary Operations in Integrated Steel Plants. (Low estimate by Cyrus Wm. Rice; High estimate by AISI)	268	1,350
Water Pollution Control Costs 1973-1983 for balance of Iron and Steel Industry (Low estimate projected by Kearney from Cyrus Wm. Rice Data; High estimate from AISI	1,200	3,115
Air Pollution Control Costs 1972-1976 given in BAH Report	1,800	2,400
Total Air and Water Pollution Control Costs for Existing Facilities	$4,633	$8,230
Air and Water Pollution Control Costs for New Facilities	1,180	1,180
Total Air and Water Pollution Control Costs	$ 5,813	$ 9,410

VI - IMPACT ANALYSIS

Any analysis of the economic impact of water pollution control requirements alone on only the primary portion of the integrated Iron and Steel Industry must be considered as only one factor among several which will have total impact on operating and capital costs in the industry. The other non-productive cost factors are water pollution control in the finishing portion of the integrated industry, water pollution control in the non-integrated steel plants, air pollution control in all sections of the Steel Industry, and in the future, the OSHA requirements and energy related expenditures in the industry. Although this study only covered the first of these factors, it should be recognized that the total impact must take into account all of the other factors.

COST EFFECTS

The estimates which were prepared by Cryus Rice and by the Steel Industry for the costs of water pollution in the primary operations of the integrated Iron and Steel Industry, can be considered as low and high estimates for purposes of impact analysis. The projected effect of these pollution control costs have been analyzed in terms of effect on costs per ton of finished steel, with the results tabulated in Exhibit VI-1. Starting with a base year, assumed to be 1973, the control capital costs were distributed evenly for each year for Level I and for Level II, with operating costs being spread out evenly for each year from 1973-1977 and 1979-1983 respectively. This distribution was used for calculation purposes only, since it is recognized that actual distribution will be non-uniform, and the tendency will be to defer any expenses as long as is possible to keep interest expense at a minimum.

Operating costs for the low estimate were taken from the Cyrus Rice report (Exhibit V-3), and high cost estimates were taken at one-third of the Industry estimated high cumulative capital costs. To arrive at an estimated cost per ton of finished steel for water pollution control costs for primary operations, raw steel production estimates for the years from 1973-1983 were converted to finished steel, using a yield of 69%, and 90% of total steel production was estimated to be produced in the integrated mills. The estimated costs per ton of finished steel for water pollution costs for primary operations in integrated steel plants were developed in Exhibit VI-1 for existing mill capacity, and in Exhibits VI-2 and VI-3 for projected mill capacity by 1983. These are summarized in the following tabulation:

TABLE 7

Cost of Water Pollution Control for Primary Operations
Per Ton Finished Steel

Year	Low Cost	High Cost
(Existing Mill Capacity)		
1977	$ 0.43	$1.80
1983	0.88	5.04
(Projected Mill Capacity)		
1977	$ 0.45	$1.86
1983	1.48	5.41

We have called attention to the fact that these costs are only a part of the total pollution control cost. Although it is beyond the scope of this study to investigate the other areas in detail, an attempt was made to arrive at order-of-magnitude costs for the other requirements, as a means of presenting the overall pollution control costs and their effect on prices. In doing this, we have taken into account: costs of installations prior to 1973; additional costs of water pollution control in all parts of all mills; and additional costs of air pollution control for all mills. This is given in Exhibit VI-4, and summarized in the following tabulation taking into account costs for added Steel Industry capacity.

Table 8

	Low Estimate (Millions 1973 Dollars)	High Estimate (Millions 1973 Dollars)
Total Capital Costs by 1983	$5,945	$ 9,410
Total Annual Operating Costs by 1983	1,930	3,138
Total Cost per Ton Finished Steel by 1983	15.07	24.50

PRICE EFFECTS

In an earlier section of this report, note was made of the alternates available to the industry with regard to the effect of costs of pollution control on steel prices. The alternates available to the industry are three: increased costs can be absorbed, thereby holding prices constant and reducing earnings; increased costs can be directly added to prices, thereby holding earnings constant and raising prices to cover increased costs; earnings can be raised to provide for capitalization requirements for pollution control, thereby raising prices beyond the amount needed only to cover control costs. The low earnings record of the industry will probably eliminate the first alternate as a viable method, while government pressures and/or regulations may possibly prevent the third alternate from taking place. The middle alternate has been chosen as the most likely to occur, resulting in a direct price increase to cover increased operating costs for pollution control.

The total cost of pollution control on composite price of finished steel is estimated to be from 7 to 11 percent of the the present cost depending on the actual final pollution control costs. Effects of OSHA control and energy related costs have not been estimated, but will have a considerable effect on increasing production costs in the future. Steel mill products have a weighting factor of 3.5 percent on the wholesale price index, so that the estimated price increase would have an effect of raising the wholesale price index by from 0.245 to 0.385 percent. Although this is not a large effect, the large usage of steel tends to result in a much greater psychological impact on attempts to combat inflation when steel prices increase.

SECONDARY EFFECTS

Steel is one of the basic materials used in our economy, and price changes in this commodity inevitably result in changes in costs of many other products. Principal users of steel in 1972 were as indicated in the following table.

Table 9
Principal Users of Steel

Construction Industry	10.1%	Machinery	5.9%
Automotive Industry	19.6%	Appliances	2.6%
Contractors Products	5.5%	Containers	7.2%
Rail Transportation	3.0%	Exports	2.8%

Increases in costs of steel will have a direct effect in increasing costs of construction, automobiles, containers, appliances, and other products. As a result of effect of yields of products from steel purchased, and the effect of pyramiding of steel prices from the initial mill costs to the effect on cost of final product, the impact of pollution control costs on costs of products using steel, will be in the order of 3 to 5 times the actual pollution control costs, varying with the method of purchase of steel by the consuming industry. Examples of the effect of the projected increases in cost of finished steel on the costs of major products and industries, are given in the following tabulation:

Table 10

Examples of Effect of Increase in Steel Prices*

Product	Typical Use of Steel	Increase in Cost: Low Estimate	Increase in Cost: High Estimate
Automobiles	3,500 lbs.	$105	$172
Construction (Homes)	3,000	113	185
Major Appliances	150	6	9
Farm Equipment	5,000	151	244

These potential cost increases include costs already in effect for installations prior to 1973. Approximately 10 percent of the low estimated effect, and 22 percent of the high estimated effect can be traced to costs for water pollution control in primary operations in integrated mills.

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* These prices are estimated costs at consumer levels after normal mark-up between steel producers and finished product sales have been included.

PROFITABILITY

Total operating costs, including fixed charges, on the pollution control facilities needed for EPA compliance are substantial and could be provided for, theoretically at least, by three alternative means. The steel companies could:

1. Absorb the additional costs involved.

2. Strive to raise profits in order to attract additional capital.

3. Raise prices sufficiently only to cover anti-pollution costs.

The first two alternatives may be ruled out, particularly in view of the industry's poor profit performance in recent years and the overall structure of increased costs that must be shouldered in the years ahead. This leaves the alternative of passing on the added cost to steel consumers, which is contingent upon a number of factors, namely, the possibility of government price controls over the period in questions, the supply-demand relationship in steel markets--both in this country and abroad, and the ability of steel users to shift their demand to substitute prodcuts.

In regard to price controls, current Phase IV regulations require that any cost increase a company intends to pass on in the form of higher prices be submitted to the Cost of Living Council for its approval, and provided the Council raises no objection within 30 days, the price increase automatically takes effect. However, hearings can be held, as was the case in late August following the Steel Industry's request to increase the prices of flat rolled products an average of approximately 5 percent. Should such regulations remain in effect, it will be more difficult for steel companies to pass on the operating costs of pollution control facilities than if there were freedom to raise prices at will.

In the absence of price controls the marketplace will determine whether or not the industry can pass on the increased cost of air and water pollution control in the form of higher prices. Considering the period ahead to 1983, when steel will most likely be a commodity in short supply, this seems to be a possibility.

The United States will require at least 183 million net tons of raw steel production by 1983 to satisfy the demands of the economy, which in light of the present steel shortage, may be a conservative figure. At present the steel capacity is between 160 million and 165 million tons. In order to produce 183 million tons, capacity will have to expand to 195 million tons, since cushion is needed for peaking periods. Thus, between 30 million and 35 million tons of capacity must be added by 1983 if the demands of the economy are to be met. There is some doubt that this amount of tonnage will be added. In fact, several companies have stated that unless price increases are permitted to restore profitability, major expenditures for capacity expansion will not be made. Consequently, there could be a shortage of steel, and if there are no government price regulations the industry will be able to charge higher prices to take care of its increased costs. There are, however, limits to this. There could possibly be competition from substitute materials should steel be in short supply and high priced. Such a situation developed at the end of World War II when many steel products were scarce. In the construction industry for example, reinforced concrete was substituted for steel to a point unknown before that time. This was inspired by the shortage of structurals to take care of the demand for highrise buildings, a demand which was not only a backlog of World War II but a backlog from the depression years of the 1930's.

Other substitutes, such as plastics and aluminum, could well move into areas served by steel if there were a shortage and prices were high, although aluminum prices have already increased significantly since removal of price controls, and unavailability of plastics may reduce sharply due to shortages of petroleum based feed stocks. Consequently, it would be up to the officials of steel companies to make a judgment as to whether or not they could afford to increase the price of steel to cover additional capital costs of pollution control in the face of possible inroads by substitute materials.

Another factor to consider in evaluating the possibility of raising steel prices is whether domestic steel consumers will be able to switch to imports. During the 1960's, imports rose rapidly from 4.5 million tons in 1959 to 19.5 million tons in 1968. The question remains as to whether a steel deficit country, which the United States could well be by the end of this decade, can count on additional supplies from other steel producing countries around the world to make up its deficit. This possibility must be ruled out in view of the expected balance of supply and demand on a worldwide basis. By 1980, the world will need one billion tons of raw steel production to satisfy its demands. This will require a capacity of 1.1 billion tons to assure the amount of production needed. At the present time there are some 800 million tons of steel capacity throughout the world, a fair portion of which is obsolete. Thus, by 1980, 300 million tons of additional capacity will be needed, and a minimum of 250 million tons of existing capacity will have to be replaced.

