GUIDANCE MANUAL

for

Estimating the Economic Effects of Pollution Control Costs

by

Office of Analysis and Evaluation
U.S. Environmental Protection Agency
Washington, D.C. 20460

November 1983

Page 127 (Exhibit 5-6) is missing from this document.

The paper copy this was reproduced from was missing the page.

PREFACE

These two documents -- the Guidance Manual and Workbook for Estimating the Economic Effects of Pollution Control Costs -- were prepared by EPA for writers of NPDES permits in state agencies and EPA Regional Offices. The Workbook contains step-by-step instructions and worksheets for performing analyses of a firm's or plant's ability to pay for pollution control. The Guidance Manual contains background information, more detailed instructions, and examples for each test; it is designed for use by those who find the Workbook too brief.

The Guidance Manual and Workbook for Estimating the Economic Effects of Pollution Control Costs were prepared for EPA by Pope-Reid Associates, Inc. They were based on the Work Book for Determining Economic Achievability for National Pollutant Discharge Elimination System Permits (Putnam, Hayes & Bartlett, Inc., August 1982).

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF EXHIBITS

LIST OF EXHIBITS (continued)

LIST OF EXHIBITS (continued)

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The Clean Water Act requires the U.S. Environmental Protection Agency (EPA) to regulate wastewater discharges. This is done through the National Pollutant Discharge Elimination System (NPDES), which is administered by either the EPA Regional Offices or individual states. To date, 33 states have approved NPDES programs for wastewater discharges.

EPA has promulgated effluent guidelines for many industries. These guidelines include a requirement that permits must be based on the "Best Available Technology Economically Achievable" (BAT) by 1984. Thus, as permits come up for renewal they must be based on economic considerations as well as engineering analyses.

BAT effluent guidelines will be promulgated by 1984 for several major industries. However, the process by which permits are reviewed and renewed will begin before then. Thus, some industries may not have promulgated effluent guidelines for some or all of their process wastewaters by the time permits are to be renewed.

For certain facilities, permit writers will be required to develop permits on a plant-by-plant basis using best professional judgement. The industries for which plant-by-plant permits will need to be written include those:

- for which no BAT effluent guidelines have been promulgated; or
- which generate and discharge process wastewaters not covered by effluent guidelines.

These permits must also be based on both engineering and economic considerations.

1.2 PROBLEM

The engineering analysis portion of preparing a permit is usually based on existing technologies and guidelines. Therefore, while it may not be easy to perform, it is usually fairly straightforward and is often related to the permit writer's primary area of expertise and experience. On the other hand, the economic evaluation could be performed in several ways or levels of complexity. If a permit writer does not have a background in financial analysis, evaluating the ability to pay for pollution control expenditures will be difficult.

The concept of "economic achievability" has many dimensions and is not consistently defined or evaluated. As used in the development of effluent guidelines, it includes an assessment of different effects such as: price and production effects; current and future supply and demand; competition by other industries; effects on sales; and product substitution. This manual does not address these aspects of economic achievability because it is not intended for use in developing permits for only one industry. Rather, this procedure is designed to assist the permit writer in determining the economic effects of pollution control expenditures in terms of "ability to pay" at the firm or plant level.

1.3 PURPOSE

This manual is designed to give someone with no formal background in financial analysis a structured, step-by-step approach to estimating the ability of a firm or plant to pay for pollution control technology. The methodology involves two types of analyses. The firm-level analysis uses publicly available data to evaluate the present financial conditon of the firm and to predict the financial effects of pollution control investments that may be required to comply with permit requirements. The plant-level analysis uses data provided by the firm to evaluate the profitability of the plant and to predict the effects of pollution control investments.

Firm-level analysis is performed for all permit evaluations. Plant-level analysis is performed only if required. Two conditions would indicate a need for plant-level analysis:

1. the firm contends that pollution control investment would make the plant unprofitable to operate; or
2. the firm-level analysis indicates that pollution control investment would have a serious detrimental effect on the firm's financial health.

1.4 OVERVIEW

To accomplish this purpose as effectively as possible, EPA has divided the manual into two documents (the Guidance Manual for Estimating the Economic Effects of Pollution Control Costs and the Workbook for Estimating the Effects of Pollution Control Costs). The Guidance Manual describes the firm-level and plant-level tests in detail, the data needed to perform the tests, and sources for these data. It also contains example data and calculations for each test. The Workbook contains blank worksheets and step-by-step instructions for completing them.

Chapter 2 of this text provides an introduction to the financial analysis method used to assess a firm or plant's ability to pay for pollution control. The types of data needed to conduct the analysis and sources for these data are presented. Chapter 2 also contains a general discussion of engineering cost estimation and the types and sources of data needed.

Chapter 3 presents the procedure for the firm-level analysis. The firm-level methodology has two components. The financial statement component analyzes a firm's reported values by calculating ratios from data in annual reports. This is essentially a historic perspective on the company's operating performance and asset values. The second component of the firm-level methodology, the market value approach, uses stock market data as a proxy for the future performance of the firm to evaluate a firm's ability to pay for pollution control.

Chapter 4 describes the plant-level methodology. The plant-level test uses confidential, plant-specific financial data provided by the company to evaluate how the costs of pollution control equipment would impact the plant's earnings. The plant-level methodology has three tests from which the permit writer must choose. The choice is based on which plant-level data are available.

Chapter 5 provides direction for interpreting the combined results of the firm-level analysis. The methodology does not provide a "cookbook" format for interpreting all possible combinations of test results. However, Chapter 5 describes several common sets of conflicting results and provides general guidelines for interpreting them. It also provides guidance on how to incorporate the results of the plant-level analysis with those of the firm-level analysis.

The Workbook contains blank worksheets for all calculations and tests; summaries of the data needed and sources for these data; and step-by-step instructions for performing the calculations and tests. If the permit writer has no need for the detailed information contained in the the Guidance Manual, or she can use the Workbook to do the firm-level and plant-level analyses.

CHAPTER 2

THEORY AND DATA

2.1 INTRODUCTION

Financial analysis assesses the position of a firm or plant at any point in time up to the present and to predict and interpret future financial changes resulting from decisions by the firm or plant. Financial analysis measures the ability of a firm or a plant within a firm to pay for pollution control. The measures of financial position are calculated to determine the current performance of the company and estimate the impacts of pollution control requirements on these various measures.

In order to perform a financial analysis, two types of data are needed. One obviously is financial data on the firm and plant which are being evaluated. The other is engineering cost data for the pollution control technology that is being considered.

This chapter contains a brief discussion of the theory behind financial and cost engineering analyses. It also describes the two types of data as they are used in this document and sources of these data.

2.2 ENGINEERING ANALYSIS AND COST DATA

The permit writer may either need to do an engineering cost estimate for the pollution control technology or review an estimate that has been provided by a firm or plant. This section contains a brief discussion of engineering cost estimates and data, because the choice of cost estimates will affect the outcome of the financial analysis.

There are two different costs associated with pollution control treatment. The costs of purchasing and installing the equipment and building the facilities to house the equipment are called capital costs or capital investment. These are one-time costs which are incurred at the beginning of the life cycle of the use a piece of equipment or a process. The costs incurred on a continuing basis to operate and maintain the equipment or process are called operating and maintenance (O&M) costs and are calculated on an annual basis. There are other recurring charges specifically to recover the capital investment in a process or facility which are added to O&M costs to obtain total annual costs.

2.2.1 Capital Costs

Capital costs are all of the costs to purchase and install the equipment and to provide necessary auxiliaries and appurtenances for the operation and use of equipment or process facilities. Capital costs include buildings, piping, foundations, instrumentation, spare parts, utilities such as water, electricity, and natural gas, and all costs for engineering, permitting, and construction. Five types of capital cost estimates are summarized in Exhibit 2-1.

The most accurate type of capital cost estimate is based on bids received from suppliers and contractors who propose to provide the equipment and/or build the facility at the bid price. This type of cost information is available only if specifications and working drawings have been prepared for the project. This cost estimate would have a reliability of $\pm$ 5% percent. Most projects at the permit applications stage will not be developed to this extent.

A slightly less accurate type of capital cost estimate is based on detailed engineering design but without the preparation of specifications and working drawings. The reliability of this cost estimate would be $\pm$ 10 percent. The permit applicant is also unlikely to have a cost estimate of this type.

Exhibit 2-1

FIVE TYPES OF CAPITAL COST ESTIMATES

Type of Estimate	Characteristics	Purpose	Usual Reliability
1. Order-of-Magnitude Ratio	Rapid. Very rough.	Preliminary indication. Result should be checked by more detailed method.	About + 30% -60%
2. Study (commonly called a factored estimate)	Requires flow diagram, material and energy balance, type and size of equipment.	For generalized evaluations. Guidance for further investigation. Basis for process selection. R&D guidance.	± 30%
3. Preliminary Budget Authorization	In addition to above, includes surveys and some engineering of foundations, transportation facilities, buildings, structures, lighting, etc.	Basis for decision to undertake detailed engineering. Sometimes basis for budget authorization. Can be for generalized evaluation, but usually for site-specific installation.	± 20%
4. Definitive Project Control	More detailed engineering, but usually short of complete specifications and working drawings. Requires experienced estimating organization and substantial outlay.	Sometimes the basis for budget authorization. Provides improved estimate of project to be built. For site-specific installations.	± 10%
5. Detailed Firm Contractor's	Complete site surveys, specifications, working drawings.	Made to control cost of project being built for site-specific installations.	± 5%

Source: U.S. Environmental Protection Agency, A Standard Procedure for Cost Analysis of Pollution Control Operations, Volume I. EPA-600/8-79-018a, June 1979.

The next most accurate type of capital cost estimate is based on estimates obtained from suppliers of the equipment and auxiliaries. Installation costs and other design and construction costs may be estimated by identifying materials and labor hour requirements and multiplying each by an appropriate unit cost. Some of these items may be estimated as a percentage or multiplier of a known cost, as a percentage of the total equipment and installation cost, for example. There are generally accepted multipliers which vary with the type of equipment, materials handled, and scale of facility. The multipliers used should be documented by the applicant and should be consistent and appropriate. Estimates prepared in this manner, sometimes called "conceptual estimates," would have a typical reliability of ± 20 percent.

A fourth type of capital cost estimate (another conceptual estimate) is very similar to the third, but uses generalized published cost data for the equipment costs instead of supplier price estimates. The installation and other design and construction costs are usually estimated using multipliers or percentages as described above. This is a less accurate method, with a reliability of ± 30 percent, but it is frequently used to obtain estimates early in capital spending and similar resource allocation decision processes.

Where a capital cost is required in the financial analysis, this cost should be based on one of the latter two types of estimates described above (the conceptual estimates). This will ensure that the cost estimate is sufficiently accurate without being costly or time-consuming to prepare. Costs used in EPA Development Documents are these types of conceptual estimates.

The least accurate type of capital cost estimate is an order-of-magnitude ratio. It is done by estimating average fixed price per unit of plant capacity; scaling a known cost for a facility of a different size; or calculating a price based on a plant's turnover ratio (annual revenue divided by total investment). The reliability of this type of estimate ranges from +30 percent to -60 percent. The permit writer should not use a capital cost of this type because it would not be accurate enough to make the results of the financial tests meaningful.

An excellent guide for preparing cost estimates, including sources of equipment costs, is the EPA publication A Standard Procedure for Cost Analysis of

Pollution Control Operations, Volumes I and II (EPA-600/8-79-018a and -018b). Other literature sources for cost estimating methods and cost data are listed in Exhibit 2-2. Information on the multipliers and percentages to be used for various equipment items and process applications can be obtained from many of these same literature sources.

2.2.2 Operating and Maintenance Costs

Operating and maintenance (O&M) costs are most likely to be estimated as specific requirements for each equipment item or processing unit. O&M costs include labor, supervision, utilities, chemicals and supplies, maintenance, labor and supplies, waste management and disposal, insurance, taxes, and other recurring items. In preparing the O&M costs, all significant cost items must be considered and the unit costs of each must be reasonable estimates. Unit requirements may be estimated from literature data on the specific equipment or process or by using engineering judgment. Unit costs for labor, chemicals, and materials may be obtained from various published sources. Other costs such as insurance and property taxes are usually estimated as percentages of the capital or operating costs. The data sources listed in Exhibit 2-2 can also be used for preparing O&M cost estimates.

A working knowledge of both the technology and typical costs is very helpful in preparing or assessing capital and O&M cost estimates. A number of options are available to the permit writer who lacks this knowledge of familiarity. A comparison can be made with costs for similar technologies and capacities. The reasonableness of capital or O&M costs estimates can also be assessed by calculating the relative contribution of each cost component to the capital or O&M total. Some of the publications listed in Exhibit 2-2 contain information on what the relative porportions the various components of a total cost should be.

2.2.3 Total Annual Costs

The total annual costs of a pollution control system include the O&M costs and charges to recover the capital investment--the latter are called capital recovery costs. The capital recovery costs are the charges a corporation will assess on any investment of capital, both to recover the original investment and to cover the costs incurred by the firm to raise the capital through all means

Exhibit 2-2

SOURCES OF COST ESTIMATING METHODOLOGIES AND DATA

SOURCES	TYPES OF COST DATA	
	Capital	O&M
Development Documents for Water Pollution Control Regulations--EPA	X	X
Permit Writers Guidance Manual/Technical Resource Documents--EPA's Office of Research and Development	X	
Richardson's Process Plant Construction Estimating Standards	X	
R. S. Means Building Construction Cost Data	X	
R. S. Means Site Work Cost Data	X	
Chemical Engineering Costs by Charles Dryden and Richard Furlow	X	X
Cost Engineering Analysis by William R. Park	X	X
Process Plant Estimating Evaluation and Control by Kenneth M. Guthrie	X	X
Plant Design and Economics for Chemical Engineers by Max Peters and Klaus Timmerhaus	X	X
Chemical Engineers Handbook by Robert Perry and Cecil Chilton	X	X
Treatment Alternatives for Hazardous Waste Management in Nine Industry Groups--Lilia A. Abron-Robinson (Peer Consultants, Inc.) and Edward J. Martin (Environmental Quality Systems, Inc.) for EPA Office of Solid Waste	X	X
A Standard Procedure for Cost Analysis of Pollution Control Operations--EPA-600/8-79-018a and -018b	X	X
Cost Comparisons of Treatment and Disposal Alternatives for Hazardous Wastes--Warren G. Hansen and Howard L. Rishel (SCS Engineers) for EPA-MERL	X	X
Estimating Water Treatment Costs--EPA-600/2-79-162a through -162d	X	X
Trade Publications and Technical Journals	X	X
Manufacturers' Literature	X	X

employed. These costs are usually not current "out-of-pocket" expenditures, but are charges assessed against the installation to recover the capital involved in the initial expenditure to purchase and build a facility.

The capital used to purchase and build a system can either come from within the firm through its own financial resources such as retained earnings or stock sales or it can be borrowed by the firm from various outside sources. In either case, the firm must recover the capital investment plus the interest paid on that investment, in order to pay back the loan or to return the money to the firm for future use on other projects. In the latter case, the investment by the firm can be viewed essentially as a loan by the firm to itself for the specific project.

2.2.3.1 Cost of Capital

The assumption used in estimating capital recovery costs is that a firm uses a mixture of debt funds (loans or bonds) and internally generated funds--called equity funds--to finance capital investments in plant and equipment. On the basis of this assumption--or as given for a specific firm--regarding the mix of debt and equity funds used to finance the investment, the appropriate cost of those funds can be determined and assigned to a project. This cost is called the cost of capital and it is expressed in the form of an interest rate, i.e. a percentage of the funds or capital invested.

The cost of capital is determined for any specific firm as the weighted average of the cost of debt funds and return on equity funds for that firm. Debt funds come from long-term loans and bonds. The interest rate for each loan and bond issue is combined in a weighted average to obtain an overall interest rate that would be the cost of debt for the firm. The cost of debt itself or data needed to calculate this is available in annual reports or directly from the firm. The return on equity is calculated as the annual dividend divided by the stock price plus an expected or projected growth rate of dividends. The overall cost of capital is then calculated for the firm assuming that the funds are used for all projects without regard to the specific source--debt or equity--and hence without discriminating as to the cost of the funds, except as an overall average.

In the absence of data on the actual cost of debt and/or the return on equity for a firm, the former can be estimated as some increment above the prime interest rate charged by banks. The percentage above the interest rate depends on the size and financial condition of the firm. Smaller and less sound firms firms will incur higher increments--perhaps up to three to six points above the prime rate. Average return on equity for the industry may be the best estimate of return on equity for the firm when data are lacking. Otherwise, an estimated interest rate based on the prime bank lending rate may be the only cost of capital estimate available.

2.2.3.2 Capital Recovery Cost

With the cost of capital or interest rate established, the capital recovery costs can be estimated. A length of time is selected for which the capital recovery charges are to be applied to the annual cost of a project to achieve the recovery of the invested capital with interest. The time period is usually less than the expected operating life of the facility or system. A frequent choice is ten years unless the operating life of the system is less than that. The interest rate to be used is the cost of capital. The calculation of the capital recovery cost factor and total annual cost is described in Chapter 4. It is performed using Worksheet 9.

Interest tables are used to obtain the capital recovery cost factor. The interest tables are included in most books of standard math tables, in many cost engineering and corporate finance texts, and in some EPA publication. The capital recovery cost factor is used as a multiplier, which is applied to the capital investment to obtain the annual cost of capital recovery. This cost, plus the O&M costs, constitute the total annual costs. The capital recovery cost can be a very substantial percentage of the total annual costs.

The capital recovery cost factor is function of the interest rate and the length of time for capital recovery. Both have significant effect on the value of the capital recovery cost factor. If information on the interest rate and/or the length of time are uncertain or essentially unavailable to the permit writer, these items could be varied in a sensitivity analysis to assess the impact on the total annual costs. The importance of the capital recovery factor could thereby be assessed and considered in the decision process.

2.3 FINANCIAL ANALYSIS AND DATA

The financial analysis presented in this manual is designed to address the ability of a firm or plant to pay for pollution control. Two levels of financial analysis are included--firm-level and plant-level. The purpose of this section is to briefly describe these types of financial analyses, the data needed to perform them, and the sources of these data.

2.3.1 Firm-Level Analysis

The firm-level analysis consists of tests that are designed to measure the financial health of a firm using publicly available data. The analysis has two components--financial statement analysis and market value analysis. The financial statement component analyzes a firm's reported financial condition by calculating ratios from available data. This provides a historical perspective on the firm's operating performance and asset values. The market value analysis uses stock market data as a proxy for the future performance of a firm to evaluate the firm's ability to pay for pollution control.

2.3.1.1 Financial Statement Analysis

Financial statement analysis focuses on three primary measures of financial position and capability of a firm:

- liquidity;
- solvency; and
- leverage.

All three measures indicate the ability of a firm to meet its financial obligations, i.e. to pay its bills and long-term debts, and the relative level of its long-term indebtedness. The purpose of measuring the liquidity, solvency, and leverage of a firm is to assess its ability to pay for pollution control investments.

Liquidity is a measure of ability to meet short-term obligations, i.e. current bills and debts that are to be paid in less than one year. Two ratios are used to measure the liquidity of a firm--the Current Ratio and the Quick Ratio. These ratios and their use are described in more detail in Chapter 3.

Solvency is the ability of a firm to meet its fixed and long-term obligations from current revenues. Two ratios are used to measure solvency. They are the Fixed-Charge Coverage Ratio and Beaver's Ratio. Both of these measures are discussed in detail in Chapter 3.

Leverage is a measure of the extent of the use of bonds and/or long-term loans by a firm as a source of money or capital. There are two basic sources of capital for a firm--debt, which is incurred via long-term loans or bonds, and equity, which is generated through the sale of corporate stock and by retaining earnings within the firm. The Debt/Equity Ratio is a measure of the degree of leverage of a firm.

Each of these ratios is evaluated against at least two of the following three criteria:

- A rule-of-thumb target that is commonly used by analysts to determine what constitutes acceptable performance in general. These targets can be considered the empirical "laws" of financial management.
- A cross-sectional analysis in which a firm's ratios are compared to the range of ratios for many of the firms in the same industry. This provides an estimate of how the firm compares with average or exceptional competitors.
- Comparisons of the movement of a firm's own ratios over time, to indicate how performance is changing over time.

These indicators are calculated for the most current year and for preceding years to obtain trends and current values. The economic effects of pollution control requirements are then assessed directly as changes in the value of these ratios and interpreted in terms of the quantitative changes in the ratios.

Financial statements provide the data needed to calculate the measures described above. These statements are prepared by all firms to report their financial status and operating results to all parties with an interest and a right to that information. The statements are prepared and distributed periodically; however, only the annual statements are of interest as data sources for this manual. There are two different statements used to communicate the financial information. The first--the balance sheet--provides a summary of the firm's financial condition at a specific point in time, typically the end of the firm's

fiscal year. Although the financial data presented can and will change from day to day, the balance sheet presents the information as if all activities of the firm were at a momentary standstill. This is standard accounting practice, and all such statements will reflect a similar approach.

The balance sheet is divided into two sections. On the left or upper section are shown the assets, and on the right or lower section are shown liabilities and stockholders' equity. Assets include all goods and property owned by the firm as well as money owed to the firm by others which has not yet been collected. Liabilities include all debts and payments which are owed by the firm. The stockholders' equity is the amount of money that would theoretically be divided among the stockholders if the firm were sold at its balance sheet value. It includes the investment of stockholders in purchasing shares in the firm and earnings from current and past years retained within the firm.

The income statement is the second of the financial statements. It shows how much money a firm has earned or lost during the fiscal year. The income statement is also called the "earnings report" or "statement of profit and loss." The income statement contains information on the revenue received from selling the firm's products or services and from other sources of income, and the costs and outlays incurred in order to operate the company. The costs incurred usually consist of cost of goods sold (raw materials, wages and salaries, rent and supplies), depreciation, interest paid on borrowed money, and taxes. Expenses are subtracted from income to obtain the net profit or net loss for the year.

Financial data on a firm are available from a variety of sources. Publicly held firms commonly report the current and preceding years' financial results in their annual reports to stockholders. Publicly held firms are those whose corporate shares are traded on stock markets and are owned by the general public. Publicly-held firms are also required to file a 10K form with the U.S. Securities and Exchange Commission. The 10K form is very similar to an annual report to the stockholders. All 10K forms and some annual reports to stockholders are available in public business libraries or university libraries. Stock brokerage firms may also have copies of annual reports.

In addition to these sources, the firm may be listed in Moody's Industrial Manual. This source provides balance sheet and income statement data for firms that trade stocks on the New York and American Stock Exchanges. Moody's provides most of the information required to perform the firm-level tests in a concise and readily available format.

Financial ratios for various industries are available from a variety of sources as well. The ratios required for the firm-level analysis are available from Robert Morris Associates' Annual Statement Studies. This source lists financial ratios for a large number of SIC codes. The information is compiled from data submitted voluntarily by Robert Morris Associates member banks and is for firms with total assets less tha $100 million.

2.3.1.2 Market Value Analysis

The financial statement analysis provides a review of recent historic performance and a point-in-time picture of a firm's financial status. What is not discernible from this vantage is how pollution control costs would affect expectations of the future performance of the firm. To predict the future effects one needs a prospective look based on expected financial performance of the firm with and without pollution control expenses.

One way of doing this would be to project pro forma (predicted) financial statements into future years by extrapolating past behavior and performance trends. Certain items such as inventory value, accounts receivable, and accounts payable could be estimated from past performance of the management of the firm in terms of ratios to total sales or average length of collection or payment time, for example. Other items like sales and operating costs could be extended along recent trend lines. These would allow a permit writer to estimate what future balance sheets and income statements might look like. Unfortunately, this would require a detailed understanding of the firm's industry and market, including how sales and costs vary with inflation, who the competitors are, what new technologies are influencing the supply and demand for the product, and how production assets are tied to sales volume and costs. Collecting this information would be a formidable task beyond the scope of the permit writer's interests or capabilities. Instead a proxy for this forward-looking approach is

used--analysis of stock prices. This is the purpose of the second component of the firm-level analysis--the market value analysis.

Stock prices reflect the opinions of many analysts and participants in the stock market who set the price of a stock by their buying and selling behavior. In theory, the price of a corporate stock is a measure of the net present value (NPV) of the future cash flows (profitability) of the firm. The value of money over time is considered in net present value by reducing--or discounting--the estimated future cash flow to a lesser amount based on the length of time involved and an assumed or effective interest rate. Thus stock prices are indicators of investors' expectations of the future profitability of a firm. They constitute a single-number substitute for a series of projected future financial statements. Because there are many security analysts who conduct detailed financial evaluations of firms for investors who value such information very highly, and many investors who act on that information, it can be assumed that the market price of a firm's stock is a good substitute for the more rigorous and time-consuming analysis.

Any cost associated with pollution control will have only negative value as an investment for a firm, because the costs will not produce any revenue and will only result in reductions in net income. However, some waste treatment technologies, e.g., recycling, flow reduction, or solvent recovery, can partially offset the gross cost of compliance. This reduction in income would reduce the stock value. Assuming the stock price represents the per-share amount of profits available now and in the future, it thus provides an indication of the upper limit on the after-tax cost of pollution control that could be incurred by a firm before deficit operation.

The impact of the present value of the pollution control costs on stock values is roughly half the cost of the capital and operating cost of the pollution control technology because the costs are tax-deductible and the stock price is an indicator of the present value of after-tax profits. The market value analysis used the ratio of stock market value to "book value" (stockholders' equity or net worth) of the firm, with and without the stock price reduced by the cost of pollution control. Book value is typically reported in financial statements as stockholder's equity or net worth.

Stock market data include two types of information. Stock prices are recorded daily in the Wall Street Journal and many other newspapers. Stock listings typically indicate current prices as well as high and low prices for the current year. Other information concerning stock performance is available from Value Line Investment Survey. This is an independent advisory service for professional analysts, corporate financial managers, and private investors. Value Line provides periodic news reports on companies' performance and predictions of future performance.

2.3.2 Plant-Level Analysis

The firm-level tests are relatively straightforward and depend on readily available data. However, these tests may not be sufficient to determine if an individual plant can maintain operations when faced with additional pollution control expenditures. Two conditions would indicate a need for plant-level analysis:

- the firm contends that pollution control investment would make the plant unprofitable to operate; or
- the firm-level analysis indicates that pollution control investment would have a serious detrimental effect on the firm's financial health.

The plant-level analysis used in this manual is based on plant-specific costs and revenues and is designed to focus on potential plant shutdowns rather than total corporate ability to pay. This type of analysis can be very complex because:

- plant-level financial data are usually confidential;
- the necessary data, particularly concerning the allocation of corporate overhead expenses, are not always collected by firms at the plant level; and
- the non-standardized accounting procedures used internally by firms do not facilitate easy verification of reported cost and revenue items.

The plant-level tests are intended and designed as screening tests rather than rigorous and definitive evaluations of a plant's ability to afford pollution control costs. If the test results indicate that pollution controls would impose severe economic impacts, then a more detailed plant closure analysis

would be necessary. This would entail working closely with the plant and corporate accountants to gather information on a variety of costs, revenues, and accounting procedures. Mathematical modelling of the plant's profitability may be necessary. Information on salvage values of plant equipment as well as projections of future economic conditions may be desirable or required. A methodology for plant closure analysis is not presented in this document.

Three tests are presented in the plant-level analysis: the Earnings Test, the Gross Margin Test and the Revenue Test. The Earnings Test measures the impact of pollution control costs on the plant's earnings before taxes. Earnings are computed as revenues minus the cost of goods sold (raw materials, wages and salaries, rent, and supplies) and the corporate overhead expenses assigned to the plant. The results of this test would provide the most clear-cut indication of a plant's ability to pay for pollution control. The cost of pollution control would directly reduce earnings to the level indicated by the results of this test.

The Gross Margin Test should be used if corporate overhead data are not available. This test measures the impact of pollution control costs as a fraction of the plant's gross margin. Gross margin is computed as revenues minus cost of goods sold. The test result is a fraction which may require more skill to interpret than the absolute number obtained from the Earnings Test.

The Revenue Test is the simplest. Pollution control costs are considered as a fraction of total revenues for the plant. No other plant-specific costs are required to perform this test.

The Earnings Test is probably the most useful to the permit writer and the Revenue Test is probably the least useful. However, the former requires the most data, and the latter requires the least. Whichever test is used, significant data problems can be expected, including a lack of specific data; misallocated, biased, or inappropriate cost data; or incomplete information. The plant-level analysis will be constrained by such problems but reasonable estimates and informed use of the available data may be sufficient. The calculation and interpretation of these tests are discussed in more detail in Chapter 4.

Data needed for the plant-level tests must be obtained from the permit applicant for the plant in question. If there are not sufficient data to perform the

Earnings Test and one of the other two tests is used, industry ratios for comparison are available from Morris' Annual Statement Studies. Data concerning the cost of pollution control can be obtained from the firm-level analysis worksheets.

CHAPTER 3

FIRM-LEVEL ANALYSIS

3.1 INTRODUCTION

The first stage in the economic analysis of pollution control expenditures is the firm-level analysis. This analysis uses publicly available financial data to determine whether a firm can afford the pollution control technology for a particular plant.

All of the firm-level tests can be performed using three years of data from publicly available sources, such as annual reports or stock market data. Evaluation of privately-held firms will be difficult, because the above data sources are not available for such companies. Dun and Bradstreet reports some information on privately held firms that will enable the permit writer to perform a limited evaluation. If sufficient data are not available or if conclusions are difficult to reach, the permit writer may need to ask the firm to provide confidential financial information.

The firm-level analysis has two components--financial statement analysis and market value analysis. The financial statement component analyzes a firm's reported financial condition by calculating ratios from available data. This provides a historic perspective on the firm's operating performance and asset values. The market value analysis uses stock market data as a proxy for the future performance of a firm to evaluate the firm's ability to pay for pollution control.

3.2 FINANCIAL STATEMENT ANALYSIS

The methodology presented in this section concentrates on three accounting indicators of financial strength:

- Liquidity -- ability to meet short-term financial obligations;
- Solvency -- ability to meet long-term financial obligations; and
- Leverage -- indebtedness as a percentage of total capital.

Five ratios will be calculated to measure these indicators, using data from balance sheets and income statements. The ratios should be calculated using three years of financial data to smooth fluctuations in reported earnings and asset values over time. They will first be calculated with the firm's reported revenues and expenses. Then the ratios for the most recent year will be adjusted for the cost of the pollution control technology to determine how the control option will impact the firm's financial health. Each ratio will be evaluated against at least two of the following three criteria:

- A rule-of-thumb target that is commonly used by analysts to determine what constitutes acceptable performance in general. These targets can be considered the empirical "laws" of financial management.
- A cross-sectional analysis in which a firm's ratios are compared to the range of ratios for many of the firms in the same industry. This provides an estimate of how the firm compares with average or exceptional competitors. Although it is impossible to identify precisely the industry in which a firm competes, it can often be usefully approximated by the SIC code of the firm. Financial statements of other firms with the same SIC code provide a distribution of the financial conditions for firms in the industry. The statements of the firm in question can then be compared to those of other firms to assess relative liquidity, solvency, and leverage.
- Intertemporal or longitudinal comparisons of the movement of a firm's own ratios over over time, to indicate how performance is changing over time.

In Chapter 5 the results of the firm-level evaluations are assessed as a whole, and in combination with the results of the plant-level tests. Chapter 5 also contains guidance for evaluating conflicting test results.

The data needed to perform the financial statement analyses can be found in the balance sheet and income statement for a firm. The balance sheet shows a financial picture of a firm at a given point in time, as if all financial activities of the firm were momentarily at a standstill. Because the balance sheet reflects a point in time, the data presented on it can change from day to day.

The balance sheet is divided into two sections. On the left or upper section are shown the assets, and on the right or lower section are shown liabilities and stockholders' equity. Assets include all goods and property owned by the firm as well as claims against others (unpaid bills owed to the firm) which have not yet been collected. Liabilities include all debts and payments which are owed by the firm. Stockholders' equity is the difference between the value of the firm's assets and the value of its liabilities. This is the amount of money that would theoretically be divided among the stockholders if the firm were liquidated at its balance sheet value. It includes the investment of stockholders in purchasing shares in the firm and earnings from current and past years retained within the firm.

The income statement shows how much money a firm makes or loses during its fiscal year. It can also be called the "earnings report" or "statement of profit and loss." The income statement contains information on the amounts received from selling the firm's products and from other sources of income, and the costs and outlays incurred in order to operate the company. The costs incurred usually consist of cost of goods sold (raw materials, wages and salaries, rent, and supplies); depreciation; interest on borrowed money; and taxes. When the expenses are subtracted from the income, the result is a net profit or a net loss for the year.

The three sets of tests that comprise the financial statement analysis are the:

- liquidity ratios;
- solvency ratios; and
- leverage ratios.

These are discussed in the next sections.

3.2.1 Liquidity Ratios

Liquidity ratios indicate a firm's ability to obtain cash to meet short-term financial obligations, i.e. current bills and debts which must be paid within one year. They measure the extent to which current assets exceed current liabilities. Ratios are used to relate the excess of current assets to the financial scale of the company.

The assets considered in liquidity ratios are cash and near-cash items such as marketable securities, accounts receivable (bills owed to the firm that have not yet been paid), and inventories. They are described as current assets because a firm can reasonably expect to convert them to cash within the current business year, if necessary, to meet its financial obligations.

Current liabilities are those items that a firm can be obligated to pay for within the current year. These typically include accounts payable (unpaid bills owed by the firm), short-term notes payable, the current portion of long-term debt, and a variety of other accrued expenses.

Liquidity ratios are comparatively easy to calculate because both current assets and current liabilities are routinely presented as subtotals on balance sheets. They provide a concise measure of the short-term financial status of the firm. However, liquidity ratios can significantly understate a firm's ability to meet its short-term obligations because the firm may have potential sources of cash that are not considered current assets. These include:

- borrowing from readily-available credit sources;
- sale of fixed assets such as land, buildings, equipment; and
- reduction of planned expenditures.

The two most commonly used liquidity ratios, the Current Ratio and the Quick Ratio, are included in this methodology.

3.2.1.1 Current Ratio

Theory

The Current Ratio is a measure of a firm's excess current assets. It is expressed as:

$$CR = \frac{CA}{CL}$$

where: CR = Current Ratio
CA = Current assets
CL = Current liabilities

The Current Ratio is a rather gross measure of liquidity in that all current assets are assumed to be equally convertable to cash.

Calculation

Data for both current assets and current liabilities can be found on the Comparative Consolidated Balance Sheet in Moody's Industrial Manual, as shown in Exhibit 3-1. It should be noted that there may be line items that are not listed in Moody's. For example, information for the current portion of long-term debt is not shown as a line item in Moody's for the sample firm. The permit writer should discuss any such uncertain or missing data with the firm to obtain the necessary clarification and/or data. The Current Ratio is calculated lated using Worksheets 1a and 1b on pages 6 and 7 of the Workbook. The calculation should be done using data for the three most recent years for which data are available. The trend in the Current Ratio values over the three years is examined, and it is also compared to Current Ratio values for the industry. Industry averages for the Current Ratio are presented by SIC code in Robert Morris Associates' Annual Statement Studies (see Exhibit 3-2). These industry averages reflect data for firms whose fiscal years end between the dates indicated. For example, the most right-hand column in Exhibit 3-2 is labelled "6/30/81-3/31/82"; the Current Ratios reflect data for firms whose fiscal years ended between 6/30/81 and 3/31/82. The permit writer should use the Current Ratios from the column that corresponds to the end of the firm's most recent fiscal year. To assess the three-year trend in industry Current Ratios, the

[7]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.

[8]1980 includes $5.8 million ($0.13 per sh.) charge for termination of operations of the joint venture terephthalate plant at Middleburg.

Consolidated Statement of Changes in Financial Position (in thousands):

Funds Provided From Operations: Sources:	1982	1981
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,819
Def. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of divs.	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727	276,996
Uses: Prop., plt. & Capital exps.	147,180	135,950
Increase in invest.	42,978	14,754
Net chge. in work. cap.	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions: Chge. in lg.-tm. debt: New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
Chge. in notes pay.	(15,125)	(75,243)
Excnge. of com. stk. for debt:		
Incr. in cap. accts.	38,845	
Extraordinary gain	11,551	
Cash dividends	(50,874)	(53,567)
Net fin. trans.	(44,038)	(31,984)
Chges. in fgn. curr. trans. adj.	(54,054)	(44,956)
Other sources (uses)	(8,318)	11,084
Net incr. (decr.) in fds.	6,606	(9,149)

Exhibit 3-1

DATA FROM MOODY'S - CURRENT RATIO

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[5]Com. Shs. Outstand.	[6]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[2]1964	576,085	499,041	77,044	*d*895	76,149	38,382	[1]37,767	18,523	38,703,611	[4]1.04
[2]1965	578,649	502,348	76,301	5,731	82,033	35,986	[1]46,046	19,121	39,395,937	[4]1.09
[3][4]1966	661,319	560,023	101,296	3,456	104,752	48,766	55,986	21,372	40,247,710	1.39
[3][4]1967	670,292	579,956	90,336	*d*1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[3][4]1968	751,055	642,915	108,140	*d*6,423	101,717	46,117	55,600	23,753	40,856,052	1.34
[3][4]1969	779,687	681,611	98,076	*d*11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[3][4]1970	832,761	724,027	108,734	*d*10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[3][4]1971	848,444	743,096	105,348	*d*9,826	95,522	41,986	[1]53,536	23,812	40,956,636	[7]1.37
[3][4]1972	972,267	832,866	139,401	*d*11,644	127,757	59,224	68,533	25,143	40,819,984	1.70
[3][4]1973	1,154,775	992,203	162,572	*d*4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[4]1974	1,525,489	1,355,316	170,173	*d*25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	*d*36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,383,028	2.44

[1]After special items: 1971, *cr*$1,289,000; 1965, *cr*$2,900,000; 1964, *dr*$1,615,842. [2]Before special items; after: 1971, $1.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET AS OF DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(in thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	13,579
[1]Notes & accounts receivable, net	380,524	419,747	417,802	407,071	332,347	273,102	267,912
[1]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	567,808
Inv. at estimated cos.	214,391	186,001	192,265	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,396
Other investments	21,933	4,809	5,904	6,266	9,522	9,147	25,710
[1]Property, plant & equipment	2,079,668	2,018,586	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[1]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	716,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,302
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,915
Accounts payable	161,226	151,047	153,294	166,657	126,817	99,759	81,158
U.S., for. & state inc. taxes	42,910	14,314	42,220	88,529	107,567	27,566	89,684
Accrued expenses	89,488	96,888	61,240	63,618	89,634	72,548	63,584
Total current liabilities	351,567	335,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	631,919	634,356	534,330	280,619	295,969	329,443	326,368
Deferred U.S. & fgn. income taxes	119,254	134,447	116,700	104,457	80,201	89,011	75,837
Pension liability	19,703	21,667	23,638	25,607	27,577	29,546	31,516
[2]Common stock	23,240	22,146	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
[1]Translation adjustment	*dr*96,744	*dr*42,690					
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631 789
Total stockholders' equity	1,079,031	1,051,477	1,009,866	945,489	818,518	757,637	742,087
[3]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	945,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,330	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133 330
[4]Other additions—deductions	*cr*61,841	*cr*15,224	.....	.....	.....	.....	.....
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,839	114,472	106,517	106,683	93,819	89,728
Retire. renewals charged to res.	51,105	21,903	35,372	77,007	20,882	12,140	59,170
Other additions	[9]*dr*25,597	[10]4,225	.....	.....	[6]5,523	[6]1,208	[6]108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	.....
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,653,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	166,222,000	.....
Total	$2,079,668,000	$1,155,992,000

[1]After reserves (1982, $4,918,000).

[2]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $133,000,000 higher than as reported on the Life method at Dec. 31, 1982.

[3]Stated value: $25/48.

[4]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.

[5]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.