Currently, on the basis of a world survey taken in all of the major steel producing countries and many of the minor ones, it is evident that there are no plans to add 300 million tons of capacity by 1980. The United States has virtually no expansion plans on the drawing boards. The Soviet Union will probably add about 50 million tons, while Japan will limit its expansion to 165 million tons, 30 million tons above its current capacity, some of which will be located outside Japan proper. Based on current plans, the European countries will add only small tonnages: Great Britain will account for 5 million to 6 million tons; France will account for possibly 8 million tons; Western Germany will add 5 million tons, and Italy will add 10 million tons. Some of the developing countries, such as Spain and Brazil, will add substantial tonnages in terms of their present capacities, but absolute figures will be confined in both countries to a total of less than 20 million tons. Therefore, given these expansion plans and the demand for steel in the world through 1980, we face a substantial shortage.

With this worldwide situation in steel, the United States will not be able to import the increasing tonnages of steel which it might need to satisfy its demand. Consequently, if the marketplace is the determinant of steel pricing, costs can be passed on. However, the limitation will be substitute materials. If there are considerable substitutes used in place of steel, they could take a substantial part of the steel market on a permanent basis; witness the reinforced concrete in construction. Therefore, the ability of the industry to pass on an increased cost in a free market will not be limitless and, as mentioned previously, if prices are controlled the ability to pass on additional costs could be severely limited.

In respect to imports it must be stressed that there are pollution problems in the present and the future. The Japanese have a particularly severe pollution problem to which they must devote considerable attention in the next few years. This is true to a lesser degree of other countries which have supplied steel to the U.S. market. Without question, the solution of these problems will be costly and will be reflected in the price of steel. Consequently, the segment of increased costs due to pollution controls in the United States and the rest of the world may produce a standoff as far as competition is concerned.

CAPITAL AVAILABILITY

(a) Alternates Available

It is the opinion expressed by industry representatives as well as by those in the financial community that traditional avenues of conventional financing will only be open to the industry in limited amounts of take care of normal replacement and modernization costs. The majority of companies in the Industr are fully committed in their equity financing, and industry analys are extremely cautious in elevating any long-term attractiveness of steel stocks in the investment community. This is primarily du to the low rate of return on investment. Improved pricing structure and rate of return could enhance this possible source of financing.

There is however, another avenue open to the industry for financing of pollution control and related investments. Industrial Revenue Bond financing, a means of providing long-term capital to industrial corporations at tax exempt rates, was conceived in certain Southern states in the late 1930's as a means of attracting industry to predominately agricultural areas. They remained a highly controversial and little-used means of long-term financing until the Internal Revenue Service ruled favorably on their tax-exempt status in 1957. Their use had become so wide-spread by the mid 1960's that projections of the U.S. Treasury Department indicated an annual tax revenue loss to the Government of $200 million in 1970 rising to an annual loss of $1.5 billion in 1975.

Substantial opposition to the use of tax exempt financing as a substitute for traditional corporate debt securities developed in the investment banking community, local governments, Congress and the Treasury Department. Passage by Congress of the 1968 Revenue and Expenditure Control Act resulted in effective revocation of the tax exempt status of Industrial Revenue Bonds and limiting such financing in general to $5 million or less. Thus, by the end of 1969 this type of corporate financing had largely disappeared.

The 1968 Act, however, contains an important exception to the general restrictions imposed on Industrial Revenue Bonds in which, regardless of size, substantially all of the proceeds of the bond issue were to be used for air and water pollution control facilities.

In August 1972, the Internal Revenue Service ruled that where all proceeds of an Industrial Revenue Bond issue were to be used for air and water pollution control facilities, the earnings of such an issue would be tax exempt.

One investment banking firm, Eastman Dillon, Union Securities & Co., cites the following benefits from a Pollution Control Industrial Revenue Bond issue (PCRB).

1. Money is borrowed at a tax-exempt rate, thereby reducing interest costs from 1¼% to 2% below prevailing corporate rates.

2. Property taxes based on a proportion of the value of pollution control facilities may be avoided.

3. Investment tax credit or rapid amortization, as well as interest deductions, are available just as if the corporation had financed with its own debt.

4. In certain instances, previously constructed facilities can be refinanced through the public authority at a tax exempt rate.

5. Alternate sources of financing, seldom available to corporations, may be used, such as insurance companies, trust accounts and commercial banks that buy tax-exempt bonds for their own portfolios and for wealthy individuals.

6. The borrower has an ability to obtain 100% of financing as opposed to having to provide some form of equity.

PCRB's are not without some disadvantages however. First Boston Corporation, in a definitive document on tax exempt pollution control financing, describes three of these:

1. Difficulty in the identification and segregation of pollution control facilities. Conformance to Internal Revenue Service guidelines in engineering cost estimates and allocations of incremental costs are complex, and can require considerable in-house education of the borrower's staff or contractors.

2. Existing mortgage liens on partially completed facilities may prove a hindrance and must be examined to determine the legality and ease of conveyance of such facilities to the financing municipality for ultimate sale or lease back to the borrower.

3. Additional lead time in financing is needed over conventional methods. There are fairly complex legal steps required for issuance of the bonds, and if a ruling from the Internal Revenue Service on compliance of the facilities within its definitions is required, the issuer can expect a three month delay until a ruling is received.

An estimate is that 120 days is required to complete a PCRB issue if no ruling is required from the Internal Revenue Service. If such a ruling is required, then an average lead time of 215 days is suggested.

On balance, however, PCRB's appear to be the current solution to financing pollution control investment in the requisite plant and equipment devices.

<u>(b) Pollution Control Financing</u>

From an initial venture by U.S. Steel in 1971, financing $5 million in air pollution control through the Allegheny County Industrial Development Authority, PCRB's for all industries totaling $84.8 million were issued in 1971, of which $7.4 million was for the Iron and Steel Industry. In 1972, total issues were $491.3 million, of which $145.9 million were for pollution control in the Industry. Present estimates by bond underwriters range from $500 to $750 million in 1973, $1 to $1.5 billion in 1974 and upwards at $2 billion annually out at least into the 1980's.

It is reasonable to assume that the Industry therefore, will have a possible source for the financing, not only that portion of pollution control costs to which this study has been directed, but for the larger scope of total pollution control investment costs required to meet the required levels over the next decade.

Parenthetically, in closing, a collateral matter is of interest. In many discussions with Industry financial representatives, frequent mention was made of new trends in the Industry to seek alternative uses of capital which provide better potential in earnings and investment return than basic steel production.

Baring a change in Internal Revenue Service regulations, PCRB's can finance pollution control. At the present time, non-taxable Pollution Control Revenue Bonds (PCRB) are being used extensively by steel companies as a principal source of capital for financing pollution abatement facilities. Bethlehem Steel, for example, recently financed a pollution control package for its Sparrows Point, Maryland plant with a $42 million bond issue; Republic Steel has a $20 million issue planned for later this year, and Wheeling-Pittsburgh has already used $30 million in PCRB financing and plans to use an additional $40 million over the next five years. There is no current legislative upper limit on the amount of capital investment for pollution control that can be financed by this means, which is being counted on throughout the steel industry as a major source of future capital for achieving compliance with federal, state and local pollution control regulations.

The major current attraction of PCRB financing from the Steel Industry's standpoint is the relatively low rate of interest involved, typified by the Bethlehem issue's 6% rate, which compared to a prime lending rate of 9.75%. This particular saving must be viewed as extraordinary reflecting the recent upward spiral in lending rates. However, non-taxable bonds traditionally carry a lower interest obligation than comparable credits sold in the taxable market, the extent of the saving determined by prevailing money market conditions. Interest considerations, therefore, will continue to favor the Industry's use of PCRB financing as a means of raising capital for pollution control.

Another factor favoring the use of PCRB is the existence of the corporate income tax and the deductibility of interest expenses in calculating steel company taxable income. Because of the tax treatment accorded interest, the debt incurred by using PCRB's is usually cheaper than any form of equity, particularly common or perferred stock. The poor market performance of common steel equities over the past decade tends to preclude the possibility of extensive new financing by this means, considering the dilution of commong share earnings and the additional downward bias to common stock prices that this would entail.

Further, the risk to shareholders of common steel equities is less with PCRB debt financing than it would be with additional preferred stock issued involving dividend expenses that are non-deductibility of interest expenses reduces the after-tax cost of debt and the size of the fixed burden borne by the common shareholder, PCRB's constitute a preferred method of steel financing, particularly in view of the need to improve the stockmarket performance of common steel equities.

The remaining alternative for financing the capital costs of pollution control, namely, retained earnings, cannot be given serious consideration in view of the industry's profit performance in recent years. Since 1964, steel industry cash flows (i.e., profits after taxes, plus depreciation and changes in reserves for future federal income taxes, minus dividend payments) have consistently lagged behind capital expenditure requirements, resulting in a sharp rise in the industry's long-term debt position. The need for continued plant and equipment replacement and a substantial addition to steel capacity, which is detailed later,* is expected to get first call on internally generated capital, particularly if low-interest PCRB's are available to finance pollution control.

*See Supplementary Statement by BAH.

In view of the reliance to be placed in PCRB financing, the question naturally arises as to whether this source of capital will be available throughout the period to 1983, when Level II compliance must be achieved. The primary reason PCRB's are favorably regarded by investors is their tax-exempt status (which accounts for their low interest charged). Consideration must be given to the very real possibility that this tax exemption may be suspended by a tax reform program aimed at closing "tax loopholes," in which case the Steel Industry's ability to finance pollution control would be seriously jeopardized.

Assuming that PCRB financing is available through 1983, the problem then becomes the resultant debt burden to be carried by steel companies,and the likelihood that it will eventually act to seriously impede their ability to attract capital for esstential purposes other than pollution control, particuarly for the replacement and expansion of capacity. The fact that PCRB debt financing is the clearly preferable means of paying for mandated pollution control expenditures restricts the control over a steel company's capital structure normally exerted by its management in selecting the amounts of debt and equity to be employed. This poses a difficulty in terms of management's ability to hold the proportions of debt and equity within the limits of its own risk preferences and, more importantly, within the limits regarded as prudent by lenders.