[7]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31, 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the year. Foreign currency transaction gains and losses are included in income currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in, first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various dates. Rental expense relating to these leases

Exhibit 3-2

DATA FROM MORRIS - CURRENT RATIO

MANUFACTURERS - PLASTIC MATERIALS & SYNTHETIC RESINS

SIC# 2821

Current Data: 52(6/30-9/30/81) 0-1MM	1-10MM	10-50MM	50-100MM	64(10/1/81-3/31/82) ALL	ASSET SIZE / NUMBER OF STATEMENTS	Comparative Historical Data: 6/30/77-3/31/78 ALL	6/30/78-3/31/79 ALL	6/30/79-3/31/80 ALL	6/30/80-3/31/81 ALL	6/30/81-3/31/82 ALL
24	68	18	6	116		120	116	144	127	116
%	%	%	%	%	ASSETS	%	%	%	%	%
8.6	4.8	3.5		5.6	Cash & Equivalents	6.2	6.7	6.6	6.2	5.6
35.5	29.6	28.9		30.1	Accts. & Notes Rec. - Trade(net)	28.0	29.8	28.5	26.5	30.1
19.7	22.7	24.9		22.4	Inventory	24.3	22.3	24.8	21.5	22.4
1.7	1.2	1.9		1.4	All Other Current	2.0	1.4	2.2	1.4	1.4
65.5	58.2	59.2		59.6	Total Current	60.6	60.1	62.3	56.5	59.6
25.2	33.6	32.6		31.8	Fixed Assets (net)	33.0	33.3	31.6	32.6	31.8
1	1.8	.6		1.1	Intangibles (net)	.4	1.4	1.3	.8	1.1
8.1	6.6	7.5		7.6	All Other Non Current	5.9	6.2	4.9	8.0	7.6
100.0	100.0	100.0		100.0	Total	100.0	100.0	100.0	100.0	100.0
					LIABILITIES					
7.0	8.8	9.7		8.4	Notes Payable Short Term	10.1	8.0	8.7	8.3	8.4
4.1	3.2	2.7		3.2	Cur. Mat. L/T/D	3.7	3.3	4.1	3.4	3.2
24.1	19.7	18.4		19.7	Accts. & Notes Payable - Trade	18.3	17.9	20.4	19.2	19.7
4.6	6.8	6.7		6.1	Accrued Expenses	5.6	6.6	6.5	5.7	6.1
8.0	2.0	4.0		3.2	All Other Current	2.9	4.1	4.4	3.2	3.2
45.9	40.4	39.4		40.6	Total Current	40.7	39.8	44.2	39.7	40.6
18.1	18.5	25.2		18.7	Long Term Debt	17.1	18.4	17.7	18.4	18.7
5.5	2.8	3.0		3.6	All Other Non Current	1.9	2.4	2.1	1.2	3.6
32.5	38.3	32.4		37.1	Net Worth	40.3	39.4	36.0	40.6	37.1
100.0	100.0	100.0		100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0
					INCOME DATA					
100.0	100.0	100.0		100.0	Net Sales	100.0	100.0	100.0	100.0	100.0
72.1	77.8	77.7		76.8	Cost Of Sales	75.7	76.2	75.8	76.3	76.8
27.9	22.2	22.3		23.2	Gross Profit	24.3	23.8	24.2	23.7	23.2
24.9	16.9	15.9		18.2	Operating Expenses	19.7	18.0	19.4	18.8	18.2
3.0	5.3	6.4		5.0	Operating Profit	4.6	5.8	4.8	5.0	5.0
1.0	1.3	2.9		1.4	All Other Expenses (net)	1.4	1.0	1.1	1.3	1.4
1.9	4.1	2.6		3.6	Profit Before Taxes	3.2	4.8	3.7	3.6	3.6
					RATIOS					
2.1	2.1	2.5		2.2	Current	2.1	2.2	2.1	2.1	2.2
1.6	1.4	1.5		1.6		1.5	1.6	1.5	1.5	1.6
1.0	1.1	1.1		1.1		1.2	1.2	1.1	1.1	1.1
1.5	1.2	1.2		1.3	Quick	1.3	1.3	1.3	1.3	1.3
1.1	.8	.8		.9		.9	1.0	.9	1.0	.9
.6	.6	.6		.6		.6	.7	.6	.7	.6
38 9.7	35 10.5	40 9.1		38 10.2	Sales/Receivables	38 9.7	37 10.0	35 10.4	40 9.2	38 10.2
48 7.4	43 8.4	54 6.8		47 7.7		47 7.8	47 7.7	46 7.9	48 7.5	47 7.7
64 5.7	58 6.3	68 5.4		58 6.3		62 5.9	62 5.9	55 6.6	59 6.2	58 6.3
23 16.1	29 12.7	37 10.0		29 12.4	Cost of Sales/Inventory	42 8.7	29 12.6	34 10.8	33 11.2	29 12.4
37 9.8	42 8.6	60 6.0		43 8.5		54 6.8	50 7.3	50 7.3	43 8.4	43 8.5
69 5.3	57 6.4	85 4.3		63 5.8		70 5.2	68 5.4	69 5.3	65 5.6	63 5.8
7.2	7.6	8.0		7.0	Sales/Working Capital	6.8	6.1	6.5	6.8	7.0
11.8	13.5	10.7		12.3		10.7	9.0	11.0	11.5	12.3
1 INF	32.7	31.1		32.3		22.8	29.5	33.9	22.3	32.3
5.1	8.2	3.7		7.6	EBIT/Interest	9.8	13.2	7.8	8.7	7.6
(22) 2.2	(58) 3.1	(17) 2.0		(101) 2.8		(95) 3.7	(83) 4.5	(115) 3.8	(105) 2.9	(101) 2.8
1.2	1.6	.9		1.4		1.6	2.2	1.6	1.2	1.4
8.3	8.7	8.3		7.9	Cash Flow/Cur. Mat. L/T/D	7.7	7.4	8.7	7.7	7.9
(12) 2.7	(55) 4.0	(13) 2.6		(84) 3.0		(87) 2.8	(78) 4.5	(90) 3.6	(83) 3.1	(84) 3.0
1.5	2.3	1.3		2.1		1.7	2.0	1.5	1.5	2.1
.4	.8	.7		.8	Fixed/Worth	.4	.5	.4	.5	.8
.8	1.0	1.3		1.0		.8	.8	.8	.7	1.0
2.0	1.8	2.1		1.7		1.4	1.5	1.5	1.4	1.7
1.0	.9	1.3		.9	Debt/Worth	.9	.8	.9	.8	.9
2.2	1.8	2.2		1.8		1.5	1.5	1.6	1.4	1.8
7.7	3.2	4.3		3.5		2.5	2.8	2.9	2.8	3.5
39.6	38.8	38.0		35.7	% Profit Before Taxes/Tangible Net Worth	35.7	41.8	39.4	32.2	35.7
(22) 25.8	(64) 24.0	16.5		(110) 23.4		(118) 22.5	(111) 25.3	(138) 24.0	(123) 18.8	(110) 23.4
5.7	10.5	-2.5		8.4		4.3	12.9	8.4	7.7	8.4
13.6	15.6	11.3		13.9	% Profit Before Taxes/Total Assets	14.8	16.4	15.3	13.8	13.9
8.3	8.8	5.0		7.3		8.1	10.2	8.2	8.0	7.3
1.2	3.0	-.6		1.5		1.9	4.1	2.7	2.1	1.5
17.4	13.2	9.1		13.4	Sales/Net Fixed Assets	10.4	10.2	12.7	11.3	13.4
13.2	7.2	6.1		7.4		6.3	6.8	7.9	6.6	7.4
7.7	4.0	4.0		4.3		3.7	4.2	4.6	4.3	4.3
3.3	2.8	2.4		2.8	Sales/Total Assets	2.4	2.7	2.7	2.8	2.8
2.7	2.2	2.0		2.2		2.1	2.1	2.2	2.1	2.2
1.9	1.8	1.4		1.7		1.7	1.6	1.8	1.5	1.7
.8	1.4	1.8		1.3	% Depr., Dep., Amort./Sales	1.5	1.3	1.5	1.4	1.3
(23) 1.9	(63) 2.0	(17) 1.9		(108) 2.0		(113) 2.3	(105) 2.3	(134) 2.1	(116) 2.1	(108) 2.0
2.7	3.3	2.8		3.2		3.7	3.9	3.4	3.5	3.2
1.7	.3			.5	% Lease & Rental Exp/Sales	.7	.4	.5	.5	.5
(15) 2.3	(24) .9			(46) 1.5		(58) 1.8	(45) 1.0	(72) 1.2	(58) 1.2	(46) 1.5
3.5	1.7			2.0		2.3	2.0	2.2	2.2	2.0
2.9	1.8			2.2	% Officers' Comp/Sales	2.0	2.5	2.1	2.1	2.2
(18) 4.1	(26) 2.9			(43) 3.5		(43) 4.1	(38) 4.0	(57) 4.0	(43) 3.6	(43) 3.5
6.5	4.3			4.7		5.8	6.3	7.6	6.5	4.7
34932M	571178M	741499M	836430M	1984039M	Net Sales ($)	1129219M	1204791M	1682251M	2539528M	1984039M
12720M	253180M	463153M	437520M	1166573M	Total Assets ($)	874729M	854930M	1259573M	1364301M	1166573M

M = $thousand 28 MM = $million

See Pages 1 through 124

permit writer should use industry ratios for the two years prior to the most recent year. The data used for the sample firm are indicated in Exhibit 3-2.

The steps for calculating the Current Ratio are as follows:

1. Find current assets on the line labelled "Total current assets" on the Comparative Consolidated Balance Sheet. One component of current assets may be marketable securities, which are carried on the balance sheet at either cost or market value. If marketable securities are a large portion of current assets, look at the footnotes to the balance sheet to determine if the securities are carried at cost and whether the market values are very different from the cost. If this is the case, use market value in determining current assets because the market value is a better indication of economic value. Record values for the three most recent years on Line 1 of Worksheet 1a (page 6 of the Workbook).

2. Find current liabilities on the line labelled "Total current liabilities". This usually includes a line item for the current portion of long-term debt. If there is a footnote which indicates that this is to be refinanced, do not include the current portion of long-term debt with current liabilities. Record the values for the three most recent years on Line 2.

3. For each of the three years, divide Line 1 (current assets) by Line 2 (current liabilities) to get the Current Ratio. Record the Current Ratios on Line 3 and on Worksheet 14 (page 57 of the Workbook).

4. Determine whether the Current Ratio increased, decreased, or remained the same over the three-year period. Record the direction and magnitude of the trend on Summary Line 1 at the bottom of Worksheet 1a (page 6 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

5. Locate Current Ratios for the appropriate industry SIC code in Morris. Current Ratios for the three most recent years can be found in the three columns on the right of the page. Record Current Ratio values for the upper quartile, median, and lower quartile on Lines 4a through 4c.

6. Evaluate the firm's performance relative to that of the industry for the three years, and record the evaluation on Summary Line 2 (page 6 of the Workbook) and on Worksheet 14 (page 57 of the Workbook). An example evaluation is:

> "Firm's performance was between the median and upper quartile for the industry for the past three years. Current Ratio declined relative to industry median over the three years but was still above industry median.

Exhibit 3-3 shows the calculation of the Current Ratio using the sample firm data.

Exhibit 3-3

WORKSHEET 1a

CURRENT RATIO WITHOUT COST OF POLLUTION CONTROL
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1.	Current Assets	782,974	854,210	791,723
2.	Current Liabilities	351,567	335,317	405,065
3.	Current Ratio Line (1) divided by Line (2)	2.2	2.5	2.0
4a.	Industry Current Ratio - Upper Quartile	2.2	2.1	2.2
4b.	Industry Current Ratio - Median	1.6	1.5	1.5
4c.	Industry Current Ratio - Lower Quartile	1.1	1.1	1.1

SUMMARY

1. Evaluation of three-year trend for firm: Current Ratio has increased over 1980; however, it has decreased during the latest fiscal year.

2. Comparison of firm's Current Ratio values with Current Ratios for industry: Firm's Current Ratio was close to industry's ratios for first and last years. For middle year it was significantly better. Ratios are at or above 2.0. Closer look at balance sheet indicates significant increase in inventories between first and second year, and then a decrease in inventories between second and third year.

In order to determine the effect of purchasing and installing pollution control equipment, the firm's Current Ratio is also calculated after the current assets value has been adjusted to reflect the cost of pollution control. The Current Ratio will be affected by the capital investment only and not by operating and maintenance (O&M) expenses associated with the control equipment. This is because the O&M expenses reduce net income, not the balance sheet items which are used to calculate the Current Ratio.

The Federal tax laws allow a reduction in tax payments equivalent to 15% of the capital investment in pollution control technology. This reduction in tax liability is called an "investment tax credit". The investment tax credit (ITC) reduces the real cost to the firm of the pollution control technology to 85% of the investment. The benefit of this ITC is accounted for by multiplying the capital cost of pollution control by 0.85. This is a short-cut method of including the benefit of the tax credit that essentially reduces the capital cost of the control technology by 15 percent. There are other factors that affect Federal tax liability when the pollution control ITC is used. However, to determine these effects could be a complex and time-consuming process and the net effect is negligible.

Because the pollution control ITC is dependent on legislation, the use and value of the ITC can change when new Federal tax legislation is passed. Therefore, when new tax legislation becomes law the permit writer should contact the Internal Revenue Service for clarification on the use of the pollution control ITC. Even if the pollution control ITC is repealed, a firm may still be eligible for other types of ITC.

The Current Ratio adjusted for the cost of pollution control is calculated on Worksheet 1b on page 7 of the Workbook. The steps in the calculation are as follows:

1. Find current assets on the line labelled "Total current assets" on Moody's Comparative Consolidated Balance Sheet (or on Line 1 of Worksheet 1a). Record the value for the most recent year on Line 1 of Worksheet 1b (page 7 of the Workbook).
2. Enter the capital cost of the pollution control equipment (as estimated by the permit writer or provided by the firm) on Line 2a.

3. Enter the investment tax credit factor on Line 2b.

4. Subtract Line 2b from 1; enter the result on Line 2c.

5. Multiply Line 2a (capital cost of pollution control equipment) by Line 2c (investment tax credit factor) to obtain the adjusted capital cost. Enter this value of Line 2d.

6. Subtract Line 2d (adjusted capital cost) from Line 1 (current assets) to obtain adjusted current assets. Enter this value on Line 3.

7. Find current liabilities on the line labelled "Total current liabilities" on the Comparative Consolidated Balance Sheet (or on Line 2 of Worksheet 1a). Record the value for the most recent year (the same year as was used for current assets on Line 1) on Line 4.

8. Divide Line 3 (adjusted current assets) by Line 4 (current liabilities) to obtain the Current Ratio adjusted for the cost of pollution control. Enter this value on Line 5 and on Worksheet 15 (page 58 of the Workbook).

9. Enter the industry Current Ratio values for upper quartile, median, and lower quartile on Lines 6a through 6c. These should be the values for the most recent year and may be found in Morris or on Lines 4a through 4c of Worksheet 1a.

10. Compare the firm's Current Ratio adjusted for the cost of pollution control with the industry Current Ratio values. Record the evaluation on Summary Line 1 at the bottom of Worksheet 1b (page 7 of the Workbook) and on Worksheet 15 (page 58 of the Workbook). An example evaluation is:

    "Current Ratio with pollution control ranks between the lower quartile and median for the industry."

Exhibit 3-4 shows the calculation of the Current Ratio adjusted for the cost of pollution control using the sample firm data.

Interpretation

Four analyses are used to evaluate the Current Ratio. These are:

1. rule of thumb;
2. three-year trend;
3. industry average; and
4. adjusted ratio.

These analyses are described below. The results and interpretation should be entered on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. Examples are provided in Chapter 5.

Exhibit 3-4

WORKSHEET 1b

CURRENT RATIO ADJUSTED FOR COST OF POLLUTION CONTROL
($1000)

	Most Recent Year of Company Data
	Year 1982
1. Current Assets Worksheet 1a, Line 1	782,975
2a. Capital Cost of Pollution Control Equipment	10,000
2b. Investment Tax Credit Factor	0.15
2c. 1 - Line (2b)	0.85
2d. Adjusted Capital Cost Line (2a) x Line (2c)	8,500
3. Adjusted Current Assets Line (1) - Line (2d)	774,475
4. Current Liabilities Worksheet 1a, Line 2	351,567
5. Current Ratio Line (3) divided by Line (4)	2.2
6a. Industry Current Ratio - Upper Quartile Worksheet 1a, Line 4a	2.2
6b. Industry Current Ratio - Median Worksheet 1a, Line 4b	1.6
6c. Industry Current Ratio - Lower Quartile Worksheet 1a, Line 4c	1.1

SUMMARY

1. Comparison of firm's Current Ratio with Current Ratios for industry:

Adjusted Current Ratio is equal to upper quartile for the industry for the most recent fiscal year.

The financial rule of thumb indicates that a firm with a Current Ratio greater than 2.0 should not have trouble meeting its short-term obligations. A ratio of less than 2.0 could imply liquidity problems, but other factors must be considered before drawing any conclusions. A very high ratio may also be undesirable because it could imply a lack of good investment opportunities or mismanagement of resources.

The three-year trend for the firm indicates whether the firm's Current Ratio has recently increased, decreased, or remained the same. Generally, a decline is a negative indicator and an increase is a positive indicator of the firm's ability to meet its short-term obligations. However, the initial Current Ratio for the three-year period must be considered. For example a decline from a very high Current Ratio might indicate that the firm has shifted excessive cash holdings into more profitable long-term investment opportunities.

Industry averages indicate the range of Current Ratios for the SIC group most closely associated with the firm. Operating characteristics vary among industries, causing optimal industry-specific Current Ratios to be greater or less than the general rule of 2.0. Therefore, comparison with industry norms and historic ratios is necessary for a more complete understanding of a firm's Current Ratio values.

Current Ratios for the firm for each of the three most recent years are compared with upper quartile, median, and lower quartile Current Ratios for the industry over the same time period. These comparisons indicate whether the firm has improved or declined relative to the industry in its ability to meet short-term financial obligations. A Current Ratio below the lower quartile value for the industry indicates that the firm may have difficulty meeting its short-term obligations.

The adjusted ratio indicates the effect of the proposed pollution control expenditures on the firm's Current Ratio. The adjusted Current Ratio is calculated by subtracting the capital cost of the pollution control device from current assets. This is not because the firm would always pay for the device out of current assets, but because this provides a conservative estimate of the firm's ability to pay. If the capital cost of the control equipment can be paid for

from current assets without the Current Ratio going below the target level, liquidity should not constrain the firm's ability to afford pollution control equipment. If, on the other hand, the company cannot pay for the control device with current assets and remain above target Current Ratio levels, it cannot be concluded that the pollution control requirement would be excessive. This is because the firm would probably not have to pay for the device with cash or other short-term assets on hand. Instead, loans or installment payments could be used to spread the cost over time.

These four analyses may produce conflicting results. In general, the industry average and the adjusted ratio are the most important criteria for evaluating the Current Ratio. If the adjusted current ratio is at least equal to the lower quartile for the industry, the proposed pollution control expenditures will probably not cause liquidity problems for the firm.

3.2.1.1 Quick Ratio

Theory

The Quick Ratio compares current assets, excluding inventories, with current liabilities. Inventories are classified as current assets, but they cannot be converted to cash as readily as other assets such as accounts receivable. In a forced liquidation, inventory may only be salable at a great discount from book value, which may make the Current Ratio misleading as a measure of liquidity. This is particularly important in evaluating firms in which inventories represent a large portion of the current assets.

The Quick Ratio is therefore a more conservative measure of liquidity. The formula for the Quick Ratio is expressed as:

$$QR = \frac{CA-I}{CL}$$

where: QR = Quick Ratio
CA = Current assets
I = Inventories
CL = Current liabilities

Calculation

The Quick Ratio is also a ratio of assets to liabilities. However, the value used for assets is that for quick assets, which is current assets minus inventories. Thus, the Quick Ratio is the ratio of quick assets to current liabilities. As with the Current Ratio, data needed to calculate the Quick Ratio can be found in Moody's Comparative Consolidated Balance Sheet and Morris' Annual Statement Studies (see Exhibits 3-5 and 3-6). A firm's Quick Ratio without the cost of pollution control is calculated for the three most recent years using Worksheet 2a on page 10 of the Workbook and the Quick Ratio values are compared to those for the industry. The Quick Ratio with pollution control costs is calculated for the most recent year on Worksheet 2b (page 11 of the Workbook).

The steps for calculating the Quick Ratio (without adjustment for pollution control costs) are as follows:

1. Find current assets on the line labelled "Total current assets" on the Comparative Consolidated Balance Sheet (or on Line 1 of Worksheet 1a). Record values for the three most recent years on Line 1 of Worksheet 2a (page 10 of the Workbook).

2. Find inventory data on the line labelled "Inventories" in the assets section of the Comparative Consolidated Balance Sheet. Record values for the three most recent years on Line 2.

3. For each of the three years, subtract Line 2 (inventory) from Line 1 (current assets) to obtain quick assets. Enter the results on Line 3.

4. Find current liabilities on the line labelled "Total current liabilities" on the Comparative Consolidated Balance Sheet (or on Line 2 of Worksheet 1a) and record the values for the three most recent years on Line 4.

5. Divide Line 3 (quick assets) by Line 4 (current liabilities) to obtain the Quick Ratio for each of the three years. Record the Quick Ratios on Line 5 (page 10 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

6. Locate Quick Ratios for the appropriate industry SIC Code in Morris, immediately below the Current Ratio data. Quick Ratios for the three most recent years should be taken from the same three columns as the Current Ratio data were taken. Record Quick Ratio values for the upper quartile, median, and lower quartile on Lines 6a through 6c.

[7]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.
[8]1980 includes $5.8 million ($0.13 per sh.) charge for termination of operations of the joint venture terephthalate plant at Middleburg.

Consolidated Statement of Changes in Financial Position (in thousands):

	1982	1981
Funds Provided From Operations:		
Sources:		
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,859
Def. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of dive.	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727	276,996
Uses:		
Prop., plt.		
Capital ex		
	135,950	134,846
Increase in invest.	42,978	14,754
Net chge. in work. cap.	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions:		
Chge. in lg.-tm. debt:		
New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
Chge. in notes pay.	(15,125)	(75,263)
Exchge. of com. stk. for debt		
Incr. in cap. accts.	38,845	
Extraordinary gain	11,553	
Cash dividends	(56,874)	(53,567)
Net fin. trans.	(44,038)	(31,984)
Chges. in fgn. curr. trans. adj.	(54,054)	(44,956)
Other sources (uses)	(8,318)	11,084
Net incr. (decr.) in fds.	6,606	(9,149)

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[5]Com. Shs. Outstand.	[6]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[2]1964	576,085	499,041	77,044	d895	76,149	38,382	[1]37,767	18,523	38,703,611	[2]1.04
[3]1965	578,649	502,348	76,301	5,731	82,033	35,986	[1]46,046	19,121	39,395,937	[2]1.09
[3][4]1966	661,319	560,023	101,296	3,456	104,752	48,766	55,986	21,372	40,247,710	1.39
[3][4]1967	670,292	579,956	90,336	d1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[3][4]1968	751,055	642,915	108,140	d6,423	101,717	46,117	55,600	23,753	40,856,052	1.36
[3][4]1969	779,687	681,611	98,076	d11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[3][4]1970	832,761	724,027	108,734	d10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[3][4]1971	848,444	743,096	105,348	d9,826	95,522	41,986	[1]53,536	23,812	40,956,636	[2]1.37
[3][4]1972	972,267	832,866	139,401	d11,644	127,757	59,224	68,533	25,143	40,319,984	1.70
[3][4]1973	1,154,775	992,203	162,572	d4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[3]1974	1,525,489	1,355,316	170,173	d25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	d36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,383,028	2.44

[1]After special items: 1971, cr$1,289,000; 1965, cr$2,900,000; 1964, dr$3,615,842. [2]Before special items; after: 1971, $2.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET AS OF DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(in thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	14,579
[1]Trade & accounts receivable, net	380,524	410,547	447,902	407,071	332,347	273,102	267,912
[1]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	568,808
Inv. in affiliated cos.	214,391	198,001	192,389	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,396
Other investments	21,933	4,809	5,906	6,266	9,522	9,147	25,710
[1]Property, plant & equipment	2,079,668	2,018,386	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[1]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	714,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,502
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,915
Accounts payable	161,226	151,047	153,294	166,657	126,817	99,759	81,158
U.S., for. & state inc. taxes	42,910	14,314	42,220	88,529	107,567	27,566	89,684
Accrued expenses	89,488	96,888	61,240	63,618	89,634	72,548	63,584
Total current liabilities	351,567	335,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	431,919	454,356	338,330	280,619	295,969	329,443	326,368
Deferred U.S. & fgn. income taxes	119,254	134,447	116,700	104,457	80,201	89,011	75,837
Pension liability	19,703	21,667	23,638	25,607	27,577	29,546	31,516
[2]Common stock	23,240	22,146	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
[3]Translation adjustment	d96,744	d42,690					
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631 789
Total stockholders' equity	1,079,031	1,051,477	1,009,866	945,489	818,518	757,637	742,087
[4]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	945,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,330	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133 338
[5]Other additions—deductions	cr61,841	cr15,224					
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,839	116,472	106,517	106,683	93,859	89,228
Retire. renewals charged to res.	51,105	21,903	35,372	77,007	20,882	12,140	59,100
Other additions	[6]dr25,597	[6]4,225			[6]5,523	[6]1,208	[6]108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,653,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	166,222,000	
Total	$2,079,668,000	$1,155,992,000

[2]After reserves (1982, $4,918,000).
[3]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $153,000,000 higher than as reported on the Lifo method at Dec. 31, 1982.
[4]Stated value: $25/48.
[5]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.
[6]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.
[7]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31, 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the ····· Foreign currency transaction gains and ····· are included in income currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in, first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various dates. Rental expense relating to these leases

DATA FROM MORRIS - QUICK RATIO

MANUFACTURERS - PLASTIC MATERIALS & SYNTHETIC RESINS

SIC# 2821

Current Data 82(6/30-9/30/81) 0-1MM	1-10MM	84(10/1/81-3/31/82) 10-50MM	50-100MM	ALL	ASSET SIZE	Comparative Historical Data 6/30/77-3/31/78 ALL	6/30/78-3/31/79 ALL	6/30/79-3/31/80 ALL	6/30/80-3/31/81 ALL	6/30/81-3/31/82 ALL
24	68	18	6	116	NUMBER OF STATEMENTS	120	118	144	127	116
%	%	%	%	%	ASSETS	%	%	%	%	%
9.6	4.8	3.5		5.6	Cash & Equivalents	6.2	8.7	6.8	6.2	5.6
35.5	29.5	28.9		30.1	Accts. & Notes Rec. - Trade(net)	28.0	29.8	28.5	28.5	30.1
19.7	22.7	24.9		22.4	Inventory	24.3	22.3	24.8	21.5	22.4
1.7	1.2	1.9		1.4	All Other Current	2.0	1.4	2.2	1.4	1.4
65.5	58.2	59.2		59.6	Total Current	60.6	60.1	62.3	58.5	59.6
25.2	33.6	32.6		31.8	Fixed Assets (net)	33.0	33.3	31.8	32.6	31.8
1	1.8	.6		1.1	Intangibles (net)	4	1.4	1.3	.9	1.1
9.1	6.6	7.5		7.6	All Other Non-Current	5.8	5.2	4.9	8.0	7.6
100.0	100.0	100.0		100.0	Total	100.0	100.0	100.0	100.0	100.0
					LIABILITIES					
7.0	8.8	9.7		8.4	Notes Payable-Short Term	10.1	8.0	8.7	8.3	8.4
4.1	3.2	2.7		3.2	Cur. Mat.-L/T/D	3.7	3.3	4.1	3.4	3.2
24.1	19.7	16.4		19.7	Accts. & Notes Payable - Trade	18.3	17.9	20.4	19.2	19.7
4.8	6.8	6.7		6.1	Accrued Expenses	5.6	5.6	6.5	5.7	6.1
6.0	2.0	4.0		3.2	All Other Current	2.9	4.1	4.4	3.2	3.2
45.9	40.4	39.4		40.6	Total Current	40.7	39.8	44.3	39.7	40.6
16.1	18.5	25.2		18.7	Long Term Debt	17.1	18.4	17.7	19.4	18.7
5.5	2.8	3.0		3.6	All Other Non-Current	1.9	2.4	2.1	3.2	3.6
32.5	38.3	32.4		37.1	Net Worth	40.3	39.4	36.0	40.6	37.1
100.0	100.0	100.0		100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0
					INCOME DATA					
100.0	100.0	100.0		100.0	Net Sales	100.0	100.0	100.0	100.0	100.0
72.1	77.8	77.7		76.8	Cost Of Sales	75.7	76.2	75.8	76.3	76.8
27.9	22.2	22.3		23.2	Gross Profit	24.3	23.8	24.2	23.7	23.2
24.8	16.9	18.9		18.2	Operating Expenses	18.7	18.8	19.4	18.8	18.2
3.0	5.3	5.4		5.0	Operating Profit	4.8	5.0	4.8	5.0	5.0
1.0	1.3	2.9		1.4	All Other Expenses (net)	1.4	1.0	1.1	1.3	1.4
1.9	4.1	2.6		3.6	Profit Before Taxes	3.2	4.8	3.7	3.6	3.6
					RATIOS					
2.1	2.1	2.5		2.2		2.1	2.2	2.1	2.1	2.2
1.6	1.4	1.5		1.6	Current	1.5	1.6	1.5	1.5	1.6
1.0	1.1	1.1		1.1		1.2	1.2	1.1	1.1	1.1
1.5	1.2	1.2		1.3		1.3	1.3	1.3	1.3	1.3
1.1	.8	.8		.9	Quick	.9	1.0	.9	1.0	.9
.6	.6	.6		.6		.6	.7	.6	.7	.6
38 9.7	35 10.5	40 9.1		38 10.2		38 9.7	37 10.0	35 10.4	40 9.2	36 10.2
48 7.4	43 8.4	64 5.8		47 7.7	Sales/Receivables	47 7.8	47 7.7	46 7.9	49 7.5	47 7.7
64 5.7	58 6.3	88 4.1		58 6.3		62 5.9	62 5.9	56 6.6	59 6.2	58 6.3
23 16.1	28 13.2	37 10.0		28 12.4		42 8.7	28 12.6	34 10.8	33 11.2	29 12.4
37 9.8	42 8.6	50 7.3		43 8.5	Cost of Sales/Inventory	54 6.8	50 7.3	50 7.3	43 8.4	43 8.5
69 5.1	57 6.4	85 4.3		63 5.8		70 5.2	68 5.4	69 5.3	65 5.6	63 5.8
7.2	7.8	8.0		7.0		6.8	6.1	6.5	6.9	7.0
11.8	13.5	10.7		12.3	Sales/Working Capital	10.7	9.0	11.6	11.5	12.3
LINF	32.7	31.1		32.3		22.9	28.5	23.9	27.3	32.3
5.1	8.2	3.7		7.6		9.8	13.2	7.8	8.7	7.6
(22) 2.2	(58) 3.1	(17) 2.0	(101)	2.8	EBIT/Interest	(95) 3.7	(83) 4.5	(115) 3.8	(105) 2.9	(101) 2.8
1.2	1.6	.9		1.4		1.6	2.2	1.6	1.2	1.4
8.3	8.7	6.3		7.9		7.7	7.4	8.7	7.7	7.9
(12) 2.7	(55) 4.0	(13) 2.6	(84)	3.9	Cash Flow/Cur. Mat. L/T/D	(87) 2.8	(78) 4.6	(90) 3.6	(93) 3.1	(84) 3.9
1.5	2.3	1.3		2.1		1.7	2.0	1.6	1.5	2.1
.4	.5	.7		.5		.4	.5	.4	.5	.5
.8	1.0	1.3		1.0	Fixed/Worth	.8	.9	.8	.7	1.0
2.0	1.6	2.1		1.7		1.4	1.5	1.5	1.4	1.7
1.0	.8	1.3		.9		.9	.8	.9	.8	.9
2.2	1.6	2.2		1.8	Debt/Worth	1.5	1.5	1.6	1.4	1.8
7.7	3.2	4.3		3.5		2.5	2.8	2.9	2.8	3.5
39.6	36.9	38.0		35.7		35.7	41.8	39.4	32.2	35.7
(22) 25.8	(64) 24.0	16.5	(110)	23.4	% Profit Before Taxes/Tangible Net Worth	(118) 22.5	(111) 25.3	(138) 24.0	(123) 18.8	(110) 23.4
5.7	10.6	-2.5		8.4		4.3	12.9	8.4	7.7	8.4
13.8	15.6	11.3		13.9		14.8	16.4	15.3	13.8	13.9
6.3	8.8	5.0		7.3	% Profit Before Taxes/Total Assets	8.1	10.2	8.2	8.0	7.3
1.2	3.0	.6		1.5		1.9	4.1	2.2	2.1	1.5
17.4	13.2	9.1		13.4		10.4	10.2	12.7	11.3	13.4
13.2	7.2	6.1		7.4	Sales/Net Fixed Assets	6.3	6.8	7.9	6.6	7.4
7.7	4.0	4.0		4.3		3.7	4.2	4.6	4.3	4.3
3.3	2.9	2.4		2.9		2.4	2.7	2.7	2.8	2.9
2.7	2.2	2.0		2.2	Sales/Total Assets	2.1	2.1	2.2	2.1	2.2
1.9	1.8	1.4		1.7		1.7	1.8	1.8	1.5	1.7
.8	1.4	1.6		1.3		1.5	1.3	1.5	1.4	1.3
(23) 1.9	(63) 2.0	(17) 1.9	(108)	2.0	% Depr., Dep., Amort./Sales	(113) 2.3	(105) 2.3	(134) 2.1	(118) 2.1	(108) 2.0
2.7	3.3	2.8		3.2		3.7	3.9	3.4	3.5	3.2
1.7	.3			.5		.7	.4	.5	.5	.5
(15) 2.3	(24) .8		(46)	1.5	% Lease & Rental Exp/Sales	(56) 1.6	(45) 1.0	(72) 1.2	(58) 1.2	(46) 1.5
3.6	1.7			2.0		2.3	2.0	2.2	2.2	2.0
2.9	1.8			2.2		2.0	2.5	2.1	2.0	2.2
(18) 4.1	(26) 2.9		(43)	3.5	% Officers' Comp/Sales	(43) 4.1	(38) 4.0	(57) 4.0	(43) 3.6	(43) 3.6
6.5	4.3			4.7		5.8	6.3	7.6	6.5	4.7
34932M	571178M	741699M	836430M	1984039M	Net Sales ($)	1129218M	1204793M	1482251M	2539526M	1984039M
12720M	253180M	483153M	437520M	1106573M	Total Assets ($)	874728M	854930M	726972M	1364301M	1106573M

©Robert Morris Associates 1982

M = thousand MM = million

See Pages 1 through 12 for 38 Explanation of Ratios and Data

7. Compare the firm's Quick Ratio values to those for the industry for the three-year period and record the evaluation on Summary Line 1 (page 10 of the Workbook) and on Worksheet 14 (page 57 of the Workbook). An example evaluation is:

> "Firm's Quick Ratio has increased over the past three years. The Quick Ratio has been between median and the lower quartile for the industry. Firm's Quick Ratio has improved slightly relative to the Quick Ratio for the industry."

Exhibit 3-7 shows the calculation of the Quick Ratio without the cost of pollution control using the example firm data.

In order to calculate the Quick Ratio with the cost of pollution control taken into account, the value for quick assets must be adjusted to reflect the capital cost of the pollution control equipment. The calculation is done using Worksheet 2b on page 11 of the Workbook. The steps are as follows:

1. Find current assets on the line labelled "Total current assets" on the Comparative Consolidated Balance Sheet (or on Line 1 of Worksheet 2a). Record the value for the most recent year on Line 1 of Worksheet 2b (page 11 of the Workbook).

2. Find inventory data for the same year on the line labelled "Inventories" in the Assets section of the Comparative Consolidated Balance Sheet (or on Line 2 of Worksheet 2a). Record the value on Line 3.

3. Enter the adjusted capital cost from Line 2d of Worksheet 1b (the Current Ratio calculation) on Line 3. This cost is the capital cost of the pollution control equipment multiplied by 1 minus the investment tax credit credit factor.

4. Subtract Line 2 (inventory) and Line 3 (adjusted capital cost) from Line 1 (current assets) to obtain the adjusted quick assets. Record this value on Line 4.

5. Find current liabilities on the line labelled "Total current liabilities" on the Comparative Consolidated Balance Sheet (or on Line 4 of Worksheet 2a). Record the value for the most recent year (the same year as was used for current assets on Line 1) on Line 5.

6. Divide Line 4 (adjusted quick assets) by Line 5 (current liabilities) to obtain the adjusted Quick Ratio. Record this value on Line 6 (page 11 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

7. Enter the industry Quick Ratio values for upper quartile, median, and lower quartile on Lines 7a through 7c. These should be the values for

Exhibit 3-7

WORKSHEET 2a

QUICK RATIO WITHOUT
COST OF POLLUTION CONTROL
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1.	Current Assets Worksheet 1a, Line 1	782,974	854,210	791,723
2.	Inventory	368,228	406,907	327,216
3.	Quick Assets Line (1) - Line (2)	415,746	447,303	454,507
4.	Current Liabilities Worksheet 1a, Line 2	351,567	335,317	405,065
5.	Quick Ratio Line (3) divided by Line (4)	1.2	1.3	1.1
6a.	Industry Quick Ratio - Upper Quartile	1.3	1.3	1.3
6b.	Industry Quick Ratio - Median	0.9	1.0	0.9
6c.	Industry Quick Ratio - Lower Quartile	0.6	0.7	0.6

SUMMARY

1. Comparison of firm's Quick Ratio values with Quick Ratios for industry:

Firm's ratios are always higher than industry median and are in upper quartile for one year. All Quick Ratios are greater than 1.0.

the most recent year and may be found in Morris or on Lines 6a through 6c of Worksheet 2a.

8. Compare the firm's Quick Ratio adjusted for the cost of pollution control with the industry Quick Ratio values. Record the evaluation on Summary Line 1 at the bottom of Worksheet 2b (page 11 of the Workbook) and on Worksheet 15 (page 58 of the Workbook). An example evaluation is:

   "Adjusted Quick Ratio ranks between the median and lower quartile for the industry."

Exhibit 3-8 shows the calculation of the Quick Ratio adjusted for the cost of pollution control using the sample firm data.

Interpretation

The Quick Ratio is evaluated using the same types of analysis as the Current Ratio. These are:

1. rule of thumb;
2. three-year average;
3. industry average; and
4. adjusted ratio.

These analyses are described below. The results should be recorded on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. Examples are provided in Chapter 5.

The financial rule of thumb indicates that a firm with a Quick Ratio greater than 1.0 should not have trouble meeting its short-term obligations. A Quick Ratio greater than 1.0 indicates that the firm could theoretically pay off all of its current liabilities from current assets without liquidating inventories.

The three-year trend for the firm indicates whether the firm's Quick Ratio has increased, decreased, or remained the same. Generally an increase reflects improving financial conditions and a decrease reflects declining conditions. However, if the Quick Ratio was initially very high a decline may indicate improved financial management.

Industry averages indicate the range of Quick Ratios for the SIC group most closely associated with the firm. Industry averages may be greater than or less than 1.0 depending on operating conditions in the industry. Quick Ratios for

the firm for each of the past three years are compared with upper quartile, median, and lower quartile Quick Ratios for the industry over the same time period. These comparisons indicate whether the firm has improved or declined relative to the industry. A Quick Ratio below the lower quartile for the industry indicates that the firm may have difficulty meeting its short-term obligations.

The adjusted Quick Ratio indicates the effect of the proposed pollution control expenditures on the firm's Quick Ratio. The adjusted Quick Ratio is based on the same conservative assumption used in the adjusted Current Ratio--that the firm would pay for the pollution control out of current assets.

These four analyses may produce conflicting results. In general, the industry average and the adjusted ratio are the most important criteria for evaluating the Quick Ratio. If the adjusted Quick Ratio is at least equal to the lower quartile for the industry, the proposed pollution control expenditures will probably not create liquidity problems for the firm.

3.2.2 Solvency Ratios

Solvency Ratios measure a firm's ability to meet its fixed and long-term financial obligations. These are bills and debts that a firm owes on a regular basis for time periods longer than one year. These ratios can also be used to predict financial problems that could lead a firm to bankruptcy within the next few years.

Predicting bankruptcy is a very complex problem. Recent literature on bankruptcy has included many studies exploring the use of ratios and more complex statistical techniques. The predictive ability of individual Solvency Ratios is limited. However, they are included in this methodology because they do provide valuable insights and because they are the best simple predictive tools available.

Solvency ratios compare earnings or cash flow to fixed obligations. The two measures of solvency presented here are the Fixed-Charge Coverage Ratio and Beaver's Ratio. Earnings and cash flow are very similar terms used to describe the financial results or performance of a firm. Sometimes the terms are used

Exhibit 3-8

WORKSHEET 2b

QUICK RATIO
ADJUSTED FOR COST OF POLLUTION CONTROL
($1000)

		Most Recent Year of Company Data
		Year 1982
1.	Current Assets Worksheet 2a, Line 1	782,974
2.	Inventory	368,228
3.	Adjusted Capital Cost of Pollution Control Worksheet 1b, Line 2d	8,500
4.	Adjusted Quick Assets Line (1) - Line (2) - Line (3)	406,246
5.	Current Liabilities Worksheet 2a, Line 4	351,567
6.	Quick Ratio Line (4) divided by Line (5)	1.2
7a.	Industry Quick Ratio Upper Quartile Worksheet 2a, Line 6a	1.3
7b.	Industry Quick Ratio - Median Worksheet 2a, Line 6b	0.9
7c.	Industry Quick Ratio - Lower Quartile Worksheet 2a, Line 6c	0.6

SUMMARY

1. Comparison of firm's Quick Ratio with Quick Ratios for industry: Adjusted Quick Ratio is between industry median and upper quartile.

interchangeably. However, each has an explicit connotation and more typical point of use.

Earnings are the residual of revenues from normal operations after all costs have been subtracted. Earnings are usually described in relation to taxes and fixed charges, e.g. gross earnings, net earnings before taxes, and after-tax earnings. The designation at each point indicates the costs and charges which have been subtracted from the operating revenues of the firm as established by accepted accounting practices and/or IRS regulations.

The cash flow of a firm is a measure of the cash generated by the normal operations of the firm and available for use at the discretion of firm. The typical definition of cash flow is after-tax earnings plus depreciation. However, it may also be used to describe the amount of cash available on a pre-tax basis for payment of interest, other fixed charges, and taxes. Nonrecurring revenues or losses should always be excluded from either earnings or cash flow.

3.2.2.1 Fixed-Charge Coverage Ratio

Theory

The Fixed-Charge Coverage Ratio is a test which measures a firm's ability to meet its current fixed-cost obligations with cash flows from operations. The fixed-cost obligations (or fixed charges) include interest payments, rent or lease payments, pension payments, and the current portion of long-term debt. The cash flows from operations are expressed as cash earnings before interest and taxes (EBIT), which is the numerator of the Fixed-Charge Coverage Ratio. The ratio can be used to evaluate a firm's ability to incur additional medium-to long-term debt. It is expressed as:

$$FCCR = \frac{NE+T+IE+D+OFP}{FC}$$

where:
- FCCR = Fixed-Charge Coverage Ratio
- NE = Net earnings (or net income)
- T = Taxes
- IE = Interest expense
- D = Depreciation
- OFP = Other fixed payments (lease or rent payments, pension payments, etc.)
- FC = Fixed charges

Calculation

The information needed to calculate the Fixed-Charge Coverage Ratio can be found in Moody's Comparative Consolidated Income Account and Comparative Consolidated Balance Sheet (see Exhibit 3-9). Supplemental profit-and-loss information provided by the firm would also be useful if such information is available. It should be noted that formats for income and profit-and-loss statements in Moody's Comparative Consolidated Income Account are less standardized than Moody's Comparative Consolidated Balance Sheet. The titles for similar items may vary among different firms. In addition, not all firms will show entries for extraordinary items in any given year. Specific guidance regarding terminology will be provided for each item in the calculation.

As with the Liquidity Ratios, the Fixed-Charge Coverage Ratio without pollution control investment is calculated for the most recent three years and the trend over the three years is evaluated. More than the most recent edition of Moody's may be needed, because in at least some cases Moody's provides depreciation values for only two years.

The Fixed-Charge Coverage Ratio without the cost of pollution control is calculated in two stages -- calculation of cash earnings before interest and taxes (EBIT), and calculation of the Fixed-Charge Coverage Ratio itself. EBIT is calculated using Worksheet 3a on page 16 of the Workbook. The steps for performing this calculation are as follows:

1. Find net earnings (also called net income) on the Comparative Consolidated Income Account. Record the values for the three most recent years on Line 1a of Worksheet 3a (page 16 of the Workbook).

2. Find the data for taxes (it should include U. S. and foreign income taxes, state income taxes, and property taxes, less any tax credits) and record the values for the three most recent years on Line 1b.

3. For each of the three years add Line 1a (net earnings) to Line 1b (taxes) to get net profit before taxes. Record these values on Line 1c.

4. Find the data labelled "Interest" (or "Interest expense") on the Comparative Consolidated Income Account. Record the values for the three most recent years on Line 2.

40% interest. 3 Taiwanese investing groups hold the remaining 60% in the joint venture.

In Apr. 1973 Company and Mexican investment interests formed Petrocel, S.A. Co. was a 40% shareholder and the Mexican interests owned 60%. Petrocel has built a multimillion dollar plant at Altamira, Tamaulipas, Mexico, for the production of DMT (dimethyl terephthalate) and TPA (terephthalic acid), both products are used in the manufacture of polyester film and polyester fiber. Plant has a combined production capacity of 242,000 metric tons. In 1977 contributed interest to Hercofina joint venture.