Debt limitations are usually established based on the degree of protection particular assets afforded lenders, and the amount of earnings expected to be available to repay interest and principal. Generally speaking, lending agencies have informally established a ratio of debt to total invested capital of 30% as an appropriate upper level for the Steel Industry, and unfortunately, given the Industry's heavy use of debt financing in recent years, it has already reached its debt limitation (i.e., 30.2% of the Industry's total capital is currently from debt and for some companies this limit has been exceeded substantially.) It is true that lenders have been somewhat flexible in their consideration of debt financing by means of PCRB's, given the low interest charges, as well as their generally favorable disposition to the objective of curtailing environmental pollution. However, it is doubtful that this flexibility will continue indefinitely, particularly in view of the sharp increase anticipated in PCRB financing to meet EPA standards over the next ten years. The figure will run into billions of dollars and will likely affect the availability of investment capital for other purposes.

PRODUCTION EFFECTS

(a) Effect on Industry

In the study of "Economic Impact of Pollution Control on the Steel Industry," prepared for the Council for Environmental Quality by Booz, Allen & Hamilton in 1972, the statement was made that steel demand is relatively inelastic to price. We believe that insofar as prices are related to pollution control costs, this will be particularly true in the future.

The assumption was made earlier in this study that the most probable effect of costs of pollution control will be to raise steel prices sufficiently to cover these costs, while retaining profits at their historical level. If this effect of pollution control costs were unique to the U.S. Iron and Steel Industry, the probable result would be that substitutions of other materials in place of steel, and imports of foreign steel would cut substantially into the markets for steel from U.S. mills. However, all indications are that the industries producing potential substitute materials such as aluminum, will also be faced with increasing costs and prices due to pollution control costs, while plastics are already faced with increasing new materials costs. Similarly, foreign steel producers are being faced with an increasing requirement for pollution control within their countries. England, Germany and Japan are already well advanced in pollution control techniques, and other countries are following. Costs of foreign steels will, therefore, in general be faced with similar increases as are required for U.S. steels. Those countries which do not require pollution controls, may possibly be faced with import duties which will penalize polluting mills to prevent them from taking unfair advantage over the mills that do practice pollution control.

We do not believe, therefore, that there will be any substantial reduction in steel demands, or of production requirements for U.S. steel mills due to increased costs for pollution control.

Production curtailments, where they take place, will be caused by another factor, the comparative economics of production in one mill versus another. We have previously segmented the integrated steel mills into those which continue to depend partially or entirely on obsolete processes or equipment, and those which are utilizing modern process and equipment for all operations. To this factor of modernity must be added other factors involving poor location with respect to raw materials and markets, poor labor climate, and high costs or unavailability of utilities and services.

To the degree that pollution control related curtailments may take place in individual plants, they will be involved with departments or equipment which have become obsolete, and which cannot be continued to be operated without expensive modifications and installation of pollution control equipment. For example, open hearth shops may be shut down where alternate steelmaking equipment is available, and small, uneconomical blast furnaces may be shut down if larger units are available. In some isolated cases, the primary operations may be shut down, and only the finishing departments operated with steel brought in from other plants, or some finishing operations may be shut down, and only part or all of the primary operations continuing to be operated.

An important problem facing the Steel Industry is related to selective curtailments, and involves premature obsolescence of plants and equipment. Historically the Industry has spent vast sums of money for capital expenditures for increased capacity, modernization, replacement and obsolescence. These costs were shown in Exhibit III-3 for the past ten years. In this period the capital expenditures have averaged about 15% of net fixed assets in the industry although they have been under 10% in recent years.

In many plants equipment is currently being used which will ultimately be scheduled for replacement in future years. However, the requirements for installation of air and water pollution controls, and at a later date OSHA controls, will involve extensive modifications to existing equipment to accommodate the controls. In some cases complete rebuilding will be necessary for this purpose. Economically, these programs are often unsound since even after extensive modification and rebuilding, the equipment is still of older, sometimes obsolete design, and with lower productive capacity. Therefore, in many cases the steel companies may elect to prematurely replace the equipment, resulting in capital expenditures some years ahead of the normal replacement schedule. This premature obsolescence requires unusual amounts of capital in addition to regularly scheduled capital expenditures for increased capacity and replacement, and for pollution control.

(b) Plant Closings

There are several steel mills located in various parts of the United States which have for many years been regarded as marginal operations, or even as losing operations. These mills have been continued in operation as long as they could be maintained without expending large sums of money for modernization, replacement or for nonproductive requirements. Once faced with the necessity for making large scale investments for pollution control, with the probability of having to replace or rebuild equipment to accommodate controls, the parent companies are faced with the decision of whether to spend money in the marginal plant, or to shut down part or all of the operations and transfer production to more profitable plants. In view of the limited amount of capital which many companies have available, they may be forced to make an unpleasant decision to close down part or all facilities in an operating plant, and to spend the available funds to increase capacity at a more profitable plant.

There is no special formula for identifying situations where potential curtailments or closures may take place, particularly since operating cost and earning information for individual plants have not been available. The assessment regarding potential plant curtailments or closures had to be made by analyzing each of the plants covered by this study, and identifying those which have been considered as marginal or obsolete operations by their parent companies. Some of these plants have been identified in prior reports used as reference material for this study, and in news media in feature articles and also used as references for this study. However, because of the confidential nature of some of the information which we received from industry sources, and because of the potential impact on the company's standing in the financial community and the economic outlook of the communities where marginal mills are located, we will not specifically name or otherwise identify such plants. Instead our discussion will be limited to the factors which may result in curtailment or closure decisions, and the national effect of such action.

In the initial screening of the 63 integrated steel plants, one-third were identified as operations which were known to be marginal to some degree with regard to production costs, quality, and ability to produce products to meet current market needs. In most cases these plants were old, were still operating with processes and equipment which may be considered obsolete, had not been provided with modern equipment and processes, and in some cases already had some of the operations shut-down. At least two of the plants were poorly located with regard to markets, as they exist today, for the products being made.

A second screening of these marginal plants narrowed the list to nine plants which were considered as prime candidates for closure or curtailment of a significant portion of their operations. In addition, two other plants are known to have already been largely shut down and have been publicized in the news media.

Factors which were considered in the final analysis included the present condition and degree of modernization of the mills in question, the attitude of the parent companies as reflected by the expenditures made in recent years to expand capacity or to modernize the facilities, and public announcements made by some of the steel companies with regard to the future of these plants. In some cases these conditions are so well known in the communities involved, that local efforts are being made to influence the companies to maintain operations at the plants involved.

Of the 11 plants involved, seven are in the primary steel production area in the eastern Great Lakes-Ohio River part of the country; two are in the south, and two are west of the Mississippi River. Two are limited operation-type plants, while the rest all produce finished products. Total employment in the 11 plants is about 33,000 or approximately 7% of the total Steel Industry employment. About 30,000 of these workers are in the plants located in the East-Central steel district. The plants are fairly well disbursed except for a principal group located in one district. This group, containing some 18,000 workers, has long been considered a problem for the parent companies, and for the district in which they are located.

The mills which may be candidates for shut-down decisions or curtailment of operations have a combined productive capacity of approximately five percent of the industry capacity, or about 8 million tons of raw steel per year. To maintain present levels of production, the capacities displaced by shutting down any of these mills will have to be taken up by increasing capacities of other mills producing similar products.

Generally it cannot be stated that the problems and costs of pollution control are the only, or even the principal reasons for the potential curtailments or closures of these plants. They have had a history of problems and were considered marginal operations before the impact of pollution control was felt. Rather it can be stated that pollution control is the final blow, like the "straw that broke the camel's back." It is entirely probable that some of those plants would ultimately have been partially or entirely closed, even without pollution control requirements, while others may have continued as long as the high demand for steel continued. In some cases, community pressures undoubtedly have contributed to the company decisions to keep the plants in operation. However, faced with the potential capital costs for air and water pollution control, the premature obsolescence costs which will accompany pollution control requirements, and the expected increases in operating costs which will result, we believe that early decisions may made by several steel companies to shut down or drastically curtail operations at most of these marginal plants.

(c) Employment Effects

The potential gross displacement of workers has been estimated to be as high as approximately 33,000 of which about 25,000 are wage earners, and the balance are salaried. Approximately one-third of the wage earners represent unskilled labor, and one-third will represent semi-skilled labor, both of which require retraining for replacement in other industries. The remaining third represents skilled and specialized labor categories, such as crane operators, maintenance men, craftsmen, melters, mill operators, etc., who can be placed in other plants in the Steel Industry or in other industries without retraining.

The salaried workers, covering supervisors, clerical, technical and management classifications can, in many cases, be reemployed in the Industry or in other industries without extensive retraining.

The losses in productive capacity which may result from the decision will probably be made up by increasing capacity and rate of operations at other plants which produce the same products. Where the plants which are closed are located near other steel mills, at least part of the workers who may be displaced will be re-employed in the other plants. In general, experience in other industries where plant closures have taken place has resulted in about half of the displaced workers, or their equivalent in numbers, being re-employed in the industry. We believe that this will take place in the Steel Industry. However, because of the fact that some of the plants are isolated or located in small communities, there will be local unemployment problems which will result from individual plant closures. The greatest problem will occur in the steel district previously described where several mills potentiall may close or curtail operations.

The net potential unemployment, requiring placement outside the Steel Industry, is therefore estimated at as much as 16,500. It is believed that this will be concentrated among the unskilled and semi-skilled wage earners, and the clerical part of the salaried staffs.

(d) Community Effects

As long as the productive output of the Steel Industry continues to grow, the effect on suppliers to the Industry will remain unchanged on a national basis. The principal raw materials, i.e., iron ore, coal, scrap, limestone and ferro-alloys, will continue to be used in about the same or greater total quantities, and principal supplies such as fuels, refractories, lubricants, and replacement parts will also continue to be used at or greater than present rates.

However, in local areas where mills close, there will undoubtedly be local effects on suppliers of raw materials and operating supplies, which may cause some companies to close down or curtail operations. This will be particularly true in the most heavily impacted district previously described. In those cases there will be secondary local unemployment effects from suppliers being forced to curtail operations.

Other effects which will be felt in communities where mills which may close are located, will involve the individuals and companies which service the mills and their employees, and companies which were established near supplies of steel to operate industries fabricating steel into finished products. In severe cases, relocations of some of these secondary companies may occur, resulting in an increased impact on the community.

(e) Balance of Trade

As previously shown in Exhibit II-6, the United States has changed from a steel exporter to a steel importer in the past 15 years. During that period the balance shifted from 4.2 million tons net exports in 1957, to 15.9 million tons net imports in 1972.

We have previously observed, that the growth in steel demand will require an increase in net imports, even if production capacity is increased in some relationship to growth in demand. (Exhibit II-5). However, if the growth in U.S. capacity does not keep up with demands, the net imports will have to increase, provided that foreign steel is available. Such increases, which could raise net imports as much as 50 percent or more in the next decade, will have a direct effect on the present unfavorable balance of trade in steel products, and consequently on our entire economy. This adds another factor to the need for providing capital for expansion of steel productive capacity in this country.

ENVIRONMENTAL PROTECTION AGENCY

EFFECT OF WATER POLLUTION CONTROL COST FOR PRIMARY OPERATIONS ONLY ON COST OF FINISHED STEEL

(1973 Dollars) (Based on 1973 Steel Capacity)

	Total Production (Million Tons)		Integrated Mill Production (Million Tons)		Low Cost Estimate				High Cost Estimate			
Year	Raw Steel	Finished Steel	Raw Steel	Finished Steel	Capital Cost per Year (Millions)	Cumulative Capital Cost (Millions)	Operating Cost per Year (Millions)	Pollution Cost per Ton	Capital Cost per Year (Millions)	Cumulative Capital Cost (Millions)	Operating Cost per Year (Millions)	Pollution Cost per Ton
1973	150	103	135	93	$29	$ 29	$ 8	$0.09	$100	$ 100	$ 33	$0.35
1974	145	100	131	90	29	58	16	0.18	100	200	67	0.74
1975	150	103	135	93	29	87	24	0.26	100	300	100	1.08
1976	150	103	135	93	29	116	32	0.34	100	400	133	1.43
1977	150	103	135	93	29	145	40	0.43	100	500	167	1.80
1978	150	103	135	93	22	167	47	0.51	150	650	217	2.34
1979	150	103	135	93	20	187	54	0.58	150	800	267	2.87
1980	150	103	135	93	20	207	61	0.66	150	950	317	3.40
1981	150	103	135	93	20	227	68	0 73	150	1,100	367	3.95
1982	150	103	135	93	20	247	75	0.81	150	1,250	417	4.50
1983	150	103	135	93	20	267	82	0 88	100	1,350	450	5.04

Notes:
(1) Integrated mill production assumed to be 90% of total mill production.
(2) Finished steel assumed to be 69% of raw steel.
(3) Low cost estimate from Cyrus Wm. Rice Report.
(4) High cost estimate from AISI Industry Survey.

EXHIBIT VI-1

ENVIRONMENTAL PROTECTION AGENCY

ESTIMATED COST OF WATER POLLUTION CONTROL FOR NEW STEEL CAPACITY

Year	Capacity Increase (Million Tons Finished Steel)	Cumulative Capacity Increase (Million Tons Finished Steel)	Cost Pollution Control Facilities (Millions)	Cumulative Cost Pollution Control Facilities (Millions)	Cumulative Cost Pollution Control Facilities-Primary Operations Only (Millions)	Annual Cost Operation Pollution Control (Millions)	Annual Cost Operation Pollution Control-Primary Operations (Millions)	Annual Cost Operation Water Pollution Control-Primary Operations (Millions)
1973	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0
1976	3	3	$ 80(A)	$ 80	$ 29	$ 27	$ 10	$ 6.0
1977	2	5	100(B)	180	65	60	22	13.5
1978	4	9	200(B)	380	137	126	46	28.5
1979	2	11	100(B)	480	173	155	58	34.0
1980	4	15	200(B)	680	245	225	81	51.0
1981	2	17	100(B)	780	281	258	93	58.5
1982	4	21	200(B)	980	353	324	117	73.5
1983	4	25	200(B)	1,180	414	390	141	88.5

Notes: (A) The first 3 million tons of increased capacity are not based on building new plants, but in up-dating existing facilities.

(B) Based on cost of $500 per annual ton finished steel capacity for new construction, plus $50 per ton for pollution control.

EXHIBIT VI-2

ENVIRONMENTAL PROTECTION AGENCY

EFFECT OF WATER POLLUTION CONTROL COST FOR PRIMARY OPERATIONS ONLY ON COST OF FINISHED STEEL
(1973 DOLLARS)

(BASED ON INCLUDING COSTS OF ADDITIONAL STEEL CAPACITY)

Year	Total Production (Million Tons)		Integrated Mill (Million Tons)		Low Cost Estimate				High Cost Estimate			
	Raw Steel	Finished Steel	Raw Steel	Finished Steel	Capital Cost per Year (Millions)	Cumulative Capital Cost (Millions)	Operating Cost per Year (Millions)	Pollution Cost per Ton	Capital Cost per Year (Millions)	Cumulative Capital Cost (Millions)	Operating Cost per Year (Millions)	Pollution Cost per Ton
1973	150	103	135	93	$29	$ 29	$ 8	$0.09	$100	$ 100	$ 33	$0.35
1974	145	100	130	90	29	58	16	0.18	100	200	67	0.74
1975	149	103	135	93	29	87	24	0.26	100	300	100	1.08
1976	154	106	139	96	46	133	38	0.40	118	418	139	1.45
1977	157	108	141	97	41	174	44	0.45	123	541	180	1.86
1978	163	112	146	101	65	239	65.0	0.64	245	786	262	2.60
1979	165	114	149	103	42	281	86.1	0.84	223	1,009	336	3.27
1980	171	118	154	106	63	344	107.2	1.01	245	1,254	418	3.95
1981	174	120	157	108	42	386	128.3	1.19	223	1,477	492	4.55
1982	180	124	162	112	63	449	149.4	1.33	245	1,722	574	5.12
1983	185	128	167	115	63	512	170.5	1.48	145	1,867	622	5.41

Notes:
(1) Integrated mill production assumed to be 90% of total mill production.
(2) Finished steel assumed to be 69% of raw steel.
(3) Low cost estimate from Cyrus Wm. Rice Report.
(4) High cost estimate from AISI Industry Survey.

EXHIBIT VI-3

ENVIRONMENTAL PROTECTION AGENCY

TOTAL ESTIMATED EFFECT OF
AIR AND WATER POLLUTION CONTROL COST
ON PRICE OF FINISHED STEEL IN 1983
(Millions of 1973 Dollars)

Description of Pollution Control Requirement	Low Estimate: Estimated Total Capital Cost	Low Estimate: Estimated Annual Operating Cost	Low Estimate: Estimated Cost per Ton Finished Steel	High Estimate: Estimated Total Capital Cost	High Estimate: Estimated Annual Operating Cost	High Estimate: Estimated Cost per Ton Finished Steel
Air and Water Pollution Controls Prior to 1973	$1,365	$ 455	$ 4.41	$1,365	$ 455	$ 4.41
Water Pollution Controls (Existing Facilities) 1973 - 1983	1,468	482	4.68	4,465	1,490	14.48
Air Pollution Controls (Existing Facilities) 1973 - 1983	1,800	600	5.82	2,400	800	7.76
Totals (Existing Facilities)	$4,633	$1,537	$14.91	$8,230	$2,745	$26.62
Air and Water Pollution Controls for New Facilities - to 1983	$1,180	$ 393	$15.70 *	$1,180	$ 393	$15.70
Totals (Existing and New Facilities)	$5,813	$1,930	$15.07	$9,410	$3,138	$24.50

Note: *For 25 million tons or new steel capacity.

EXHIBIT VI-

VII - LIMITS OF THE ANALYSIS

INDUSTRY SEGMENTATION

Attention has previously been called to the fact that this study covers only water pollution control in the primary operations of the integrated Iron and Steel Industry. This portion of the costs represents only about 15 to 20 percent of the total air and water pollution control expenditures which remain to be carried out in the entire Industry, and only about one-fourth to one-fifth of the total water pollution control costs for the Industry. This limitation in industry coverage has greatly limited the effectiveness of the study, since it is almost impossible to isolate only a part of the operations in the plants, and attempt to analyze the effect of water pollution control for so small a portion of the total pollution control cost, and then relate it to the entire plant.

RANGE OF ERROR

The primary input to this study was the "Effluent Guidelines Study" prepared by Cyrus Wm. Rice Division for EPA. The capital and operating cost data prepared by Rice have been revised four times in the course of the study. Furthermore, they are considered by almost all sources who have reviewed their report as highly questionable with regard to accuracy and completeness. The general belief, in which we concur, is that the costs are very low. Some of these problems are caused by recommendation of unrealistic standards which we do not believe can be met within the limitations of Levels I and II guidelines. The low estimates of capital cost are, we believe, caused by not recognizing that it is not possible to install the water pollution controls which are required without major replacements or rebuilding of facilities in which these controls are located.

As a means of establishing a more reasonable range of cost data for water pollution control, we have used figures developed by the Environmental Committee of the American Iron and Steel Institute. These figures are almost five times the totals estimated by Rice, and while possibly on the high side, do establish a range within which the cost effects could be estimated. However, it should be noted that the accuracy of the figures used in this report has been subject to question from the beginning, and at best only provide a range of order-of-magnitude numbers.

CRITICAL ASSUMPTIONS

The most critical assumption which has been made is that the Steel Industry can actually achieve the effluent guidelines at the costs proposed by Rice. At this time the Environmental

Committee of AISI has stated that the guidelines cannot be met in the time periods established with known technology, and in fact, based their own estimates on levels that they believed could be achieved. If entirely new technology has to be developed to achieve some of the proposed effluent requirements, the control costs could be far in excess of those estimated, even by the Industry.

REMAINING QUESTIONS

Until the balance of the Industry is studied, and control guidelines and costs are established, the overall impact of water pollution controls on the Industry cannot be accurately assessed. Additionally, since in this Industry the costs and problems of air and water pollution control are inseparable, and are completely related, any realistic analysis must take into account the total pollution control problem and costs.