In Feb. 1974 Company and a U.S. affiliate of Montedison S.p.A. (Milan, Italy) formed Adria Laboratories Inc. Adria will perform the clinical testing leading up to U.S. Food & Drug Administration approval for drugs already developed and being sold in Europe by Montedison's pharmaceutical affiliates. In Oct. 1977 Adria Laboratories, Inc. acquired Warren-Teed Pharmaceuticals, Inc.

On Aug. 31, 1976, Co. and American Petrofina, Inc. formed two joint ventures, Hercofina and Hercofina Europe, for production and marketing of terephthalates. Co. sold to American Petrofina a 25% interest in its terephthalate assets. Co. contributed its remaining terephthalate assets for a 75% interest in the joint ventures. Co. interest will be reduced as American Petrofina elects to invest additional money for capital expansion.

On Jan. 1, 1978 Haveg Industries, Inc., subsidiary, and Phillips Products Co., subsidiary of Phillips Petroleum Co. formed a joint venture to develop chemical means of increasing oil recovery from reservoirs that already have been tapped, called Custom Oil Recovery Technology Co.

In May 1979 Co. and American Petrofina Inc., announced that Hercofina sold its methanol plant in Pinquemine, La. to International Minerals & Chemical Corp. who will form a joint venture with Ashland Chemical Co.

In Mar. 1979, Co. and Boots Co., Ltd. England formed a joint venture, Boots Hercules Agro-Chemical Co., to make agricultural chemical in North America.

In May 1979, Co. and Solvay Et Cie, of Brussels, Belgium formed two joint venture partnerships, Lextar in North America and in Europe, to commercialize polyolefin pulps. These steps further implement existing Hercules/Solvay synthetic pulp development venture. Semicommercial quantities of these synthetic pulps will be manufactured at a Solvay plant in Rosignano, Italy. The joint venture constructed a facility located in Deer Park, Tex. for production of these synthetic pulps. In Dec. 1981, Co. purchased all of Solvay Et Cie's interests in the joint venture partnership.

In Apr. 1980, Co. and Shin Nihon Rika of Japan formed a joint venture, Rika Hercules K.K., to construct a synthetic resin plant in Japan. Terms were not disclosed. The new venture will be located in Tokushima City. The products will include pressure-sensitive adhesives, hotmelt adhesives, printing ink, paint and varnish, and chewing gum.

In Dec. 1981, Co. and Sukai Chemical Industries Ltd. of Osaka Japan formed a joint venture, Japan Magnetics Ltd. to develop and market advanced magnetic particles for use in high-performance video, audio and computer tape applications.

In May 1982, Co. and Pechiney Ugine Kuhlmann of France formed a joint venture, Societe Europeene de Fibres et Composites, to manufacture [illegible] in Grenoble, France. The [illegible] 2,000,000 and should start [illegible] third quarter of

Exhibit 3-9

DATA FROM MOODY'S - EBIT

[illegible] products through industry segments listed below:

PLASTICS
Polypropylene Resin
Polypropylene Film
Polypropylene Fiber
Other Plastic Products

WATER SOLUBLE PRODUCTS
Polymers, Gum and Coatings
Flavors & Fragrances
Water Management Chemicals

ORGANICS
Resins
Elastomers & Specialty Chemicals
Paper Chemicals

EXPLOSIVES AND AEROSPACE
Explosives
Aerospace
Graphite Fibers

OTHER PRODUCTS
Terephthalates
Graphic Systems
Recording Products
Synpulp

PRINCIPAL PLANTS & PROPERTIES

PLASTICS

Bayport, Tex.	Middletown, Del.
Union, Mo.	Oxford, Ga.
Calhoun, Ga.	Marshalliton, Del.
Covington, Va.	Terre Haute, Ind.
Crowley, La.	Winooski, Vt.
Lake Charles, La.	
International:	
Beringen, Belgium	Varennes, Canada
Brantham, Eng.	

WATER-SOLUBLE PRODUCTS

Brunswick, Ga.	Middletown, N.Y.
Harbor Beach, Mich.	Parlin, N.J.
Hopewell, Va.	Vero Beach, Fla.
Louisiana, Mo.	Houston, Tex.
International:	
Sao Paulo, Brazil	Grossenbrode, Germany
Lille Skensved, Denmark	Bergamo, Italy
Perivale, England	Amersfoort, Netherlands
Alizay, France	Zwijndrecht, Netherlands
Bremen, Germany	Tarragona, Spain
	Sandarne, Sweden

ORGANICS

Baton Rouge, La.	Hattiesburg, Miss.
Brunswick, Ga.	Kalamazoo, Mich.
Burlington, N.J.	Louisiana, Mo.
Chicopee, Mass.	Milwaukee, Wisc.
Franklin, Va.	Portland, Ore.
Gibbstown, N.J.	Savannah, Ga.
	West Elizabeth, Pa.
International:	
Traun, Austria	Tampere, Finland
Sao Paulo, Brazil	Voreppe, France
Burlington, Canada	Sobernheim, Germany
St. Jean, Canada	Busnago, Italy
Pendlebury, England	Middelburg, Netherlands
Beringen, Belgium	Zwijndrecht, Netherlands
	Lilla Edet, Sweden

EXPLOSIVE AND AEROSPACE

Bessemer, Ala.	Louisiana, Mo.
Carthage, Mo.	Magna, Utah
Donora, Pa.	McGregor, Tex.
Ishpeming, Mich.	Port Ewen, N.Y.
Kenvil, N.J.	Rocket Center, W.Va.

OTHER PRODUCTS

Deer Park, Tex.	Pulaski, Va.
Middleton, Del.	Wilmington, N.C.
International:	
St. Jean, Canada	

MANAGEMENT

Officers

A.F. Giacco, Chmn., Pres. & Chief Exec. Off.

Divisional Vice-Presidents

E.D. Crittenden
A.B. Engebretsen, Treasurer
R.J. Leahy

Vice-Presidents

F.L. Buckner	K.A. Wagner
D.S. Hollingsworth	H.A. Schowengerdt
L.G. Maury	R.O. Watson

Other Officers

S.M. Turk, Vice-Pres. & Gen. Counsel
R.R.P. Morrow, Secretary
G. MacKenzie, Controller
D.F. Desmond, Asst. Treas.
A.L. Searl, Ass't Treas.
C.W.K. Gamble, Ass't Sec.
P.M. Kendall, Asst. Controller

Directors

(Showing Principal Corporate Affiliations)

Alexander F. Giacco, Chmn., Pres. and Chief Exec. Off., Hercules Inc.

Eugene D. Crittenden, Jr., Divisional Vice-Pres., Hercules, Inc.

Stuart E. Eizenstat, Partner, Powell, Goldstein, Frazer & Murphy, Atlanta law firm.

Argen B. Engebretsen, Divisional Vice-Pres. and Treas., Hercules, Inc.

David S. Hollingsworth, Vice-Pres., Hercules, Inc.

Robert J. Leahy, Divisional Vice-Pres., Hercules Inc.

Guy T. McBride, Jr., Pres., Colorado School of Mines.

Arthur C. Nielsen, Jr., Chairman and Chief Executive Off., A.C. Nielsen Co.

John R. Petty, President and Chief Exec. Off., Marine Midland Bank, N.A. and President, Marine Midland Banks, Inc.

General Counsel: S.M. Turk.

Director of Purchasing: E.J. Sheehy.

Auditors: Coopers & Lybrand.

Shareholder Relations: W.W. Bewley, Jr., Director Investor Relations Tel: 1(800)441-9274.

Directors Meetings: Last Wednesday of each month.

Annual Meeting: Fourth Tuesday in March.

No. of Stockholders: Dec. 31, 1982, 35,390.

No. of Employees: Dec. 31, 1982, 21,598.

General Office: Hercules Plaza, Wilmington, DE 19899. Tel.: (302)594-5000.

INCOME ACCOUNTS

COMPARATIVE CONSOLIDATED INCOME ACCOUNT, YEARS ENDED DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(In thousands of dollars)

	1982	1981	1980	1979	1978	1977	1976
Net sales & oper. revenues	2,468,971	2,718,366	2,485,226	2,345,425	1,946,477	1,697,787	1,595,956
Cost of goods sold & oper. expenses	2,040,968	2,198,111	2,038,806	1,853,120	1,502,181	1,346,819	1,226,884
Selling, general & admin. expenses	314,305	308,599	291,519	280,786	258,140	226,964	209,032
Operating profit	113,698	211,656	154,901	211,519	186,156	124,004	160,040
Gain on sale of assets	.....	.....	.....	50,166	.....	.....	56,780
Other income, net	20,597	15,461	dr2,807	8,543	2,911	dr489	2,997
Total income	134,295	227,117	152,094	270,228	189,067	123,515	219,817
Interest & debt expense	50,707	46,671	37,456	31,840	31,122	32,273	31,495
Equity in net earn. affil. cos.	25,317	17,099	22,825	20,566	20,010	14,837	12,609
Inc. bef. taxes, extraordinary gain & acctg. change	109,105	197,545	137,461	258,954	177,755	106,079	200,931
[4]U.S. & fgn. inc. tax curr. pay.	21,024	76,060	19,969	58,864	53,676	41,242	67,444
Deferred U.S. & fgn. income taxes	9,193	cr13,950	17,756	28,718	21,466	13,033	27,565
State income taxes	cr524	cr482	3,659	6,139	4,632	3,309	2,103
Invest. tax credit	9,449	10,566	18,023	7,300	5,283	9,435	2,982
Inc. bef. extra. gain	89,963	125,351	77,054	172,533	103,264	57,930	106,801
[1]Extraordinary gain	11,553	.....	.....	.....	.....	.....	.....
Net income	98,414	[2]116,481	[3]114,000	[5]172,533	[6]103,264	[6]57,930	[6]106,801
Retained earns. begin. of year	981,187	898,273	835,188	708,217	647,336	631,789	560,975
Common dividends	56,874	53,567	50,915	45,562	42,383	42,383	35,987
Retained earns. end of year	1,022,727	981,187	898,273	835,188	708,217	647,336	631,789

[1]Includes research expenses: 1982, $70,697,000; 1981, $61,410,000; 1980, $53,462,000; 1979, $46,701,000; 1978, $40,081,000; 1977, $37,361,000; 1976 $35,389,000.

[2]Nontaxable gain from exchange of 2,038,154 shares of common stock for $50,000,000 principal amount of 6½% convertible subordinated debentures.

[3]Prior to application of investment tax credit: 1982, $9,449,000; 1981, $10,566,000; 1980, $18,023,000; 1979, $7,300,000; 1978, $5,283,000; 1977, $9,435,000; 1976, $2,982,000.

[4]Includes gain on sale of terephthalate assets and Hercules, California, plant in the third and fourth quarters of 1976 [illegible] million ($0.39 per share) and $12.2 million ($0.27 per share), respectively.

[5]1981 includes $12.3 million ($0.27 per share) write down of facilities and investments; 1978 includes $4.9 million ($0.11 per share) and 1977 includes $6.2 million ($0.14 per share) write-down of facilities.

[7]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.

[8]1980 includes $5.8 million ($0.13 per sh.) charge for termination of operations of the joint-venture terephthalate plant at Middleburg.

Consolidated Statement of Changes in Financial Position (in thousands):

Funds Provided From Operations: Sources:	1982	1981
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,839
Def. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of divs.	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727•	276,996

Exhibit 3-9 (continued)

P C C N 189

DATA FROM MOODY'S - EBIT

	135,950	134,846
Increase in invest.	42,978	14,754
Net chge. in work. cap.	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions:		
Chge. in lg.-tm. debt:		
New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
Net chge. in notes pay.	(15,125)	(75,243)
Exchge. of com. stk. for debt:		
Incr. in cap. accts.	38,845	.....
Extraordinary gain	11,553	.....
Cash dividends	(56,874)	(53,567)
Net fin. trans.	(44,038)	(31,984)
Chges. in fgn. curr. trans. adj.	(54,056)	(44,956)
Other sources (uses)	(8,318)	11,084
Net incr. (decr.) in fds.	9,606	(9,149)

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[5]Com. Shs. Outstand.	[6]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[1][2]1964	576,085	499,041	77,044	d895	76,149	38,382	[1]37,767	18,523	38,703,611	[7]1.04
[1][2]1965	578,649	502,348	76,301	5,731	82,033	35,986	[1]46,046	19,121	39,395,937	[7]1.09
[1][2]1966	661,319	560,023	101,296	3,456	104,752	48,766	$55,986	21,372	40,247,710	1.39
[1][2]1967	670,292	579,956	90,336	d1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[1][2]1968	751,055	642,915	108,140	d6,423	101,717	46,117	55,600	23,753	40,856,052	1.36
[1][2]1969	779,687	681,611	98,076	d11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[1][2]1970	832,761	724,027	108,734	d10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[1][2]1971	848,444	743,096	105,348	d9,826	95,522	41,986	[1]53,536	23,812	40,956,636	[7]1.37
[1][2]1972	972,267	832,866	139,401	d11,644	127,757	59,224	68,533	25,143	40,319,984	1.70
[3][4]1973	1,154,775	992,203	162,572	d4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[2]1974	1,325,489	1,155,316	170,173	d25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	d36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,385,028	2.44

[1]After special items: 1971, cr$1,289,000; 1965, cr$2,900,000; 1964, dr$3,615,842. [2]Before special items; after: 1971, $1.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET AS OF DEC. 31

(Taken from reports filed with Securities and Exchange Commission)

(In thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	13,579
[1]Notes & accounts receivable, net	380,524	419,747	417,802	407,071	332,347	273,102	267,912
[1]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	567,808
Inv. in affiliated cos.	214,391	168,001	152,385	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,398
Other investments	21,933	4,809	5,904	6,266	9,522	9,147	25,710
[1]Property, plant & equipment	2,079,668	2,018,586	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[1]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	714,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,503
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,382
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,919
Accounts payable	161,226	151,047	153,294	166,657	126,817	99,759	81,358
U.S., for. & state inc. taxes	42,910	14,314	42,220	88,529	107,567	27,566	89,684
Accrued expenses	89,488	96,888	61,240	63,618	89,634	72,548	63,584
Total current liabilities	351,567	335,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	431,919	454,356	334,530	280,619	295,969	329,443	328,368
Deferred U.S. & fgn. income taxes	119,254	134,447	116,700	104,457	80,201	89,011	75,837
Pension liability	19,703	21,667	23,638	25,607	27,577	29,546	31,516
[6]Common stock	23,240	22,146	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
[7]Translation adjustment	dr96,744	dr42,690	.....	.....	.....	.....	.....
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631,789
Total stockholders' equity	1,079,031	1,051,477	1,009,866	945,489	818,518	757,637	742,087
[1]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	945,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,430	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133,338
[8]Other additions, deductions	cr41,841	cr15,274	.....	.....	.....	.....	.....
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,819	114,472	106,517	106,683	93,859	89,228
Retire. renewals charged to ret.	51,105	21,903	35,372	77,007	26,882	12,140	59,180
Other additions	[9]dr25,597	[8]4,225	.....	.....	[5]5,523	[5]1,208	[5]108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	.....
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,653,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	166,222,000	.....
Total	$2,079,668,000	$1,155,992,000

[2]After reserves (1982, $4,918,000).

[3]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $193,000,000 higher than as reported on the Lifo method at Dec. 31, 1982.

[4]Stated value: $25/48.

[5]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.

[6]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.

[7]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31, 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the yea[illegible]ign currency transaction gains and losse[illegible]ncluded in income currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in, first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various dates. Rental expense relating to these [illegible]

5. Find the data for depreciation in Moody's. Depreciation may be found in: the Supplementary Profit and Loss Data Section of the Comparative Consolidated Consolidated Income Account; the section called "Sources and Uses of Funds"; or the Depreciation Reserve--Analysis section, which is usually attached to the Comparative Consolidated Balance Sheet. If the depreciation data are found in the Depreciation Reserve--Analysis section, the data may be described as "Additions charged to profit and loss." Record the values for the three most recent years on Line 3.

6. Find the other fixed payments, which will be labelled as "Rents," "Cost of rentals," or a similar description. Record the values for the three most recent years on Line 4.

7. For each of the three years, add Line 1c (net profit before taxes), Line 2 (interest), Line 3 (depreciation), and Line 4 (other fixed payments) to get cash earnings before interest and taxes (EBIT). This is the numerator for calculating the Fixed-Charge Coverage Ratio. Enter these values on Line 5.

Exhibit 3-10 shows the calculation of EBIT using the sample firm data.

Worksheet 3b on page 17 of the Workbook is used for calculating the Fixed-Charge Coverage Ratio without the cost of pollution control. The ratio is calculated for the three most recent years and the trend for the three years is evaluated. The steps for calculating the Fixed-Charge Coverage Ratio are as follows:

1. On Worksheet 3b (page 17 of the Workbook), enter on Line 1 the cash earnings before interest and taxes (EBIT) values, from Line 5 of Worksheet 3a, for the three most recent years.

2. Find the current portion of long-term debt on the Comparative Consolidated Balance Sheet. Record the values for the three most recent years on Line 2a.

3. Find the data labelled "Interest" (or "Interest expense") on the Comparative Consolidated Income Account. These data are also on Line 2 of Worksheet 3a. Enter these values on Line 2b.

4. Find the other fixed payments which will be labelled as "Rents," "Cost of rentals," or a similar description, on the Comparative Consolidated Income Account. These data are also on Line 4 of Worksheet 3a. Enter these values on Line 2c.

5. For each of the three years, add Line 2a (current portion of long-term debt), Line 2b (interest), and Line 2c (other fixed payments) to get total fixed charges. Record these values on Line 3.

6. Calculate the Fixed-Charge Coverage Ratio for each of the three years by dividing Line 1 (EBIT) by Line 3 (total fixed charges). Enter the results on Line 4 (page 17 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

Exhibit 3-10

WORKSHEET 3a

CASH EARNINGS BEFORE INTEREST AND TAXES (EBIT)
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1a.	Net Earnings (or Net Income)	86,861*	136,481	114,000
1b.	Taxes	20,244	51,062	23,361
1c.	Net Profit Before Taxes Line (1a) + Line (1b)	107,105	187,543	137,361
2.	Interest Expense	50,707	46,673	37,356
3.	Depreciation	121,841	118,839	114,472
4.	Other Fixed Payments (Lease or rent payments, pension payments, etc.)		(not listed)	
5.	Cash Earnings Before Interest and Taxes (EBIT) Line (1c) + Line (2) + Line (3) + Line (4)	279,653	353,055	289,189

*Note that extraordinary item has been deducted.

7. Compare the Fixed-Charge Coverage Ratio with the following critical values:

> 2.0 - firm is solvent
1.5-2.0 - grey area - solvency of firm is uncertain
< 1.5 - firm is insolvent

Evaluate the historical trend over the past three years and record the evaluation on Summary Line 1 (page 17 of the Workbook) and on Worksheet 14 (page 57 of the Workbook). An example evaluation is:

"The ratio has been between 1.5 and 2.0 for the past three years, and it has increased each year."

Exhibit 3-11 shows the calculation of the Fixed-Charge Coverage Ratio without the cost of pollution control using the sample firm data.

Calculating the Fixed-Charge Coverage Ratio adjusted for the cost of pollution control equipment is a two-step process. The first step is the calculation of the debt ratio for the firm. For the purposes of this document it is assumed that the control equipment will be financed with a proportion of debt equal to this debt ratio. The debt ratio indicates the portion of total capital which has been financed by debt. It is expressed as:

$$DR = \frac{LTL}{TC}$$

where: DR = Debt ratio
LTL = Total long-term liabilities
TC = Total capital

Total long-term liabilities are the sum of long-term debt, other accrued liabilities, deferred income taxes, and minority interest (stock in the firm that is owned by a subsidiary of the firm). Total capital is the sum of total long-term liabilities and net shareholders' equity. The calculation is done using Worksheet 3c on page 18 of the Workbook. Step 1 is done for the three most recent years and Steps 2 through 4 are done for the most recent of the three years. The steps in the calculation are as follows:

1. Find the long-term liability data on Moody's Comparative Consolidated Balance Sheet (see Exhibit 3-12). For the three most

Exhibit 3-11

WORKSHEET 3b

FIXED-CHARGE COVERAGE RATIO WITHOUT
COST OF POLLUTION CONTROL
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1.	Cash Earnings Before Interest and Taxes (EBIT) Worksheet 3a, Line 5	279,653	353,055	289,189
2a.	Current Portion of Long-Term Debt		(not listed)	
2b.	Interest Expense Worksheet 3a, Line 2	50,707	46,673	37,356
2c.	Other Fixed Payments Worksheet 3a, Line 4		(not listed)	
3.	Total Fixed Charges Line (2a) + Line (2b) + Line (2c)	50,707	46,673	37,356
4.	Fixed-Charge Coverage Ratio Line (1) divided by Line (3)	5.5	7.6	7.7

SUMMARY

1. Evaluation of three-year trend: Firm seems to be solvent; however, current portion of long-term debt and other fixed payments are unknown. Including these missing data would make the Fixed-Charge Coverage Ratio lower.

[1]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.

[2]1980 includes $5.8 million ($0.13 per sh.) charge for termination of operations of t ture terephthalate plant at Middleburg.