SUPPLEMENT

FINAL REPORT

Analysis of the Ability of the U.S.
Steel Industry to Finance Pollution
Control Equipment

ENVIRONMENTAL PROTECTION AGENCY

Washington, D. C.

January 9, 1974

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I N D E X O F E X H I B I T S
(Continued)

I. INTRODUCTION

I. INTRODUCTION

This report contains an evaluation of the ability of the U. S. Steel industry to obtain the capital required to meet pollution abatement and other capital needs over the period 1973-1983. The following specific subjects are addressed in the body of the report:

- Steel industry capital expenditure requirements
  - Capacity modernization and replacement
  - Capacity expansion
  - Pollution abatement
- Steel industry earnings and cash flow
- Steel industry capital access
  - Internally generated funds
  - Access to debt markets
  - Access to equity markets

We wish to acknowledge our appreciation to the staff of A. T. Kearney for their cooperation and assistance in preparing this report.

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II. STEEL INDUSTRY CAPITAL EXPENDITURE REQUIREMENTS

II. STEEL INDUSTRY CAPITAL EXPENDITURE REQUIREMENTS

This chapter contains estimates of steel industry capital expenditure requirements over the period 1973-1983.

The future capital expenditures required by the domestic steel industry can be placed into the following three categories:

- Expenditures for capacity modernization and replacement
- Expenditures to expand output capacity
- Pollution abatement expenditures

Each category of expenditures is discussed in turn below.

1. EXPENDITURES FOR CAPACITY MODERNIZATION AND REPLACEMENT

The steel industry, as is the case in all manufacturing industries, must maintain a minimum annual level of capital expenditures to modernize and replace obsolete and worn out production facilities. If such investment does not take place, productive capacity will decrease over time as over-age facilities are phased out of production without replacement.

In a report prepared by Booz, Allen & Hamilton Inc. for the Council on Environmental Quality in 1972 on the economic impact of pollution control costs on the steel industry, minimum annual expenditures for capacity modernization were estimated to be approximately $1.375 billion. This same estimate is used for purposes of this study.

2. EXPENDITURES TO EXPAND OUTPUT CAPACITY

The level of capital expenditures required to increase productive steel capacity depends on the output capability of presently existing capacity, future demand for steel, and the cost of new capacity.

(1) Current Productive Capacity

As has been pointed out in several previous studies, domestic steelmaking capacity has been extremely difficult to estimate. This difficulty arises from the fact that steelmaking capacity is not systematically reported by domestic producers.

The events of 1973, however, appear to provide a reasonably good basis for estimating capacity. Steel demand since January, 1973 has been running at record levels with consumption for the year expected to reach more than 120 million tons of finished steel. Raw steel production during the year has peaked at an annual rate of 155-156 million tons in the face of increasing producer backlogs, with some producers reporting their order books filled through the first quarter of 1974. Net finished steel shipments for 1973 are expected to be approximately 109 million tons with about 103 million tons representing current year production and the balance representing producer inventory withdrawals. The above events suggest that domestic raw steel production capacity is about 155 million tons and capacity to produce and ship finished steel on a sustained basis is about 103 million tons. Exhibit I, following this page, presents a summary of the apparent relationships between raw steel production capacity and sustainable finished steel shipment capacity during 1973. It should be noted that the differential between finished steel production capacity (107 million tons) and sustainable annual steel shipment capacity (103 million tons) is smaller than traditional methods of computing shipment capacity would indicate. Traditional practice would require the provision of approximately 9 million tons of finishing capacity, equal to approximately 6% of raw steel capacity to accommodate demand peaking and product mix changes. Developments during the current year suggest that during very strong demand periods the pattern of demand tends to smooth with customers taking all of the steel they can get, whenever they can get it.

For purpose of further analysis, current sustainable domestic steel shipment capacity will be considered to be 103 million tons per year.

(2) Steel Consumption and Shipments

Exhibit II, following this page, contains baseline projections of finished steel consumption, net imports and shipments. The projection of finished steel consumption for the period 1974-1983 has been prepared by A. T. Kearney, Inc. Projected steel shipments have been derived by estimating the potential level of net finished steel imports.

The annual level of net imports indicated (13 million - 14 million tons) is considerably lower than that experienced in prior years. There are two basic reasons for postulating lower future import levels:

> Steel demand in the current year is strong throughout the world and has placed significant pressure on productive capacity in most producing nations. This pressure on world-wide capacity is expected to continue for the foreseeable future as currently known capacity expension plans are not expected to keep pace with growth

in world-wide demand. The expected tight supply-demand situation in world-wide markets should cause import pressure on U. S. markets, which is greatest in periods of world-wide excess capacity, to ease considerably.

The devaluations of the dollar have improved the competitive position of U. S. producers in relation to major foreign producers.

To achieve the level of shipments indicated, additional finished steel production capacity of about 9 million tons would be required by 1978, increasing to a total of about 26 million tons by 1983. In addition, continued capacity expansion at a rate of 2 million tons per year after 1983 has been used as a basis for estimating capital expenditures for the period 1980-1983 with an assumed four year construction lead time.

There remains the question of whether producers will be motivated to expand capacity in view of current industry profit levels. Given the operation of a free market and the expected tight supply-demand balance in world markets, it would appear, conceptually, that prices and associated profits should increase to a level to make capacity expansion attractive. This specific subject is explored in greater detail in Chapter III of this report.

(3) The Cost of New Capacity

The Association of Iron and Steel Engineers (AISE) and the American Iron and Steel Institute estimate that the cost of fully integrated new steel capacity is approximately $500 per annual ton, before allowing for any additional costs related to pollution abatement requirements. For some portion of the incremental capacity to be installed, the cost will be less than $500 per ton as capacity can be increased by rounding out existing facilities. According to data supplied by steel industry sources during a recent study completed by Booz, Allen for the Council on Environmental Quality, the extent of capacity expansion achievable through such practices is limited, although not known with any precision. Accordingly, a sliding scale has been applied to estimate the cost of additional capacity as follows:

Cost per Ton	Capacity Increment
$200	1st million tons
$275	2nd million tons
$350	3rd million tons
$425	4th million tons
$500	All additional capacity increments

The above scale was developed and used in the CEQ study mentioned above and has been used for estimating purposes in this study.

Provision must be made for the cost of installing pollution abatement equipment on new capacity. A. T. Kearney, Inc. has estimated the cost of such equipment installed on new fully integrated capacity to be approximately $50 per annual ton of capacity. This estimate has been adopted for this study. Where incremental capacity is priced at less than $500 per ton (see the sliding scale above) pollution abatement cost per ton is assumed to be equal to 10 percent of the basic capacity cost.

(4) <u>Capital Investment for New Capacity</u>

Exhibit III, following this page, shows estimated annual capital investment required for additional capacity (excluding pollution abatement) over the period 1973-1983. The estimated cost per ton for new capacity is based upon the sliding scale discussed above. Expenditure patterns are based on the following assumptions:

Capacity must be in place at the end of the year prior to operation

Construction lead times will be:

- First three million tons - 2 years
- Fourth and fifth million tons - 3 years
- All additional tonnage - 4 years

Total capital expenditures for new capacity, including pollution abatement expenditures, are shown on Exhibit IV, following this page. Over the period 1973-1983 total expenditures for steel industry capacity expansion should come to approximately $16.2 billion, including expenditures for capacity to become operational over the period 1984-1987 at the rate of 2 million tons per year.

3. POLLUTION ABATEMENT EXPENDITURES

Capital expenditures related to pollution abatement can be placed in two categories.

- Expenditures to install air and water pollution abatement equipment
- Expenditures to replace capacity, which would normally remain operational, but which cannot economically be cleaned up

(1) Expenditures to Install Pollution Abatement Equipment

Exhibit V, following Exhibit IV, shows estimated high and low air and water pollution abatement capital expenditures covering existing capacity for the period 1973-1983. Estimated total expenditures have been provided by A. T. Kearney, Inc. The annual pattern of expenditures is based upon the following:

- Air pollution abatement expenditures must be completed by the end of 1976 to meet compliance deadlines

- Water pollution abatement expenditures have been spread according to a pattern of outlays developed by A. T. Kearney (Exhibit VI-1 of the A. T. Kearney Report to EPA).

Total estimated pollution abatement capital expenditures for the period 1973-1983 range from \$3.4 billion to \$6.9 billion.

(2) Expenditures to Replace Capacity Shut Down as a Result of Pollution Abatement Requirements

A. T. Kearney, Inc. estimates that eleven plants representing approximately 5.6 million tons of finished steel production capacity may be shut down, due at least partially to pollution abatement costs. These shutdowns may be regarded as being accelerated by pollution abatement requirements as the plants would likely continue to operate for several years were pollution abatement requirements not imposed.

The estimated annual capital investment required to replace the 5.6 million tons of capacity lost is \$2.5 billion as indicated to Exhibit VI, following this page. The following assumptions were made in preparing this estimate.

- Capacity to be shut down will be taken out of service by the end of 1976 because of pollution abatement compliance deadlines. Replacement capacity must be operational by the beginning of 1977.

- The cost of replacement capacity will be $450 per ton

  - Plants to be replaced are primarily integrated. They will be replaced with integrated plants.

  - Ore extraction and transportation facilities will not require replacement, thus reducing the cost per ton of replacement capacity from $500 to $450 per ton.

- Pollution abatement capital expenditure requirements for replacement capacity are not included in the estimates shown on Exhibit V as they include the cost of cleaning up the 5.6 million tons of capacity vulnerable to shutdown.

4. TOTAL CAPITAL EXPENDITURE REQUIREMENTS

Exhibit VII, following Exhibit VI, shows total steel industry capital expenditure requirements. It should be noted that the totals contained in previous Exhibits have been reduced by 10 percent to facilitate financial analysis. Steel industry financial statistics as reported by the AISI cover integrated steel producers accounting for approximately 90 percent of total domestic output. Capital investment estimates have accordingly been adjusted for compatibility with reported industry financial data.

Over the period 1973-1983 integrated steel producers will require investments of $18 billion to $21 billion to maintain existing capacity and meet pollution abatement requirements. If expenditures are to be made to replace facilities potentially shut down by pollution abatement and to expand capacity, total outlays would increase to $35 billion - $38 billion.

5. NET INCREMENTAL CASH OUTLAYS

For purposes of the financial analysis contained in the following chapter, the capital expenditures shown on Exhibit VII must be adjusted to reflect net incremental cash outlays by integrated producers. The adjusted expenditures are shown in Exhibit VIII, following this page. The expenditures shown reflect adjustments for the 7 percent investment tax credit which has been assumed to be operational through 1983 and for depreciation, computed on a 15 year straight-line basis. Specific assumptions used in making adjustments are as follows:

Capacity modernization and replacement

- Outlays were reduced by the amount of the 7 percent investment credit

- No provision was made for depreciation. It is assumed for purposes of the financial analysis in the following chapter that depreciation for replacement and modernization facilities is included in the annual industry depreciation base (i.e., that facility retirements balance with replacements).

. Pollution abatement

  - Outlays were reduced by the amount of the 7 percent investment credit

  - Depreciation on each year's expenditures was computed as follows:

    . The first year's depreciation was taken on 50 percent of the amount invested per Exhibit VII. In subsequent years, the full amount of annual depreciation was taken.

    . The full value of depreciation has been credited against annual investment reflecting the assumption that price increases will result in full depreciation recovery.

. Accelerated facilities replacement

  - Outlays were reduced by the amount of the 7 percent investment credit

  - Annual depreciation was computed as described above

  - Credits against annual investment were taken for 50 percent of the applicable annual depreciation reflecting the depreciation tax shelter. Price increases to fully recover depreciation were not assumed.

- No adjustments were made to depreciation calculations to reflect accelerated facilities retirements. It was assumed that such facilities would continue to be depreciated after shutdown.

- Capacity Expansion

  - Outlays were reduced by the amount of the 7 percent investment credit

  - Depreciation was computed as indicated above

  - Credits for the full amount of depreciation were taken against that portion of total expenditures representing investment in pollution abatement equipment

The net outlays contained in Exhibit VIII provide the basis for the financial analysis in the following chapter.

III. FINANCING STEEL INDUSTRY POLLUTION ABATEMENT CAPITAL EXPENDITURES

III. FINANCING STEEL INDUSTRY POLLUTION ABATEMENT CAPITAL EXPENDITURES

This chapter contains an evaluation of the ability of the U. S. steel industry to finance pollution abatement capital expenditures over the period 1973-1983.

1. STEEL INDUSTRY PROFITS AND CASH FLOW

Since the late 1960's, steel industry earnings have fallen off sharply in the face of slack demand coupled with rising imports. In 1970 and 1971, profits were equal to only 2.8 percent of sales. Return on stockholders' equity was only about 4 percent in both years. In 1972, profits increased to 3.4 percent of sales and return on equity to 5.7 percent as steel shipments recovered from the 1971 low. For 1973, demand and steel shipments are running at record levels with net steel shipments expected to reach 109 million tons, an increase of 18 million tons over the 1972 level.

The best available estimate of industry profits for 1973 indicates that profits should increase to approximately $1.2 billion, an increase of about 55 percent over 1972. Considering increased shipments and what price increases have taken place, net profits should increase to about 4.3 percent of sales and return on shareholders' equity to 8.0 - 8.3 percent. It should be noted that estimated profit margins for 1973 are lower than those in seven of the preceding eleven years. Estimated returns on shareholders' equity for 1973 are lower than those experienced during the peak years of the 1960's (1964-1966), although the amount of debt in the steel industry's capital structure in proportion to equity has increased sharply and steadily since those years.

For purposes of analysis, baseline steel industry profits and cash flow have been projected for the period 1973-1983 in constant 1973 dollars. The assumption has also been made that capacity will not be increased in order to test the possibility of financing pollution abatement capital expenditures without a concurrent increase in capacity. Projected steel industry funds available for investment using the above assumptions are shown on Exhibit IX following this page. Specific elements of this projection have been developed as follows:

- Net profits reflect steel shipments of 109 million tons for 1973, 100 million tons for 1974, and 10[illegible] million tons for 1975-1983, adjusted to apply to integrated producers. It is assumed that the effect of productivity increases and price increases will offset cost increases but no price increases to increase profitability will be made. (The subject of price increases is addressed in the following sections of this chapter.)
- Depreciation is assumed to be constant with capacity retirements balancing replacements.

- Dividends are assumed to be slightly less than 50 percent of earnings with the dollar amount of dividends paid approximating levels experienced in the 1960's.

- Net borrowing available has been computed at 40 percent of annual earnings retained (net profit less dividends) under the assumption that the industry's debt ceiling is equal to approximately 40 percent of shareholders' equity, a level at which the industry now stands.

It should be noted that the pattern of earnings indicated in Exhibit IX presumes a high degree of future stability in domestic steel markets. In the past, steel output and steel company profits have been subject to fairly wide fluctuations reflecting cyclical swings in steel demand and pressure from imports. At the present time, the energy shortage has raised questions about near term steel output in terms of both demand for steel products and the capability of producers to acquire the fuel needed to maintain output.

Assuming no fuel shortage and no capacity expansion, the impact of cyclical downturns on domestic steel production should be less severe in future years than in preceding years for the following reasons:

- The gap between domestic consumption and domestic capacity will increase, thus insulating domestic producers from the effects of a downturn in demand.

- Import pressure should lessen as current estimates indicate that for the near term, at least, worldwide demand may exceed supply. Given such an imbalance the influence of cyclical demand fluctuations on worldwide excess capacity should be mitigated. In addition, devaluation and inflation in major steel producing nations have made U. S. steel products more competitive with foreign produced products than in the past.

Vulnerability to cyclical demand swings could potentially be a serious problem if large scale capacity expansion programs were undertaken simultaneously both in the U. S. and in other producing nations. Such a worldwide surge of capacity, however, is not apparent at this time. In addition, the increased competativeness of U. S. output should provide a restraint to import penetration which has not existed in the past. Nevertheless, a significant economic showdown in the midst or at the completion of a large scale industry capacity expansion could seriously curtail industry profits and cash flow when capital needs would be greatest. This type of risk will undoubtedly be carefully weighed by responsible executives in establishing rates of return required to justify capacity expansion and in establishing tonnage goals for new capacity.

In the past, industry wage negotiations have contributed to loss of market share to imports as purchasers would stockpile steel at a rate far exceeding domestic output capabilities in anticipation of a steel strike. Both the steel industry and the United Steel Workers have recognized this problem and in an attempt to solve it have developed a no strike agreement for the coming 1974 negotiations which, it is hoped, will set the pattern for the future. Whether this arrangement will work remains to be seen. If it does work, however, this source of pressure on steel output and producer profits will be removed.

The primary source of uncertainty regarding future steel consumption and output in the near term is the energy shortage. Because the true extent of the shortage is not known at this time, the consequences cannot be projected with any degree of confidence. Nevertheless, it is possible to identify elements of the situation which will bear on the consequences. These are discussed below:

- The U. S. is significantly more self sufficient in fuels and energy than either Western Europe or Japan. Consequently, the Arab oil embargo, if applied equally to all nations, can be expected to have a greater impact in these areas than in the U. S. For the same reason, fuel price increases by the OPEC countries will have a greater and more immediate inflationary impact in Western Europe and Japan than in the U. S.

- The impact of fuel shortages on industrial production in Japan and Western Europe will be greater than in the U. S., Arab oil policies remaining equal because of their import dependence. Accordingly, it is possible that steel shortages will exist due to lack of imports in the near term even if U. S. output is maintained at or near capacity.

- Concerning the internal impacts of the energy shortage on output, constraints can be imposed by both demand and supply factors. Steel consumption in the automotive and appliance industries is likely to decrease; however, industry analysts have estimated that strength in the capital goods and construction materials markets will keep 1974 shipments at or above 100 million tons. In the final analysis, however, the impact of the energy shortage on industrial expansion and construction starts, if severe enough, could cause these markets to contract sharply. In addition to overall consumption, the availability of imports or lack thereof will remain an important swing factor. For example, if domestic consumption decreased by 17 million tons from 1973 levels and imports were simply not available due to foreign production cutbacks for lack of fuel, U. S. producers would be required to operate at full capacity to meet domestic demand. On the supply side, shortages of natural gas and fuel oil, if severe enough, could force steel production cutbacks due to lack of fuel to operate plants.

For the short term, the impact of the energy shortage, as indicated above, is unclear. Over the long term, the energy shortage, if it persists, will have a restraining influence on steel consumption, output, and capacity expansion.

2. FINANCING POLLUTION ABATEMENT INVESTMENT

Exhibit X, following this page, illustrates the impact of pollution abatement capital expenditures on the steel industry's funds availability, assuming constant profitability. In preparing this analysis, provision has been made for a small increase in working capital occasioned by pollution abatement annual operating and maintenance costs. As is apparent, only limited funds would be available for capacity expansion, at least through 1977. There would be no financing capacity available to replace facilities shut down as a result of pollution abatement or to expand capacity until close to the end of this decade.

The analysis presented in Exhibit X does not, of course, reflect the individual differences among producers in profitability and cash flow. If such factors were taken account of, the possibility exists that industry financing capacity in total would be insufficient with some firms unable to meet their capital needs.

At the constant level of profitability assumed, access to equity markets for capital would be out of the question. Returns of 8 percent on equity are clearly not sufficient to make a stock issue feasible.

3. FINANCING CAPACITY EXPANSION, ASSUMING NO POLLUTION ABATEMENT REQUIREMENTS

Exhibit XI, following this page, shows the impact of increased production on steel industry cash flow and funds availability, assuming current steel prices and a net profit on sales of 4.3 percent. Note that until 1979, required increases in working actually produce a negative funds flow.

The impact of financing requirements for capacity expansion on the industry's financing capability are indicated in Exhibit XII, following this page. It is clear that capacity expansion at the rate indicated, even without the requirement for pollution abatement expenditures would not be feasible at current levels of profitability. Indeed, current industry returns are not sufficient to justify an investment decision, even if the financial resources were available.