Exhibit 3-12

DATA FROM MOODY'S - DEBT RATIO FOR FIRM

Consolidated Statement of Changes in Financial Position (in thousands):

Funds Provided From Operations: Sources:	1982	1981
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,839
Def. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of dividends	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727	276,996
Uses: Prop., pl		
Capital		
Increase in invest.	42,978	14,754
Net chge. in work. cap.	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions:		
Chge. in lg.-tm. debt:		
New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
n notes	(15,125)	(75,243)
Exchge. of com. stk. for debt:		
Incr. in cap. accts.	38,845	
Extraordinary gain	11,553	
Cash dividends	(56,874)	(53,567)
Net fin. trans.	(44,038)	(31,964)
Chges. in fgn. curr. trans. adj.	(54,054)	(44,956)
Other sources (uses)	(8,318)	11,084
Net incr. (decr.) in fds.	6,606	(9,149)

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[1]Com. Shs. Outstand.	[2]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[3][4]1964	576,085	499,041	77,044	*d*895	76,149	38,382	[5]37,767	18,523	38,703,611	[6]1.04
[3]1965	578,649	502,348	76,301	5,731	82,033	35,986	[5]46,046	19,121	39,395,937	[6]1.09
[3][4]1966	661,319	560,023	101,296	3,456	104,752	48,766	55,986	21,372	40,247,710	1.39
[3][4]1967	670,292	579,956	90,336	*d*1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[3][4]1968	751,035	642,915	108,140	*d*6,423	101,717	46,117	55,600	23,753	40,856,052	1.36
[3][4]1969	779,687	681,611	98,076	*d*11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[3][4]1970	832,761	724,027	108,734	*d*10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[3][4]1971	848,444	743,096	105,348	*d*9,826	95,522	41,986	[7]53,536	23,812	40,956,636	[8]1.37
[3][4]1972	972,267	832,866	139,401	*d*11,644	127,757	59,224	68,533	25,143	40,319,984	1.70
[3][4]1973	1,154,775	992,203	162,572	*d*4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[4]1974	1,525,489	1,355,316	170,173	*d*25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	*d*36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,383,028	2.44

[1]After special items: 1971, *cr*$1,289,000; 1965, *cr*$2,900,000; 1964, *dr*$3,615,842. [2]Before special items; after: 1971, $1.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET AS OF DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(In thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	13,379
[1]Notes & accounts receivable, net	380,524	419,747	417,802	407,071	332,347	273,102	267,912
[2]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	567,608
Inv. in affiliated cos.	214,391	168,001	152,385	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,396
Other investments	21,933	4,809	5,904	6,266	9,522	9,147	25,710
[3]Property, plant & equipment	2,079,668	2,018,586	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[3]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	714,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,502
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,915
Accounts payable	161,226	181,047	153,294	166,657	128,817	99,759	81,358
U.S., for. & state inc. taxes	42,910	14,314	42,220	88,529	107,567	27,366	89,684
Accrued expenses	89,484	96,888	61,240	63,618	89,634	72,548	63,384
Total current liabilities	351,563	365,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	431,919	454,356	334,530	280,619	295,969	329,443	326,368
Deferred U.S. & fgn. income taxes	119,254	134,447	116,700	104,457	80,201	89,011	75,837
Pension liability	19,703	21,667	23,638	25,607	27,577	29,546	31,516
[4]Common stock	23,240	22,748	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
[5]Translation adjustment	*dr*96,744	*dr*42,690					
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631,789
Total stockholders' equity	1,079,031	1,051,477	1,009,866	943,489	818,518	757,637	742,087
[6]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	943,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,330	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133,358
[7]Other additions—deductions	*cr*61,841	*cr*15,224					
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,819	114,472	106,517	106,683	93,819	89,428
Retire. renewals charged to res.	51,105	21,903	35,372	77,007	26,882	12,140	59,110
Other additions	[8]*dr*25,597	[8]4,225			[9]5,523	[9]1,208	[9]108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,653,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	166,222,000	
Total	$2,079,668,000	$1,155,992,000

[2]After reserves (1982, $4,918,000).

[3]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $153,000,000 higher than as reported on the Life method at Dec. 31, 1982.

[4]Stated value: $25/48.

[5]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.

[6]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.

[7]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31, 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the year. Foreign currency transaction gains and losses are included in income currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in, first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various dates. Rental expense relating to these leases

recent years, enter long-term debt on Line 1a; other accrued liabilities on Line 1b; deferred income taxes on Line 1c; and minority interest on Line 1d of Worksheet 3c (page 18 of the Workbook). Other accrued liabilities may include such items as other deferred charges and pension liabilities. Add lines 1a through 1d to get total long-term liability; enter results on Line 1e.

2. Find the net shareholders' equity on Moody's Comparative Consolidated Balance Sheet (see Exhibit 3-12). Record the value for the most recent year on Line 2.

3. For the most recent year, add Line 2e (total long-term liability) and Line 2 (net shareholders' equity) to get total capital. Record this value on Line 3.

4. For the most recent year, divide line 1e (total long-term liability) by Line 3 (total capital) to calculate the debt portion of total capital (debt ratio) for the firm. Enter the result on Line 4.

An example of this calculation using the sample firm data is shown in Exhibit 3-13.

Worksheet 3d on pages 19 and 20 of the Workbook is used to calculate the Fixed-Charge Coverage Ratio adjusted for the cost of the pollution control equipment. One of the data items needed in this calculation is the interest rate to be paid on the new long-term debt (for the pollution control equipment). One source for this information is Moody's Bond Record, which lists average yields by bond rating classification. The interest rate on the firm's most recent bond issue should be used to determine the interest rate. If bond interest rates for the firm are not available, assume the interest rate to be three points above the current U.S. Treasury Bill rate. The adjusted Fixed-Charge Coverage Ratio calculation is done for the most recent of the three years evaluated. The steps in the calculation are as follows:

1. Subtract the investment tax credit factor from 1 and multiply this by the capital cost of the pollution control equipment to get the capital cost of pollution control adjusted for the investment tax credit. This adjusted capital cost can also be found on Line 2d of Worksheet 1b. Enter this value on Line 1 of Worksheet 3d (page 19 of the Workbook).

2. Enter the debt ratio for the firm (from Worksheet 3c, Line 4) on Line 2a.

3. Multiply Line 1 (adjusted capital cost of pollution control) by Line 2a (debt ratio) to get the portion of the pollution control expenditure financed with debt. Enter the result on Line 2b.

Exhibit 3-13

WORKSHEET 3c

DEBT RATIO FOR FIRM
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1a.	Long-Term Debt	431,919	454,356	334,530
1b.	Other Accrued Liabilities	19,703	21,667	23,638
1c.	Deferred Income Taxes	119,254	134,447	116,700
1d.	Minority Interest	----	----	----
1e.	Total Long-Term Liability Line (1a) + Line (1b) + Line (1c) + Line (1d)	570,876	610,470	474,888
2.	Net Shareholders' Equity	1,078,911		
3.	Total Capital Line (1e) + Line (2)	1,649,787		
4.	Debt Ratio Line (1e) divided by Line (3)	0.35		

4. Enter the interest rate charged on new debt on Line 3.

5. Multiply Line 2b (portion of pollution control expenditure financed with debt) by Line 3 (interest rate) to get interest expense before taxes. Enter the result on Line 4.

6. Divide Line 2b (portion of pollution control expenditure financed with debt) by 5 (assuming a five-year debt retirement) to get the additional principal payments for pollution control. Enter result on Line 5.

7. Enter total fixed charges from Line 3 of Worksheet 3b on Line 6.

8. Add Line 4 (interest expense), Line 5 (additional principal payments), and Line 6 (total fixed charges) to get adjusted fixed charges. Enter the result on Line 7.

9. Enter cash earnings before interest and taxes (EBIT) from Line 5 of Worksheet 3a on Line 8.

10. Enter annual O&M expenditures associated with the pollution control equipment on Line 9.

11. Subtract Line 9 (annual O&M expenditures) from Line 8 (EBIT) to get adjusted cash earnings before interest and taxes. Enter result on Line 10.

12. Divide Line 10 (adjusted EBIT) by Line 7 (adjusted fixed charges) to get the Fixed-Charge Coverage Ratio adjusted for the cost of pollution control. Enter the result on Line 11 (page 19 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

13. Compare the adjusted Fixed-Charge Coverage Ratio with the following critical ratios:

> 2.0 - firm is solvent
1.5 - 2.0 - grey area - solvency of firm is uncertain
< 1.5 - firm is insolvent

Record the evaluation on Summary Line 1 (page 20 of the Workbook) and on Worksheet 15 (page 58 of the Workbook). An example evaluation is:

"Fixed-Charge Coverage Ratio adjusted for pollution control cost is between 1.5 and 2.0. This ratio is in the grey area."

An example calculation of the Fixed-Charge Coverage Ratio (adjusted for the cost of pollution control) using the sample firm data is shown in Exhibit 3-14.

Exhibit 3-14

WORKSHEET 3d

FIXED-CHARGE COVERAGE RATIO ADJUSTED
FOR COST OF POLLUTION CONTROL
($1000)

		Most Recent Year of Company Data
		Year 1982
1.	Adjusted Capital Cost of Pollution Control Worksheet 1b, Line 2d	8,500
2a.	Debt Ratio Worksheet 3c, Line 4	0.35
2b.	Portion of Expenditure Financed with Debt Line (1) x Line (2a)	2,975
3.	Interest Rate on New Debt	0.14
4.	Interest Expense (before tax) Line (2b) x Line (3)	416.5
5.	Additional Principal Payments Line (2b) divided by 5	595
6.	Total Fixed Charges Worksheet 3b, Line 3	50,707
7.	Adjusted Fixed Charges Line (4) + Line (5) + Line (6)	51,718.5
8.	Cash Earnings Before Interest and Taxes (EBIT) Worksheet 3a, Line 5	279,653
9.	Annual O&M Expenditures	1,000
10.	Adjusted EBIT Line (8) - Line (9)	278,653
11.	Adjusted Fixed-Charge Coverage Ratio Line (10) divided by Line (7)	5.39

Exhibit 3-14 (continued)

WORKSHEET 3d (continued)

SUMMARY

1. Evaluation of Fixed-Charge Coverage Ratio against critical values:

   Firm appears solvent, but some data are missing from original Fixed-Charge Coverage Ratio, which may be too high as a result.

Interpretation

Three analyses are used to evaluate the Fixed-Charge Coverage Ratio. These are:

1. critical values;
2. three-year trend; and
3. adjusted ratio.

These analyses are described below. The results should be entered on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. Examples are presented in Chapter 5.

Critical values for the Fixed-Charge Coverage Ratio were developed from a statistical study of a small sample of firms (Putnam, Hayes & Bartlett, Inc., Testing a Firm's Ability To Pay, prepared for the Economic Analysis Division, Office of Planning and Evaluation, U. S. EPA, February 9, 1981). Firms with Fixed-Charge Coverage Ratios greater than 2.0 are classified as solvent. Firms with ratios between 1.5 and 2.0 are considered to be in the grey area where the solvency of the firm is uncertain. Firms with a Fixed-Charge Coverage Ratio less than 1.5 are considered to be insolvent.

The three-year trend for the firm indicates whether the firm's Fixed-Charge Coverage Ratio has increased, decreased, or remained the same. If the ratio has been steadily declining there could be some concern over the firm's solvency. On the other hand, if the ratio is in the grey area but is increasing towards 2.0 the firm's condition is probably improving.

The adjusted ratio indicates the effect of pollution control expenditures on the firm's Fixed-Charge Coverage Ratio. If the adjusted ratio is greater than 2.0 the firm should be able to afford the pollution controls without difficulty. If the adjusted ratio is less than 1.5, the pollution controls can be expected to cause solvency problems for the firm. Between 1.5 and 2.0 the adjusted ratio is in a grey area.

These three analyses can produce conflicting results. Two combinations of results can be interpreted as indications that the firm may encounter solvency problems. These are:

1) The Fixed-Charge Coverage Ratio is greater than 2.0 or between 2.0 and 1.5 and the adjusted ratio is less than 1.5;

2) The Fixed-Charge Coverage Ratio and the adjusted ratio are both between 2.0 and 1.5 and the three-year trend is declining.

3.2.2.2 Beaver's Ratio

Theory

This test, developed by William H. Beaver, is designed to assess the short-term solvency of a firm. A study by Beaver published in 1967 indicated that this ratio was the single best predictor of bankruptcy up to two years prior to failure when judged against other individual ratios or combinations of ratios. However, it should be noted that the recent literature has been critical of Beaver's results. In addition to indicating likelihood of bankruptcy, Beaver's Ratio indicates the extent of a decrease in earnings that a firm can endure without defaulting on its fixed financial obligations.

Beaver's Ratio involves calculating the ratio of internally generated cash flow to total debt. Internally generated cash flow is defined as net income after taxes plus depreciation. Internally generated cash flow would also normally include other non-cash expenses such as deferred taxes. In order to be consistent with Beaver's study, however, non-cash expenses other than depreciation are not included. Total debt is defined as the sum of current liabilities and long-term debt. Beaver's Ratio is expressed as:

$$BR = \frac{CF}{TD}$$

where: BR = Beaver's Ratio
CF = Cash flow
TD = Total debt

Calculation

The Calculation of Beaver's Ratio without pollution control costs uses data from Moody's Comparative Consolidated Income Account and Comparative Consolidated Balance Sheet (Exhibit 3-15). The calculation is done using Worksheet 4a on page 24 of the Workbook. It is performed for the three most recent years and the steps are as follows:

1. Find net income after taxes on the line labelled "Net income" in Moody's Comparative Consolidated Income Account. Enter values for the three most recent years on Line 1 of Worksheet 4a (page 24 of the Workbook).

40% interest. 3 Taiwanese investing groups hold the remaining 40% in the joint venture.

In Apr. 1973 Company and Mexican investment interests formed Petrocel, S.A. C 40% shareholder and the Mexican owned 60%. Petrocel has built a mul dollar plant at Altamira, Tamaulipas, for the production of DMT (dimethyl terephthalate) and TPA (terephthalic acid), both products are used in the manufacture of polyester film and polyester fiber. Plant has a combined production capacity of 242,000 metric tons. In 1977 contributed interest to Hercofina joint venture.

In Feb. 1974 Company and a U.S. affiliate of Montedison S.p.A. (Milan, Italy) formed Adria Laboratories Inc. Adria will perform the clinical testing leading up to U.S. Food & Drug Administration approval for drugs already developed and being sold in Europe by Montedison's pharmaceutical affiliates. In Oct. 1977 Adria Laboratories, Inc. acquired Warren-Teed Pharmaceuticals, Inc.

On Aug. 31, 1976, Co. and American Petrofina, Inc. formed two joint ventures, Hercofina and Hercofina Europe, for production and marketing of terephthalates. Co. sold to American Petrofina a 25% interest in its terephthalate assets. Co. contributed its remaining terephthalate assets for a 75% interest in the joint ventures. Co. interest will be reduced as American Petrofina elects to invest additional money for capital expansion.

On Jan. 1, 1978 Hayes Industries, Inc., subsidiary, and Phillips Products Co., subsidiary of Phillips Petroleum Co. formed a joint venture to develop chemical means of increasing oil recovery from reservoirs that already have been tapped, called Custom Oil Recovery Technology Co.

In May 1979 Co. and American Petrofina Inc., announced that Hercofina sold its methanol plant in Plaquemine, La. to International Minerals & Chemical Corp. who will form a joint venture with Ashland Chemical Co.

In Mar. 1979, Co. and Boots Co., Ltd. England formed a joint venture, Boots Hercules Agro-Chemical Co., to make agricultural chemical in North America.

In May 1979, Co. and Solvay Et Cie. of Brussels, Belgium formed two joint venture partnerships, Lextar in North America and in Europe, to commercialize polyolefin pulps. These steps further implement existing Hercules/Solvay synthetic pulp development venture. Semicommercial quantities of these synthetic pulps will be manufactured at a Solvay plant in Rosignano, Italy. The joint venture constructed a facility located in Deer Park, Tex. for production of these synthetic pulps. In Dec. 1981, Co. purchased all of Solvay Et Cie's interests in the joint venture partnership.

In Apr. 1980, Co. and Shin Nihon Rika of Japan formed a joint venture, Rika Hercules K.K., to construct a synthetic resin plant in Japan. Terms were not disclosed. The new venture will be located in Tokushima City. The products will include pressure-sensitive adhesives, hotmelt adhesives, printing ink, paint and varnish, and chewing gum.

In Dec. 1981, Co. and Sakai Chemical Industries Ltd. of Osaka Japan formed a joint venture, Japan Magnetics Ltd. to develop and market advanced magnetic particles for use in high-performance video, audio and computer tape applications.

In May 1982, Co. and Pechiney Ugine Kuhlmann of France formed a joint venture, Societe Europeene de Fibres et Composites, to manufac [illegible] in Grenoble, France. [illegible] 12,000,000 and should a [illegible] ited quarter of [illegible]

Exhibit 3-15

DATA FROM MOODY'S - BEAVER'S RATIO

[illegible] ucts through industry segments listed below:

PLASTICS
Polypropylene Resin
Polypropylene Film
Polypropylene Fiber
Other Plastic Products

WATER SOLUBLE PRODUCTS
Polymers, Gum and Coatings
Flavors & Fragrances
Water Management Chemicals

ORGANICS
Resins
Elastomers & Specialty Chemicals
Paper Chemicals

EXPLOSIVES AND AEROSPACE
Explosives
Aerospace
Graphite Fibers

OTHER PRODUCTS
Terephthalates
Graphic Systems
Recording Products
Synpulp

PRINCIPAL PLANTS & PROPERTIES

PLASTICS

Bayport, Tex.	Middletown, Del.
Union, Mo.	Oxford, Ga.
Calhoun, Ga.	Marshallton, Del.
Covington, Va.	Terre Haute, Ind.
Crowley, La.	Winooski, Vt.
Lake Charles, La.	
International:	
Beringen, Belgium	Varennes, Canada
Brantham, Eng.	

WATER-SOLUBLE PRODUCTS

Brunswick, Ga.	Middletown, N.Y.
Harbor Beach, Mich.	Parlin, N.J.
Hopewell, Va.	Vero Beach, Fla.
Louisiana, Mo.	Houston, Tex.
International:	
Sao Paulo, Brazil	Grosenbrode, Germany
Lille Skensved, Denmark	Bergamo, Italy
Perivale, England	Amersfoort, Netherlands
Aliaxy, France	Zwijndrecht, Netherlands
Bremen, Germany	Tarragona, Spain
	Sandarne, Sweden

ORGANICS

Baton Rouge, La.	Hattiesburg, Miss.
Brunswick, Ga.	Kalamazoo, Mich.
Burlington, N.J.	Louisiana, Mo.
Chicopee, Mass.	Milwaukee, Wisc.
Franklin, Va.	Portland, Ore.
Gibbstown, N.J.	Savannah, Ga.
	West Elizabeth, Pa.
International:	
Traun, Austria	Tampere, Finland
Sao Paulo, Brazil	Voreppe, France
Burlington, Canada	Sobernheim, Germany
St. Jean, Canada	Busnago, Italy
Pendlebury, England	Middelburg, Netherlands
Beringen, Belgium	Zwijndrecht, Netherlands
	Lilla Edet, Sweden

EXPLOSIVE AND AEROSPACE

[illegible]semer, Ala.	Louisiana, Mo.
[illegible]thage, Mo.	Magna, Utah
[illegible]ora, Pa.	McGregor, Tex.
[illegible]eming, Mich.	Port Ewen, N.Y.
Kenvil, N.J.	Rocket Center, W.Va.

OTHER PRODUCTS

Deer Park, Tex.	Pulaski, Va.
Middleton, Del.	Wilmington, N.C.
International:	
St. Jean, Canada	

MANAGEMENT

Officers

A.F. Giacco, Chmn., Pres. & Chief Exec. Off.

Divisional Vice-Presidents

E.D. Crittenden
A.B. Engebretsen, Treasurer
R.J. Leahy

Vice-Presidents

F.L. Buckner	K.A. Wagner
D.S. Hollingsworth	H.A. Schuwengerdt
L.G. Maury	R.O. Watson

Other Officers

S.M. Turk, Vice-Pres. & Gen. Counsel
R.R.P. Morrow, Secretary
G. MacKenzie, Controller
D.F. Desmond, Asst. Treas.
A.L. Searl, Ass't Treas.
C.W.K. Gamble, Ass't Sec.
P.M. Kendall, Asst. Controller

Directors

(Showing Principal Corporate Affiliations)

Alexander F. Giacco, Chmn., Pres. and Chief Exec. Off., Hercules Inc.

Eugene D. Crittenden, Jr., Divisional Vice-Pres., Hercules, Inc.

Stuart E. Eizenstat, Partner, Powell, Goldstein, Frazer & Murphy, Atlanta law firm.

Arden B. Engebretsen, Divisional Vice-Pres. and Treas., Hercules, Inc.

David S. Hollingsworth, Vice-Pres., Hercules, Inc.

Robert J. Leahy, Divisional Vice-Pres., Hercules Inc.

Guy T. McBride, Jr., Pres., Colorado School of Mines.

Arthur C. Nielsen, Jr., Chairman and Chief Executive Off., A.C. Nielsen Co.

John R. Petty, President and Chief Exec. Off., Marine Midland Bank, N.A. and President, Marine Midland Banks, Inc.

General Counsel: S.M. Turk.

Director of Purchasing: E.J. Sheehy.

Auditors: Coopers & Lybrand.

Shareholder Relations: W.W. Bewley, Jr., Director Investor Relations Tel: 1(800)441-9274.

Directors Meetings: Last Wednesday of each month.

Annual Meeting: Fourth Tuesday in March.

No. of Stockholders: Dec. 31, 1982, 35,390.