4. THE IMPACT OF A PRICE INCREASE ON THE STEEL INDUSTRY'S FINANCING CAPABILITY

As indicated above, the capability of the steel industry to finance pollution abatement investments at current levels of profitability is marginal at best, especially over the next 4-5 years. If investments to replace capacity shut down as a result of pollution abatement requirements or to expand capacity are considered in addition to basic pollution abatement expenditures, the industry's financing capabilities are clearly insufficient to meet its capital needs.

The question next arises as to the impact of a price increase on the industry's financing capability in terms of access to debt and equity capital markets.

(1) Access to Equity Markets

At the present time the stocks of major steel makers are selling at slightly more than 50 percent of their book value with earnings multiples of approximately 7 times. A stock issue when market values are less than book value is clearly out of the question for the following reasons:

- The equity position of current stockholders would be diluted
- Even with an increase in total earnings, the addition of a greater than proportional number of shareholders for a given amount of capital would likely result in dilution of earnings and dividends per share thus causing returns to individual stockholders to decrease. For example, to maintain earnings per share undiluted, the return on a stock selling at one half of book value would have to be double that of the issuers return on equity prior to the stock issue, assuming, of course, that the market would accept such an issue.

It is clear then, that to make a new stock issue feasible the market value of steel industry stocks must increase. This increase will take place only as a result of improved earnings.

During the 1960's, steel stocks sold at earnings multiples ranging from 10 to 14 for the most part. During this period, returns on stockholder equity peaked at close to 9 percent in 1965-1966 with earnings multiples for major producers at about 11-12 times. Because the industry is more highly levered now than in the past, a higher return on equity would likely be required to produce similar multiples in the future.

If industry returns on shareholders' equity were to increase to 10 percent, with good prospects for future market stability, it appears reasonable to assume an earnings multiple of about 12 times.

A ten percent return on equity would require an increase in earnings per share of about 25 percent over 1973 levels. Assuming such an earnings increase and a resulting earnings multiple of 12 times, the market value of steel stocks could increase to 130 percent of book value, a level which could make a public offering of stock feasible. To produce a ten percent plus return on equity, a price increase of roughly $10 per ton over current levels would be required. This price increase which is equal to about 4.3 percent of current prices would be in addition to price increases required to offset increased production costs.

(2) Steel Industry Financing Capability

Exhibit XIII, following this page, indicates the impact of a $10 per ton price increase (in addition to price increases to pass on increased cost) on steel industry investment funds availability. Exhibit XIV, following this page, shows the impact of the price increase on the ability of the industry to finance all capital outlays required including capacity expansion, pollution abatement and accelerated facilities replacement. Note that by 1976 a cumulative amount of $2.6 - $3.5 billion in outside funding will be required. The need for such funds to meet investment requirements would be immediate as deficits of up to $1 billion would occur in 1974. The ability of the steel industry to acquire the indicated amount of capital in equity markets, even after adjustments for increased borrowing power (30 percent of required funds) and considering incremental dividend payments to new shareholders to prevent dividend dilution (about $100 million annually), within the very short time period indicated is highly questionable even if a January 1, 1974 price increase of $10 per ton purely to increase profits were granted. Given the time required for an earnings record to be acquired to make the issue marketable and the preparations required to take the issues to the market place, as well as the need to carefully time the offering of stock, especially since several companies would be issuing stock, it is unlikely that the funds would be available prior to 1976. The uncertainties created by the current energy shortage would also have a negative impact on the marketability of a new issue. Of course, the feasibility of a $10 per ton price increase to increase profits is also highly questionable given the current climate regarding steel prices.

5. CONCLUSIONS

On the basis of the preceding analysis, the following conclusions can be drawn:

- Without price increases, the ability of the steel industry to finance either pollution control capital expenditures or significant capacity expansion is doubtful. Pollution abatement capital requirements will preclude capacity expansion.

- Even if a $10 per ton price increase were achieved, purely to increase profits, on January 1, 1974 the ability of the steel industry to meet all potential near term capital requirements is doubtful. In view of this situation, it is probable that capacity expansion would be deferred in favor of required pollution abatement expenditures.

* * *

EXHIBIT I

Environmental Protection Agency

ESTIMATED SUSTAINABLE ANNUAL
DOMESTIC STEEL SHIPMENT CAPACITY - 1973
(Millions of Short Tons)

	Tons	Percent
Raw Steel Capacity	155	100.0
Provision for Finishing Scrappage	(48)	(31.0)
Finished Steel Production Capacity	107	69.0
Provision for Demand Peaks and Product Mix Changes	(4)*	(2.6)*
Sustainable Annual Steel Shipment Capacity	103	66.4

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* Note: Traditional practice would require the use of a factor of 6% of raw steel capacity to provide for demand peaking and product mix changes. The lower figure of 2.6% of raw steel capacity has been used for this estimate to reflect the apparent smoothing of demand peaks during periods of very strong demand as has occurred during 1973.

EXHIBIT II

Environmental Protection Agency

PROJECTED NET STEEL SHIPMENTS 1973 - 1983
(Millions of Short Tons)

Year	Projected Finished Steel Consumption	Net Imports	Projected Domestic Steel Shipments
1973	122	(13)	109
1974	113	(13)	100
1975	116	(13)	103
1976	120	(14)	106
1977	122	(14)	108
1978	126	(14)	112
1979	128	(14)	114
1980	132	(14)	118
1981	134	(14)	120
1982	138	(14)	124
1983	142	(14)	128

Source: A. T. Kearney - Steel Consumption 1974 - 1983

Booz, Allen & Hamilton Inc. - Steel Consumption 1973
- Net Imports and Domestic Steel Shipments 1973-1983

Environmental Protection Agency

CAPITAL INVESTMENT REQUIRED
TO EXPAND CAPACITY 1973-1983
(Millions of 1973 $)

Capacity Increment (million tons)	Cost ($) Per Ton	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	$200		$100	$100								
2	275		133	137								
3	350		175	175								
4	425		142	141	$141							
5	500		167	167	166							
6	500		125	125	125	$125						
7	500		125	125	125	125						
8	500		125	125	125	125						
9	500		125	125	125	125						
10	500			125	125	125	$125					
11	500			125	125	125	125					
12	500				125	125	125	$125				
13	500				125	125	125	125				
14	500				125	125	125	125				
15	500				125	125	125	125				
16	500					125	125	125	$125			
17	500					125	125	125	125			
18	500						125	125	125	$125		
19	500						125	125	125	125		
20	500						125	125	125	125		
21	500						125	125	125	125		
22	500						125*	125*	125	125*		
23	500							125	125	125	$125	
24	500							125	125	125	125	
25	500							125	125	125	125	
26	500							125	125	125	125	
27 (1984)	500								125	125	125	$125
28 (1984)	500								125	125	125	125
29 (1985)	500									125	125	125
30 (1985)	500									125	125	125
31 (1986)	500										125	125
32 (1986)	500										125	125
33 (1987)	500											125
34 (1987)	500											125
Total Investment		$ -	$1,222	$1,471	$1,557	$1,500	$1,625	$1,875	$1,625	$1,625	$1,250	$1,000

Includes construction of 1 million ton reserve for peaking and product mix changes.

EXHIBIT III

EXHIBIT IV

Environmental Protection Agency

TOTAL CAPITAL EXPENDITURES
FOR NEW CAPACITY 1973-1983
(Millions of 1973 $)

Year	Capacity Expansion	Pollution Abatement	Total Capital Expenditures
1973	$ -	$ -	$ -
1974	1,222	122	1,344
1975	1,471	147	1,618
1976	1,557	156	1,713
1977	1,500	150	1,650
1978	1,625	163	1,788
1979	1,875	188	2,063
1980	1,625	163	1,788
1981	1,625	163	1,788
1982	1,250	125	1,375
1983	1,000	100	1,100
Total	$14,750	$1,477	$16,227*

* Of total expenditures, $2.75 billion represents expenditures for capacity to become operational over the period 1984-1987.

EXHIBIT V

Environmental Protection Agency

AIR AND WATER POLLUTION ABATEMENT
CAPITAL INVESTMENT REQUIREMENTS
FOR EXISTING CAPACITY 1973-1983
(Millions of 1973 $)

Year	Low			High		
	Water	Air	Total	Water	Air	Total
1973	$ 174	$ 450	$ 624	$ 330	$ 600	$ 930
1974	175	450	625	331	600	931
1975	174	450	624	330	600	930
1976	175	450	625	330	600	950
1977	173	-	173	330	-	330
1978	131	-	131	500	-	500
1979	120	-	120	496	-	496
1980	120	-	120	496	-	496
1981	120	-	120	496	-	496
1982	120	-	120	496	-	496
1983	118	-	118	330	-	330
	$1,600	$1,800	$3,400	$4,465	$2,400	$6,865

EXHIBIT VI

Environmental Protection Agency

CAPITAL INVESTMENT REQUIRED TO REPLACE CAPACITY SHUT DOWN AS A RESULT OF POLLUTION ABATEMENT COSTS
(Millions of 1973 $)

Year	Capacity Replaced (million tons)	Investment @ $450/ton
1974	1.87	$ 842
1975	1.87	842
1976	1.86	837
Total	5.6	$2,521

Source: Booz, Allen & Hamilton Inc.

TOTAL CAPITAL EXPENDITURES FOR INTEGRATED STEEL PRODUCERS 1973-1983 (Millions of 1973 $)

Year	Capacity * Modernization and Replacement	Pollution Abatement Low	Pollution Abatement High	Subtotal Low	Subtotal High	Accelerated Facilities Replacement	Capacity Expansion	Total Expenditures Low	Total Expenditures High
1973	$ 1,375	$ 562	$ 837	$ 1,937	$2,212	$ -	$ -	$ 1,937	2,212
1974	1,375	563	838	1,938	2,213	758	1,210	3,906	4,181
1975	1,375	562	837	1,937	2,212	758	1,456	4,151	4,426
1976	1,375	563	837	1,938	2,212	753	1,542	4,233	4,507
1977	1,375	156	297	1,531	1,672	-	1,485	3,016	3,157
1978	1,375	118	450	1,493	1,825	-	1,609	3,102	3,434
1979	1,375	108	448	1,483	1,823	-	1,857	3,340	3,680
1980	1,375	108	448	1,483	1,823	-	1,609	3,092	3,432
1981	1,375	108	448	1,483	1,823	-	1,609	3,092	3,432
1982	1,375	108	448	1,483	1,823	-	1,238	2,721	3,061
1983	1,375	106	297	1,481	1,672	-	990	2,471	2,662
	$15,125	$3,062	$6,185	$18,187	$21,310	$2,269	$14,605	$35,061	$38,184

* Expenditures for capacity modernization and replacement were derived from statistical data covering integrated producers. Accordingly, the 10 percent adjustment has not been applied.