No. of Employees: Dec. 31, 1982, 21,598.

General Office: Hercules Plaza, Wilmington, DE 19899. Tel.: (302)594-5000.

INCOME ACCOUNTS

COMPARATIVE CONSOLIDATED INCOME ACCOUNT YEARS ENDED DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(In thousands of dollars)

	1982	1981	1980	1979	1978	1977	1976
Net sales & oper. revenues	2,468,971	2,718,366	2,485,226	2,345,425	1,946,477	1,697,787	1,593,936
Cost of goods sold & oper. expenses	2,040,968	2,198,111	2,038,806	1,853,120	1,502,181	1,346,819	1,226,884
[1]Selling, general & admin. expenses	314,305	308,599	291,519	280,786	258,140	226,964	209,032
Operating profit	113,698	211,656	154,901	211,519	186,156	124,004	160,040
Gain on sale of assets	.....	.....	.....	50,166	.....	.....	56,780
Other income, net	20,597	15,461	*dr2,807*	8,543	2,911	*dr489*	2,997
Total income	134,295	227,117	152,094	270,228	189,067	123,515	219,817
Interest & debt expense	50,707	46,673	37,356	31,840	31,322	32,273	31,495
Equity in net earn. affil. cos.	23,517	7,099	22,623	20,566	20,010	14,837	12,609
Inc. bef. prov. for income taxes	107,105	187,543	137,361	258,954	177,755	106,079	200,931
[2]U.S. & fgn. inc. tax curr. pay.	21,024	76,060	19,969	58,864	53,676	41,242	67,444
Deferred U.S. & fgn. income taxes	9,193	*cr13,950*	17,756	28,718	21,466	13,033	27,565
State income taxes	*cr524*	*cr482*	3,659	6,139	4,632	3,309	2,103
Invest. tax credit	9,449	10,566	18,023	7,300	5,283	9,435	2,982
Inc. bef. extra. gain	86,861	136,481	114,000	172,533	103,264	57,930	106,801
[3]Extraordinary gain	11,553	.....	.....	.....	.....	.....	.....
Net income	98,414	[4]136,481	[4]114,000	[5]172,533	[4]103,264	[4]57,930	[4]106,801
Retained earns. bgnn. of year	[illegible]	[illegible]	[illegible]	708,217	647,336	631,789	560,975
Common divi lends	56,874	53,567	50,915	45,562	42,383	42,383	35,987
Retained earns. end of year	1,022,727	981,187	898,273	835,188	708,217*	647,336	631,789

[1]Includes research expenses: 1982, $70,697,000; 1981, $61,410,000; 1980, $53,462,000; 1979, $46,701,000; 1978, $40,081,000; 1977, $37,361,000; 1976 $35,389,000.

[2]Nontaxable gain from exchange of 2,038,154 shares of common stock for $50,000,000 principal amount of 6½% convertible subordinated debentu[illegible]

[3]Includes gain on sale of terephthalate assets and Hercules, California, plant in the third and fourth quarters of 19[illegible] 17.7 million ($0.39 per share) and $12.2 million ($0.27 per share), respectively.

[4]Prior to application of investment tax credit: 1982, $9,449,000; 1981, $10,566,000; 1980, $18,023,000; 1979, $7,300,000; 1978, $5,283,000; 1977, $9,435,000; 1976, $2,982,000.

[5]1981 includes $12.3 million ($0.27 per share) write down of facilities and investments; 1978 includes $4.9 million ($0.11 per share) and 1977 includes $6.2 million ($0.14 per share) write-down of facilities.

[1]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.
[2]1980 includes $5.8 million ($0.13 per sh. charge for termination of operations of the j ture terephthalate plant at Middlebura.

Exhibit 3-15 (continued)

DATA FROM MOODY'S - BEAVER'S RATIO

Consolidated Statement of Changes i cial Position (in thousands):

Funds Provided From Operations: Sources:	1982	1981
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,839
Def. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of divs.	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727	276,996
Increase in invest.	42,978	14,754
Net chge. in work. cap.	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions: Chge. in lg.-tm. debt:		
New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
ge. in notes	(15,125)	(75,243)
e. of com. stk. for debt:		
Incr. in cap. accts.	38,845	.....
Extraordinary gain	11,553	.....
Cash dividends	(56,874)	(53,567)
Net fin. trans.	(44,038)	(31,984)
Chges. in fgn. curr. trans. adj.	(54,664)	(44,956)
Other sources (uses)	(8,318)	11,086
Net incr. (decr.) in fds.	6,606	(9,149)

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[5]Com. Shs. Outstand.	[1]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[2]1964	576,085	499,041	77,044	*d*895	76,149	38,382	[3]37,767	18,523	38,703,611	[2]1.04
[2]1965	578,649	502,348	76,301	3,731	82,033	35,986	[4]46,046	19,121	39,395,937	[2]1.09
[3][4]1966	661,319	560,023	101,296	3,456	104,752	48,766	55,986	21,372	40,247,710	1.39
[3][4]1967	670,292	579,956	90,336	*d*1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[3][4]1968	751,055	642,915	108,140	*d*6,423	101,717	46,117	55,600	23,753	40,856,052	1.36
[3][4]1969	779,687	681,611	98,076	*d*11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[3][4]1970	832,761	724,027	108,734	*d*10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[3][4]1971	848,444	743,096	105,348	*d*9,826	95,522	41,986	[5]53,536	23,812	40,956,636	[6]1.37
[3][4]1972	972,267	832,866	139,401	*d*11,644	127,757	59,224	68,533	25,143	40,319,984	1.70
[3][4]1973	1,134,775	992,203	162,572	*d*4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[4]1974	1,325,689	1,155,316	170,173	*d*25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	*d*36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,383,028	2.44

[1]After special items: 1971, *cr*$1,289,000; 1965, *cr*$2,900,000; 1964, *dr*$3,615,642. [2]Before special items; after: 1971, $1.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET, AS OF DEC. 31
(Taken from reports filed with Securities and Exchange Commission)
(In thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	13,579
[1]Notes & accounts receivable, net	380,524	419,747	417,802	407,071	332,347	273,102	267,912
[1]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	567,808
Inv. in affiliated cos.	214,391	168,001	152,385	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,398
Other investments	21,933	4,809	5,904	6,266	9,522	9,147	25,710
[2]Property, plant & equipment	2,079,668	2,018,586	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[2]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	714,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,502
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,915
Accounts payable	161,226	151,047	153,294	166,657	126,817	99,759	81,358
U.S., for. & state inc. taxes	42,910	14,114	42,220	88,529	107,567	27,566	89,684
Accrued expenses	89,488	96,888	61,240	63,618	89,634	72,548	63,584
Total current liabilities	351,567	335,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	[illegible]	[illegible]	[illegible]	280,619	295,969	329,443	326,368
Deferred U.S. & fgn. income taxes	119,254	134,447	116,700	104,457	80,201	89,011	75,837
Pension liability	19,703	21,667	23,638	25,607	27,577	29,546	31,516
[3]Common stock	23,240	22,146	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
[4]Translation adjustment	*d*94,744	*d*42,690	.....	.....	.....	.....	.....
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631 789
Total stockholders' equity	1,079,031	1,051,477	1,009,866	945,489	818,518	757,637	742,087
[5]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	945,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,330	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133 338
[6]Other additions, deductions	cr61,841	cr15,224	.....	.....	.....	.....	.....
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,810	114,472	106,517	106,683	93,839	89,228
Retire. renewals charged to res.	31,105	21,905	35,376	77,007	20,882	12,140	59,400
Other additions	[6]*dr*25,597	[6]4,225	.....	.....	[6]5,523	[6]1,208	[6]108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	.....
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,053,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	166,222,000	.....
Total	$2,079,668,000	$1,155,992,000

[1]After reserves (1982, $4,918,000).
[2]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $153,000,000 higher than as reported on the Lifo method at Dec. 31, 1982.
[3]Stated value: $25/48.
[4]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.
[5]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.
[6]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the ---- Foreign currency transaction gains and ---- come currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in, first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various

2. Find the data for depreciation in Moody's or on Line 3 of Worksheet 3a. Enter values for the three most recent years on Line 2.

3. For each of the three years subtract Line 2 (depreciation) from Line 1 (net income after taxes) to get cash flow. Enter results on Line 3.

4. Find current liabilities on the line labelled "Total current liabilities" on the Comparative Consolidated Balance Sheet or on Line 2 of Worksheet 1a. Enter values for the three most recent years on Line 4.

5. Enter total long-term liabilities (from Line 1e of Worksheet 3c) for the three most recent years on Line 5.

6. For each year add Line 4 (current liabilities) and Line 5 (total long-term liabilities) to get total debt. Enter results on Line 6.

7. For each year divide Line 3 (cash flow) by Line 6 (total debt to get Beaver's Ratio. Enter results on Line 7 (page 24 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

8. Compare Beaver's Ratio for the three years with the following critical values:

> 0.2 - firm is solvent
0.15-0.2 - grey area - solvency of firm is uncertain
< 0.15 - firm is insolvent

Record the evaluation on Summary Line 1 (page 24 of the Workbook and on Worksheet 14 (page 57 of the Workbook). An example evaluation is:

"Ratio has been in grey area for past two years after being in the insolvent range for the previous year. Historical trend indicates improvement but ratio still indicates uncertain position."

An example of the Beaver's Ratio calculation (without the cost of pollution control) is shown in Exhibit 3-16 using the sample firm data.

Beaver's Ratio is also calculated after being adjusted for the cost of the pollution control equipment, using the conservative assumption that the equipment will be financed partly by borrowing rather than by issuing new stocks. In this calculation, any additional expenditures serve to decrease the internally generated cash flow of the firm while increasing the firm's total debt, thus decreasing the ratio of cash flow to total debt.

Exhibit 3-16

WORKSHEET 4a

BEAVER'S RATIO WITHOUT COST OF POLLUTION CONTROL
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1.	Net Income After Taxes	98,414	136,481	114,000
2.	Depreciation Worksheet 3a, Line 3	121,841	118,839	114,472
3.	Cash Flow Line (1) + Line (2)	220,255	255,320	228,472
4.	Current Liabilities Worksheet 1a, Line 2	351,567	335,317	405,065
5.	Total Long-Term Liabilities Worksheet 3c, Line 1e	570,876	610,470	474,888
6.	Total Debt Line (4) + Line (5)	922,443	945,787	879,953
7.	Beaver's Ratio Line (3) divided by Line (6)	0.24	0.27	0.26

SUMMARY

1. Evaluation of Beaver's Ratio values: Ratios indicate solvency for all three years.

To account for the pollution control costs, all additional interest payments and annual operating and maintenance costs are subtracted from the firm's internally generated cash flow, and any additional debt which will be incurred to finance any capital expenditures are added to the firm's total debt. Any tax shield realized from the additional depreciation is added to the firm's cash flow because depreciation is a non-cash tax-deductible expense. Thus, for any increase in depreciation, the firm's income after taxes will decline by the amount of the depreciation expense after tax (or (1-tax rate) x depreciation). The cash flow will increase by the amount of depreciation less the depreciation expense after tax since depreciation is added to after-tax income to arrive at cash flow. Therefore cash flow will increase by an amount equal to the increase in depreciation multiplied by the tax rate. This is often referred to as the depreciation tax shield.

Beaver's Ratio adjusted for the cost of pollution control is calculated for the most recent of the three years using Worksheet 4b on pages 25 and 26 of the Workbook. The steps in the calculation are as follows:

1. Enter portion of capital expenditures financed by debt (from Line 2b of Worksheet 3d) on Line 1 of Worksheet 4b (page 25 of the Workbook).
2. Enter interest expense before tax (from Line 4 of Worksheet 3d) on Line 2.
3. Enter marginal tax rate for firm (if available or use 0.46) on Line 3.
4. Subtract Line 3 (marginal tax rate) from 1; enter result on Line 4.
5. Multiply Line 2 (interest expense before tax) by Line 4 to get after-tax interest expense. Enter result on Line 5.
6. Enter annual O&M expenditures for pollution control equipment (from Line 9 of Worksheet 3d) on Line 6.
7. Multiply Line 4 by Line 6 (annual O&M expenditures) to get after-tax O&M expenditures. Enter result on Line 7.
8. Multiply the capital cost of the pollution control equipment by the investment tax credit factor to get the adjusted capital cost, or find this value on Line 1 of Worksheet 3d. Enter this value on Line 8a.
9. Divide Line 8a (adjusted capital cost) by 5 (years until debt retirement) to get additional tax depreciation. Enter result on Line 8b.

10. Multiply Line 4 by Line 8b (additional tax depreciation) to get tax shield from depreciation. Enter result on Line 8c.

11. Enter cash flow (from Line 3 of Worksheet 4a) on Line 9.

12. Subtract Line 5 (after tax interest expense) and Line 7 (after-tax O&M expense) from Line 9 (cash flow) and add Line 8c (tax shield from depreciation) to get adjusted cash flow. Enter result on Line 10.

13. Enter total debt (from Line 6 of Worksheet 4a) on Line 11a.

14. Add Line 1 (portion of capital cost financed with debt) to Line 11a (total debt) to get adjusted total debt. Enter result on Line 11b.

15. Divide Line 10 (adjusted cash flow) by Line 11b (adjusted total debt) to get Beaver's Ratio adjusted for pollution control expenditures. Enter result on Line 12 (page 26 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

16. Compare the adjusted Beaver's Ratio with the following critical values:

> 0.2 - firm is solvent
0.15-0.2 - grey area - solvency of firm is uncertain
< 0.15 - firm is insolvent

Record the evaluation on Summary Line 1 (page 26 of the Workbook) and on Worksheet 15 (page 58 of the Workbook). An example evaluation is:

"Adjusted Beaver's Ratio is between 0.15 and 0.2, indicating borderline solvency."

An example of the Beaver's Ratio calculation adjusted for the cost of pollution control is shown in Exhibit 3-17 using the sample firm data.

Interpretation

Three analyses are used to evaluate Beaver's Ratio. These are:

1. critical values;
2. three-year trends; and
3. adjusted ratio.

These are described below. The results should be entered on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. Examples of this are presented in Chapter 5.

Exhibit 3-17

WORKSHEET 4b

BEAVER'S RATIO ADJUSTED FOR COST OF POLLUTION CONTROL
($1000)

		Most Recent Year of Company Data
		Year 1982
1.	Portion of Expenditure Financed with Debt Worksheet 3d, Line 2b	2,975
2.	Interest Expense (before tax) Worksheet 3d, Line 4	416.5
3.	Marginal Income Tax Rate	0.46
4.	1 - Tax Rate	0.54
5.	After-Tax Interest Expense Line (2) x Line (4)	224.9
6.	Annual O&M Expenditures for Pollution Control Equipment Worksheet 3d, Line 9	1,000
7.	After-Tax O&M Expenditures Line (4) x Line (6)	540
8a.	Capital Cost of Pollution Control Adjusted for ITC Worksheet 3d, Line 1	8,500
8b.	Additional Tax Depreciation Line (8a) divided by 5	1,700
8c.	Tax Shield from Depreciation Line (4) x Line (8b)	918
9.	Cash Flow Worksheet 4a, Line 3	220,255
10.	Adjusted Cash Flow Line (9) - Line (5) - Line (7) + Line (8c)	220,408.1
11a.	Total Debt Worksheet 4a, Line 6	922,443

Exhibit 3-17 (continued)

WORKSHEET 4b (continued)

	Most Recent Year of Company Data
	Year 1982
11b. Adjusted Total Debt Line (1) + Line (11a)	925,418
12. Adjusted Beaver's Ratio Line (10) divided by Line (11b)	0.24

SUMMARY

1. Evaluation of Beaver's Ratio: With costs of pollution control, firm is still in solvency range.

Critical values are ranges for Beaver's Ratio which indicate the relative probability of bankruptcy. In Beaver's study of 79 pairs of firms (each pair consisting of one firm which went bankrupt and another that remained solvent) the mean ratio of the failed firms was about 0.15 five years prior to failure and it declined steadily thereafter. Using his results as target values, the firm should be classified as solvent if it has a Beaver's Ratio (cash flow to total debt) which exceeds 0.20. If this ratio falls below 0.15, the firm is considered insolvent. A grey area exists between 0.15 and 0.20.

The three-year trend indicates whether the firm's Beaver's Ratio has increased, decreased, or remained the same in recent years. Generally an increase indicates improving financial conditions. Industry averages are not available for comparison with the three-year trend.

The adjusted ratio indicates the effect of pollution control expenditures on the Beaver's Ratio for the firm. If the adjusted Beaver's Ratio is above 0.20, this test indicates a low probability of bankruptcy; below 0.15 indicates a high probability of bankruptcy. Values between 0.20 and 0.15 are considered to be in a grey area.

These three analyses can produce conflicting results. Two combinations of results can be interpreted as indications of potential solvency problems. These are:

1) Beaver's Ratio is less than 0.20 and the adjusted ratio is less than 0.15; and

2) Both the Beaver's Ratio and the adjusted ratio are in the grey area between 0.20 and 0.15) and the three-year trend is declining.

3.2.3 Leverage Ratios

Leverage Ratios measure the extent to which a firm has fixed financial obligations. Leverage is the proportion of a firm's value that is financed by debt relative to that which is financed by stockholders. Leverage Ratios can indicate in a general way how much more debt financing (loans) a firm could expect to receive. A highly levered firm (one with a high Leverage Ratio) is likely to have problems borrowing more. The Debt/Equity Ratio is the most commonly used measure of leverage.

3.2.3.1 Debt/Equity Ratio

Theory

The Debt/Equity Ratio is the ratio of long-term debt to total stockholders' equity. In general, the debt holders (banks, etc.) in a highly levered firm (one with a high Debt/Equity Ratio) bear more risk than those in a less levered company, especially if there is some probability of bankruptcy. Thus, while the Debt/Equity Ratio alone is not a particularly useful number for assessing financial health, it can be used in combination with the Solvency Ratios to evaluate the stability of a firm's operations.

The Debt/Equity Ratio is calculated for the three most recent years and is not adjusted for the cost of pollution control. This is because the firm is assumed to be at its optimal debt/equity level before the pollution control equipment is added. Investment in pollution control is a capital investment that does not increase a firm's borrowing power because it will not produce future cash flows to repay the debt. It is assumed that the pollution control equipment will be paid for with amounts of debt and equity which are proportional to the total debt ratio of the firm.

The Debt/Equity Ratio is expressed as:

$$D/E = \frac{LTL}{TSE}$$

where: D/E = Debt/Equity Ratio
LTL = Total long-term liabilities
TSE = Total stockholders' equity

Calculation

The data needed to do this calculation are found in the liabilities section of Moody's Comparative Consolidated Balance Sheet (Exhibit 3-18) and in Morris' Annual Statement Studies (Exhibit 3-19). The three-year trend in a firm's Debt/Equity Ratios is evaluated and it is compared to average industry values. These industry ratios are Debt/Worth Ratios, in which total long-term liabilities are divided by tangible net worth. The Debt/Equity calculation is done using Worksheet 5 on pages 29 and 30 of the Workbook. The steps are as follows:

[7]1979 includes $28.0 million ($0.62 per sh.) gain on sale of pigment and methanol assets.

[8]1980 includes $5.8 million ($0.13 per sh.) charge for termination of operations of th ture terephthalate plant at Middleburg.

Consolidated Statement of Change cial Position (in thousands):

Funds Provided From Operations: Sources:	1982	1981
Inc. bef. extraord. gain	$86,861	$136,481
Deprec. & amort.	120,487	118,839
Del. taxes on inc.	(15,193)	15,092
Eq. in net inc. of affil. cos. in excess of divs.	(12,972)	4,704
Writedown of facil.	3,544	3,880
	182,727	276,996
Uses: Prop., pl. & Capital exp		167,189
Increase in invest.	135,950	134,846
Net chge. in work. cap.	42,978	14,754
	(109,217)	70,689
	69,711	220,289
Net fds. prov. fr. oper.	113,016	56,707
Financing Transactions: Chge. in lg.-tm. debt: New borrowings	177,247	247,270
Reductions	(199,684)	(150,444)
	(22,437)	96,826
e. in notes	(15,125)	(75,243)
of com. stk. for debt:		
Incr. in cap. accts.	38,845	
Extraordinary gain	11,553	
Cash dividends	(56,874)	(53,567)
Net fin. trans.	(44,038)	(31,984)
Chges. in fgn. curr. trans. adj.	(54,004)	(44,956)
Other sources (uses)	(8,318)	11,084
Net incr. (decr.) in fds.	6,606	(9,149)

Record of Earnings, years ended Dec. 31 (in thousands of dollars):

Year	Net Sales	Cost and Expenses	Balance	Oth. Inc. & Deb. (Net)	Inc. Bef. Taxes	Income Taxes	Net Income	Common Dividends	[5]Com. Shs. Outstand.	[6]Earn. Per Com. Sh.
1963	476,462	410,627	65,835	631	66,466	34,532	31,935	13,643	36,543,422	0.86
[2]1964	576,085	499,041	77,044	d895	76,149	38,382	[1]37,767	18,523	38,703,611	[2]1.04
[2]1965	578,649	502,348	76,301	5,731	82,033	35,986	[1]46,046	19,121	39,395,937	[2]1.09
[2][4]1966	661,319	560,023	101,296	3,456	104,752	48,766	55,986	21,372	40,247,710	1.39
[2][4]1967	670,292	579,956	90,336	d1,013	89,323	40,309	49,014	23,567	40,483,104	1.19
[2][4]1968	751,055	642,915	108,140	d6,423	101,717	46,117	55,600	23,753	40,856,052	1.36
[2][4]1969	779,687	681,611	98,076	d11,269	86,807	39,675	47,132	23,741	41,054,192	1.15
[2][4]1970	832,761	724,027	108,734	d10,988	97,746	45,159	52,587	23,642	40,753,376	1.29
[2][4]1971	848,444	743,096	105,348	d9,826	95,522	41,986	[1]53,536	23,812	40,956,636	[3]1.37
[2][4]1972	972,267	832,866	139,401	d11,644	127,757	59,224	68,533	25,143	40,319,984	1.70
[2][4]1973	1,154,775	992,203	162,572	d4,931	157,641	66,018	91,623	29,056	41,732,194	2.21
[4]1974	1,525,489	1,355,316	170,173	d25,574	144,599	52,575	92,024	33,426	41,812,649	2.20
1975	1,413,111	1,335,932	77,179	d36,529	40,650	8,191	32,459	33,579	42,193,700	0.77
1976	1,595,956	1,435,916	160,040	40,891	200,931	94,130	106,801	35,987	42,383,028	2.44

[1]After special items: 1971, cr$1,289,000; 1965, cr$2,900,000; 1964, dr$3,615,842. [2]Before special items; after: 1971, $1.41; 1965, $1.16; 1964, $0.95. [3]Restated for 1973 pooling of interests. [4]Restated for Statements of Financial Accounting Nos. 5 & 7 adopted in 1975. [5]Restated to reflect 2-for-1 stk. split Apr. 6, 1973.