EXHIBIT VII

Environmental Protection Agency

TOTAL NET CASH OUTLAYS FOR INTEGRATED STEEL PRODUCERS 1973-1983 (Millions of 1973 $)

Year	Capacity Modernization and Replacement	Pollution Abatement		Subtotal		Accelerated Facilities Replacement	Capacity Expansion	Total Net Outlays	
		Low	High	Low	High			Low	High
1973	$ 1,279	$ 504	$ 750	$ 1,783	$ 2,029	$ -	$ -	$ 1,783	$ 2,029
1974	1,279	464	695	1,743	1,974	692	1,103	3,538	3,769
1975	1,279	429	638	1,708	1,917	668	1,284	3,660	3,869
1976	1,279	393	582	1,672	1,861	638	1,308	3,618	3,807
1977	1,279	(10)	42	1,269	1,321	(75)	1,201	2,395	2,447
1978	1,279	(54)	159	1,225	1,438	(75)	1,261	2,411	2,624
1979	1,279	(72)	128	1,207	1,407	(75)	1,427	2,559	2,759
1980	1,279	(78)	93	1,201	1,377	(75)	1,135	2,261	2,437
1981	1,279	(86)	68	1,193	1,317	(75)	1,076	2,194	2,348
1982	1,279	(92)	38	1,187	1,317	(75)	678	1,790	1,920
1983	1,279	(100)	(128)	1,179	1,151	(75)	407	1,511	1,483
	$14,069	$1,298	$3,070	$15,367	$18,139	$1,473	$10,880	$27,720	$29,492

Source: Booz, Allen & Hamilton Inc.

EXHIBIT VIII

Environmental Protection Agency

STEEL INDUSTRY FUNDS AVAILABLE
FOR INVESTMENT ASSUMING CONSTANT
PRICES AND NO CAPACITY INCREASE
1973-1983
(Millions of 1973 $)

Year	Net Profit	Depreciation	Total Cash Flow	Dividends	Net Cash Flow	Net Borrowing Available	Total Funds Available for Investment
1973	$1,200	$1,200	$2,400	$(450)	$1,950	$300	$2,250
1974	950	1,200	2,150	(450)	1,700	200	1,900
1975	1,000	1,200	2,200	(450)	1,750	220	1,970
1976	1,000	1,200	2,200	(450)	1,750	220	1,970
1977	1,000	1,200	2,200	(450)	1,750	220	1,970
1978	1,000	1,200	2,200	(450)	1,750	220	1,970
1979	1,000	1,200	2,200	(450)	1,750	220	1,770
1980	1,000	1,200	2,200	(450)	1,750	220	1,770
1981	1,000	1,200	2,200	(450)	1,750	220	1,970
1982	1,000	1,200	2,200	(450)	1,750	220	1,970
1983	1,000	1,200	2,200	(450)	1,750	220	1,970

EXHIBIT IX

Environmental Protection Agency

FINANCING POLLUTION ABATEMENT INVESTMENT
ASSUMING NO CAPACITY EXPANSION AND NO
ACCELERATED FACILITIES REPLACEMENT
1973-1983
(Millions of 1973 $)

Year	Funds Available for Investment	Net Outlay for Capacity Replacement Pollution Abatement		Working Capital Increase		Cumulative Funds Surplus (Deficit)	
		Low	High	Low	High	Low	High
1973	$2,250	$1,783	$2,029	$32	$48	$ 435	$ 173
1974	1,900	1,743	1,974	32	48	560	51
1975	1,970	1,708	1,917	32	48	790	56
1976	1,970	1,672	1,861	32	48	1,056	117
1977	1,970	1,269	1,321	9	17	1,748	749
1979	1,970	1,207	1,407	6	26	3,243	1,792
1980	1,970	1,201	1,377	6	26	4,006	2,359
1981	1,970	1,193	1,347	6	26	4,777	2.956
1982	1,970	1,187	1,317	6	26	5,554	3,583
1983	1,970	1,179	1,151	6	17	6,339	4,385

EXHIBIT X

Environmental Protection Agency

NET FUNDS AVAILABLE FOR INVESTMENT FROM INCREASED OUTPUT 1973-1983
(Millions of 1973 $)

Year	Incremental* Tonnage	Incremental Revenue @ $228/ton Yearly	Total Annual	Incremental Net Profit @ 4.3% of Revenue	Incremental Borrowing Available	Total Incremental Funds Available	Increase in Working Capital	Net Funds Annually Available	Cumulative Net Funds Available
1973	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1974	-	-	-	-	-	-	-	-	-
1975	-	-	-	-	-	-	-	-	-
1976	2.7	616	616	26	10	36	(106)	(70)	(70)
1977	1.8	410	1,026	44	18	62	(71)	(11)	(81)
1978	3.6	821	1,847	79	32	111	(142)	(31)	(112)
1979	1.8	410	2,257	97	39	136	(71)	65	(47)
1980	3.6	821	3,078	132	53	185	(142)	43	(4)
1981	1.8	410	3,488	150	60	210	(71)	139	135
1982	3.6	821	4,309	185	74	259	(142)	117	252
1983	3.6	821	5,130	221	88	309	(142)	167	419

* Adjusted to 90 percent of industry totals to cover integrated producers

EXHIBIT XI

Environmental Protection Agency

FINANCING CAPACITY EXPANSION
WITH NO REQUIREMENT FOR
POLLUTION CONTROL 1973-1983
(Millions of 1973 $)

Year	Total Funds Available for Investment	Net Funds Available Through Increased Production	Net Capital Outlay Required For Facilities Replacement and Capacity Expansion[1]	Cumulative Funds Surplus (Deficit)
1973	$2,250	$ -	$1,279	$ 971
1974	1,900	-	2,284	587
1975	1,970	-	2,451	106
1976	1,970	(70)	2,478	(684)
1977	1,970	(11)	2,383	(1,108)
1978	1,970	(31)	2,443	(1,612)
1979	1,970	65	2,599	(2,176)
1980	1,970	43	2,338	(2,501)
1981	1,970	139	2,289	(2,681)
1982	1,970	117	1,931	(2,525)
1983	1,970	167	1,688	(2,076)

[1] Excludes investment for pollution abatement on new capacity

EXHIBIT X

Environmental Protection Agency

ADDITIONAL FUNDS AVAILABLE FOR INVESTMENT ASSUMING A STEEL PRICE INCREASE OF $10 PER TON 1973-1983
(Millions of 1973 $)

Year	Net Steel Shipments* (million tons)	Incremental Revenue	Incremental Net Profit	Additional Borrowing Available	Total Additional Funds Available
1973	95.4	$ -	$ -	$ -	$ -
1974	90.0	900	450	180	630
1975	92.7	927	464	186	650
1976	95.4	954	477	191	668
1977	97.2	972	486	194	680
1978	100.8	1,008	504	202	706
1979	102.6	1,026	513	205	718
1980	106.2	1,062	531	212	743
1981	108.0	1,080	540	216	756
1982	111.6	1,116	558	223	781
1983	115.2	1,152	576	230	806

* Adjusted to apply to integrated producers

EXHIBIT XIII

Environmental Protection Agency

FINANCING TOTAL POTENTIAL STEEL INDUSTRY CAPITAL OUTLAYS ASSUMING A PRICE INCREASE 1973-1983
(Millions of 1973 $)

Year	Funds Available for Investment	Incremental Funds Available Through Production Increase	Incremental Funds Available Through Price Increase	Total Funds Available	Total Net Outlays Required		Annual Funds Surplus (Deficit)		Cumulative Funds Surplus (Deficit)	
					Low	High	Low	High	Low	High
1973	$2,250	$ -	$ -	$2,250	$1,783	$2,029	$ 467	$ 221	$ 467	$ 221
1974	1,900	-	630	2,530	3,538	3,769	(1,008)	(1,230)	(541)	(1,018)
1975	1,970	-	650	2,620	3,660	3,869	(1,040)	(1,249)	(1,581)	(2,267)
1976	1,970	(70)	668	2,568	3,618	3,807	(1,050)	(1,239)	(2,631)	(3,506)
1977	1,970	(11)	680	2,639	2,395	2,447	244	192	(2,387)	(3,314)
1978	1,970	(31)	706	2,645	2,411	2,624	234	21	(2,153)	(3,293)
1979	1,970	65	718	2,753	2,559	2,759	194	6	(1,959)	(3,287)
1980	1,970	43	743	2,756	2,261	2,437	495	319	(1,464)	(2,968)
1981	1,970	139	756	2,865	2,194	2,348	671	517	(793)	(2,451)
1982	1,970	117	781	2,868	1,790	1,920	1,078	948	285	(1,503)
1983	1,970	167	806	2,943	1,511	1,483	1,432	1,460	1,717	(43)

EXHIBIT X

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPA-230/1-73-027	2.	3. Recipient's Accession No.
4. Title and Subtitle Economic Analysis of the Proposed Effluent Guidelines for the Iron and Steel Industry			5. Report Date February, 1974
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address A. T. Kearney, Inc. 100 South Wacker Drive Chicago, Illinois 60606			10. Project/Task/Work Unit No.
			11. Contract/Grant No. 68-01-1545
12. Sponsoring Organization Name and Address Office of Planning and Evaluation Environmental Protection Agency Washington, D.C. 20460			13. Type of Report & Period Covered Final Report
			14.

15. Supplementary Notes

16. Abstracts

The report summarizes the economic impact of water pollution abatement on the Iron and Steel Industry. Discussed are the industry structure, financial profile, sources of water pollution, projected costs and price increases, and the effects on production plant closings on local communities.

17. Key Words and Document Analysis. 17a. Descriptors

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17b. Identifiers/Open-Ended Terms

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