BALANCE SHEETS

COMPARATIVE CONSOLIDATED BALANCE SHEET AS OF DEC. 31

(Taken from reports filed with Securities and Exchange Commission)

(in thousands of dollars)

ASSETS	1982	1981	1980	1979	1978	1977	1976
Cash & time deposits	28,855	26,700	28,947	52,793	47,871	26,538	17,092
U.S. Govt. & other securities, cost	5,307	856	7,758	3,532	10,058	2,524	13,579
[1]Notes & accounts receivable, net	380,524	419,747	417,802	407,071	332,347	273,102	267,912
[1]Inventories, net	368,288	406,907	337,216	321,089	316,779	297,330	269,225
Total current assets	782,974	854,210	791,723	784,485	707,055	599,494	567,808
Inv. in affiliated cos.	214,191	168,001	152,385	137,087	107,780	88,273	70,325
Advances to affiliates	960	8,524	8,962	2,472	2,463	856	5,196
Other investments	21,933	4,809	5,904	6,266	9,522	9,147	25,710
[1]Property, plant & equipment	2,079,668	2,018,586	1,882,348	1,703,481	1,615,368	1,537,050	1,432,234
[1]Less: Depreciation reserves	1,155,992	1,110,853	1,009,692	930,592	901,082	815,758	732,851
Net property account	923,676	907,733	872,656	772,889	714,286	721,292	699,383
Goodwill	1,821	1,167	4,197	5,517	6,292	8,267	7,158
Deferred charges, etc.	55,599	52,700	53,852	52,461	49,200	50,214	54,502
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
LIABILITIES							
Notes payable	57,943	73,068	148,311	86,268	50,382	72,100	19,915
Accounts payable	161,226	151,047	153,296	166,657	126,817	99,759	81,358
U.S., for. & state inc. taxes	42,910	14,314	42,220	88,529	107,567	27,506	89,684
Accrued expenses	89,488	96,888	61,240	63,618	89,634	72,548	63,584
Total current liabilities	351,567	335,317	405,065	405,072	374,400	271,973	254,541
Long-term debt	431,919	454,356	334,530	280,619	295,969	329,443	326,368
Deferred U.S. & fgn. income taxes	119,294	134,447	116,700	104,457	80,201	89,011	75,837
Pension liabilities	19,503	21,447	24,438	25,607	27,577	29,546	31,516
[4]Common stock	23,240	22,146	22,111	22,076	22,076	22,076	22,076
Paid-in surplus	129,808	90,834	89,482	88,225	88,225	88,225	88,222
Revaluation surplus							
Retained earnings	1,022,727	981,187	898,273	835,188	708,217	647,336	631,789
Total stockholders' equity	1,079,011	1,051,477	1,009,866	945,489	818,518	757,637	742,087
[1][5]Less: Treasury stock at cost	120	120	120	67	67	67	67
Net stockholders' equity	1,078,911	1,051,357	1,009,746	945,422	818,451	757,570	742,020
Total	2,001,354	1,997,144	1,889,679	1,761,177	1,596,598	1,477,543	1,430,282
Net current assets	431,407	518,893	386,658	379,413	332,655	327,521	313,267
PROPERTY ACCT.—ANALYSIS							
Additions at cost	171,219	189,110	229,163	195,686	121,330	129,716	150,779
Retirements or sales	48,296	37,648	50,296	107,573	43,012	24,900	133 338
[6]Other additions—deductions	cr61,841	cr15,224	.....	.....	.....	.....	.....
DEPREC. RESERVE—ANALYSIS							
Additions charged to profit & loss	121,841	118,839	114,472	106,517	106,683	93,839	89,228
Retire. renewals charged to res.	51,105	21,903	35,372	77,007	26,882	12,140	59,140
Other additions	[7]dr25,597	[8]6,225	.....	.....	[9]5,523	[4]1,208	[4]3,108

[1]1982:	Book Value	Deprec. Res.
Land	$20,481,000	.....
Bldgs., mach. & eq.	1,826,117,000	$1,117,874,000
Transportation eq.	53,268,000	31,653,000
Miscellaneous	13,580,000	6,465,000
Construction in progress	186,222,000	.....
Total	$2,079,668,000	$1,155,992,000

[1]After reserves (1982, $4,918,000).

[2]Co. extensively uses the last-in, first-out (LIFO) method for valuing inventories. If valued on the average cost method, inventories would have been $151,000,000 higher than as reported on the Lifo method at Dec. 31, 1982.

[3]Stated value: $25/48.

[4]Shares at cost: 1982-80, 6,589; 1979-76, 3,689.

[5]1978-76: Represents accumulated depreciation of acquired company at date of acquisition.

[6]Adjustments resulting from translating foreign accounts at current rates of exchange.

General Notes

(a) Consolidated financial statements include the accounts of Co., all wholly-owned subsidiaries with the exception of finance and insurance subsidiaries, and Co.'s pro rata share of the Hercofina joint ventures.

Investments in affiliated companies, owned 20% or more, are accounted for on the equity method, as are wholly-owned finance and insurance subsidiaries (due to their dissimilar business activities). Accordingly consolidated net income includes Co.'s share of their net income.

All significant intercompany transactions are eliminated in consolidation.

(b) Translation of Foreign Currencies: As a result of adopting Statement of Financial Accounting Standard No. 52, Foreign Currency Translation, in 1981, for years ended Dec. 31, 1981 and thereafter balance sheet accounts of foreign companies are translated at current exchange rates. The resulting translation adjustment is included in stockholder's equity. Revenues, expenses, gains and losses for 1981 and years thereafter are translated at rates prevailing during the year. Foreign currency transaction gains [illegible] are included in income currently. Prior years have not been restated. For those years, accounts of foreign companies were translated at current exchange rates, except that inventories, property, plant and equipment, depreciation, goodwill, and deferred taxes are translated at historical exchange rates. Revenues, expenses, gains and losses (other than inventory costs, depreciation, and amortization of goodwill) were translated at rates prevailing during the year.

(c) Inventories: Inventories are stated at the lower of cost or market. Substantially all domestic inventories are valued on the last-in first-out (LIFO) method, and foreign inventories are valued principally on the average cost method.

(d) Commitments and Contingent Liabilities:

Co. has certain operating leases, including office space, and transportation and data processing equipment, expiring at various dates. Rental expense relating to these leases

DATA FROM MORRIS - DEBT/EQUITY RATIO

MANUFACTURERS - PLASTIC MATERIALS & SYNTHETIC RESINS

SIC# 2821

Current Data: 52 (5/30-8/30/81) 0-1MM	1-10MM	10-50MM	50-100MM	ALL	ASSET SIZE / NUMBER OF STATEMENTS	Comparative Historical Data: 8/30/77-3/31/78 ALL	8/30/78-3/31/79 ALL	8/30/79-3/31/80 ALL	8/30/80-3/31/81 ALL	8/30/81-3/31/82 ALL
24	68	18	6	116		120	118	144	127	116
%	%	%	%	%	**ASSETS**	%	%	%	%	%
8.6	4.8	3.5		5.6	Cash & Equivalents	6.2	8.7	6.8	6.2	5.6
35.5	29.5	28.9		30.1	Accts. & Notes Rec. - Trade(net)	28.0	29.8	28.5	29.5	30.1
19.7	22.7	24.9		22.4	Inventory	24.3	22.3	24.8	21.5	22.4
1.7	1.2	1.9		1.4	All Other Current	2.0	1.4	2.2	1.4	1.4
65.5	58.2	59.2		59.6	Total Current	60.6	60.1	62.3	58.5	59.6
25.2	33.6	32.8		31.8	Fixed Assets (net)	33.0	33.3	31.6	32.6	31.8
1	1.6	.8		1.1	Intangibles (net)	.4	1.4	1.3	.8	1.1
9.1	6.6	7.5		7.6	All Other Non-Current	5.9	5.2	4.8	8.0	7.6
100.0	100.0	100.0		100.0	Total	100.0	100.0	100.0	100.0	100.0
					LIABILITIES					
7.0	8.8	9.7		8.4	Notes Payable-Short Term	10.1	8.0	8.7	8.3	8.4
4.1	3.2	2.7		3.2	Cur. Mat. L/T/D	3.7	3.3	4.1	3.4	3.2
24.1	19.7	16.4		19.7	Accts. & Notes Payable - Trade	18.3	17.9	20.4	19.2	19.7
4.6	6.8	8.7		6.1	Accrued Expenses	5.6	6.6	6.5	5.7	6.1
6.0	2.0	4.0		3.2	All Other Current	2.9	4.1	4.4	3.2	3.2
45.9	40.4	39.4		40.6	Total Current	40.7	39.8	44.2	39.7	40.6
16.1	18.5	25.2		18.7	Long Term Debt	17.1	18.4	17.7	18.4	18.7
5.5	2.8	3.0		3.6	All Other Non-Current	1.9	2.4	2.1	3.2	3.6
32.5	38.3	32.4		37.1	Net Worth	40.3	39.4	36.0	40.6	37.1
100.0	100.0	100.0		100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0
					INCOME DATA					
100.0	100.0	100.0		100.0	Net Sales	100.0	100.0	100.0	100.0	100.0
72.1	77.8	77.7		76.8	Cost Of Sales	75.7	76.2	75.8	76.3	76.8
27.9	22.2	22.3		23.2	Gross Profit	24.3	23.8	24.2	23.7	23.2
24.8	18.9	18.9		18.2	Operating Expenses	19.7	18.0	19.4	18.8	18.2
3.0	3.3	6.4		5.0	Operating Profit	4.6	5.8	4.8	5.0	5.0
1.0	1.3	.2.9		1.4	All Other Expenses (net)	1.4	1.0	1.1	1.3	1.4
1.9	4.1	2.6		3.6	Profit Before Taxes	3.2	4.8	3.7	3.6	3.6
					RATIOS					
2.1	2.1	2.5		2.2	Current	2.1	2.2	2.1	2.1	2.2
1.6	1.4	1.5		1.6		1.5	1.6	1.5	1.5	1.6
1.0	1.1	1.1		1.1		1.2	1.2	1.1	1.1	1.1
1.5	1.2	1.2		1.3	Quick	1.3	1.3	1.3	1.3	1.3
1.1	.8	.8		.9		.9	1.0	.9	1.0	.9
.8	.6	.6		.6		.6	.7	.6	.7	.6
38 9.7	36 10.5	40 9.1	36 10.2		Sales/Receivables	38 9.7	37 10.0	35 10.4	40 9.2	36 10.2
48 7.4	43 8.4	54 6.8	47 7.7			47 7.8	47 7.7	46 7.9	49 7.5	47 7.7
64 5.7	58 6.3	68 5.4	58 6.3			62 5.9	62 5.9	55 6.6	59 6.2	58 6.3
23 16.1	29 12.7	37 10.0	29 12.4		Cost of Sales/Inventory	42 8.7	29 12.6	34 10.8	33 11.2	29 12.4
37 9.8	42 8.6	50 7.3	43 8.5			54 6.8	50 7.3	50 7.3	43 8.4	43 8.5
69 5.1	57 6.4	65 4.3	63 5.8			70 5.2	68 5.4	69 5.3	65 5.6	63 5.8
7.2	7.6	8.0	7.0		Sales/Working Capital	6.8	8.1	8.5	6.9	7.0
11.8	13.5	10.7	12.3			10.7	9.0	11.6	11.5	12.3
1INF	32.7	31.1	32.3			22.9	29.5	33.9	22.3	32.3
5.1	6.2	3.7	7.6		EBIT/Interest	9.8	13.2	7.8	8.7	7.6
(22) 2.2	(58) 3.1	(17) 2.0	(101) 2.8			(95) 3.7	(83) 4.5	(115) 3.8	(105) 2.9	(101) 2.8
1.2	1.8	.9	1.4			1.6	2.2	1.6	1.2	1.4
8.3	8.7	6.3	7.9		Cash Flow/Cur. Mat. L/T/D	7.7	7.4	8.7	7.7	7.9
(12) 2.7	(56) 4.0	(13) 2.6	(84) 3.9			(87) 2.8	(78) 4.5	(90) 3.8	(93) 3.1	(84) 3.9
1.5	2.3	1.3	2.1			1.7	2.0	1.6	1.5	2.1
.4	.5	.7	.5		Fixed/Worth	.4	.5	.4	.5	.5
.8	1.0	1.3	1.0			.8	.9	.8	.7	1.0
2.0	1.8	2.1	1.7			1.4	1.5	1.5	1.4	1.7
1.0	.8	1.3	.9		Debt/Worth	.8	.8	.8	.8	.9
2.2	1.8	2.2	1.8			1.6	1.5	1.6	1.4	1.8
7.7	3.2	4.3	3.5			2.5	2.8	2.9	2.6	3.5
39.6	36.9	38.0	35.7		% Profit Before Taxes/Tangible Net Worth	35.7	41.8	39.4	32.2	35.7
(22) 25.6	(64) 24.0	16.5	(110) 23.4			(118) 22.5	(111) 25.3	(138) 24.0	(123) 18.8	(110) 23.4
5.7	10.5	-2.5	8.4			4.3	12.9	8.4	7.7	8.4
13.8	15.8	11.3	13.9		% Profit Before Taxes/Total Assets	14.8	16.4	15.3	13.8	13.9
6.3	8.8	5.0	7.3			8.1	10.2	8.2	8.0	7.3
1.2	3.0	-.6	1.6			1.9	4.1	2.2	2.1	1.6
17.4	13.2	9.1	13.4		Sales/Net Fixed Assets	10.4	10.2	12.7	11.3	13.4
13.2	7.2	6.1	7.4			6.3	6.8	7.9	8.6	7.4
7.7	4.0	4.0	4.3			3.7	4.2	4.6	4.3	4.3
3.3	2.9	2.4	2.9		Sales/Total Assets	2.4	2.7	2.7	2.8	2.9
2.7	2.2	2.0	2.2			2.1	2.1	2.2	2.1	2.2
1.9	1.8	1.4	1.7			1.7	1.6	1.6	1.5	1.7
.8	1.4	1.6	1.3		% Depr., Dep., Amort./Sales	1.5	1.3	1.5	1.4	1.3
(23) 1.8	(63) 2.0	(17) 1.9	(108) 2.0			(113) 2.3	(105) 2.3	(134) 2.1	(116) 2.1	(108) 2.0
2.7	3.3	2.8	3.2			3.7	3.9	3.4	3.5	3.2
1.7	.3		.5		% Lease & Rental Exp/Sales	.7	.4	.5	.5	.5
(15) 2.3	(24) .9		(46) 1.5			(56) 1.6	(45) 1.0	(72) 1.2	(58) 1.2	(46) 1.5
3.5	1.7		2.0			2.3	2.0	2.2	2.2	2.0
2.9	1.8		2.2		% Officers' Comp/Sales	2.0	2.5	2.1	2.0	2.2
(16) 4.1	(26) 2.9		(43) 3.5			(43) 4.1	(38) 4.0	(57) 4.0	(43) 3.6	(43) 3.5
6.5	4.3		4.7			5.8	6.3	7.6	6.5	4.7
34932M	571178M	741489M	638430M	1984039M	Net Sales ($)	1129218M	1206793M	1682251M	2539528M	1984039M
12720M	251388M	483183M	437520M	1106573M	Total Assets ($)	874729M	854930M	726872M	1364301M	1106573M

M = $thousand MM = $million

See Pages 1 through 12 for Explanation of Ratios and Data

1. Enter total long-term liabilities for the three most recent years (from Line 1e of Worksheet 3c) on Line 1 of Worksheet 5 (page 29 of the Workbook).

2. Find common stock at par (the value of the stock at its original purchase price) on the Comparative Consolidated Balance Sheet and subtract the value of any treasury stock. Record the results for the three most recent years on Line 2.

3. Find additional paid-in capital (may also be listed as "Capital Surplus".) on the Comparative Consolidated Balance Sheet. Record values for the three most recent years on Line 3.

4. Find the total value of the preferred stock (if any is listed) on the Comparative Consolidated Balance Sheet. Record values for the three most recent years on Line 4.

5. Find retained earnings on the Comparative Consolidated Balance Sheet. Record values for the three most recent years on Line 5.

6. For each year add Line 2 (common stock at par), Line 3 (additional paid-in capital), Line 4 (preferred stock), and Line 5 (retained earnings) to get stockholders' equity. Enter the results on Line 6.

7. For each year divide Line 1 (total long-term liabilities) by Line 6 (stockholders' equity) to get the Debt/Equity Ratio. Enter the results on Line 7 (page 29 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

8. Locate Debt/Worth Ratios for the appropriate SIC code in Morris' Annual Statement Studies. Record upper quartile, median, and lower quartile values for Debt/Worth Ratios for the three most recent years on Lines 8a through 8c.

9. Evaluate the three-year trend in the firm's Debt/Equity Ratios. Record the evaluation on Summary Line 1 (page 29 of the Workbook) and Worksheet 14 (page 57 of the Workbook). An example evaluation is:

   > "Debt/Equity Ratio has declined over the past three years, indicating an improvement in the firm's leverage position."

10. Compare the firm's Debt/Equity Ratios with the industry average Debt/Worth Ratios. Record the evaluation on Summary Line 2 (page 30 of the Workbook) and on Worksheet 14 (page 57 of the Workbook). An example evaluation is:

    > "The firm has had a Debt/Equity Ratio between the industry median and upper quartile for the past three years. The ratios have declined relative to industry averages over the past three years, indicating an improved leverage position."

An example calculation of the Debt/Equity Ratio using the sample firm data is shown in Exhibit 3-20.

Exhibit 3-20

WORKSHEET 5

DEBT/EQUITY RATIO WITHOUT COST OF POLLUTION CONTROL
($1000)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1.	Total Long-Term Liabilities Worksheet 3c, Line 1e	570,876	610,470	474,888
2.	Common Stock at Par	23,120	22,126	21,991
3.	Additional Paid-In Capital	129,808	90,834	89,482
4.	Preferred Stock	---	---	---
5.	Retained Earnings	1,022,727	981,187	898,273
6.	Stockholders' Equity Line (2) + Line (3) Line (4) + Line (5)	1,175,655	1,100,147	1,009,746
7.	Debt/Equity Ratio Line (1) divided by Line (6)	0.49	0.55	0.47
8a.	Industry Debt/Worth Ratio Upper Quartile	0.9	0.8	0.9
8b.	Industry Debt/Worth Ratio Median	1.8	1.4	1.6
8c.	Industry Debt/Worth Ratio Lower Quartile	3.5	2.8	2.9

SUMMARY

1. Evaluation of three-year trend in Debt/Equity Ratios: Firm's Debt/Equity Ratio has remained fairly constant over three years.

Exhibit 3-20 (continued)

WORKSHEET 5 (continued)

2. Comparison of Debt/Equity Ratios with industry averages: Firm is in much better position than rest of industry.

Interpretation

Two analyses are used to evaluate the Debt/Equity Ratio. These are:

1. industry averages; and
2. three-year trend.

The results should be recorded on Worksheets 14 and 16 on pages 57 and 58 of the Workbook. Examples are provided in Chapter 5.

No critical values are available because the degree of leverage that is desirable is a function of a firm's operating characteristics and therefore varies among industries and even over the life cycle of one firm. No adjusted ratio is calculated because pollution controls will not affect the Debt/Equity Ratio, assuming that the expenditure will be financed at the prevailing debt ratio.

Industry average Debt/Worth Ratios are more important comparative indicators than the three-year trend, since they depict the level of debt commonly associated with the riskiness of that line of business. Industry median and quartile ratios are used for comparison because better targets do not exist, but this comparison alone is often too simplistic. Operating characteristics may vary considerably within an industry, causing target leverage ratios to be different. Industry averages should, therefore, be used only as general indicators of the firm's degree of leverage. A Debt/Equity Ratio greater than the upper quartile Debt/Worth Ratio for the industry indicates that the firm may have trouble borrowing additional capital.

The three-year trend indicates whether the Debt/Equity Ratio has increased, decreased, or remained the same in recent years. If the Debt/Equity Ratio is above the industry median, an increase may indicate potential problems. A high Debt/Equity Ratio is a problem if there is a fair degree of uncertainty about future earnings of the firm. This uncertainty could be caused by unstable business conditions in the firm or the industry as a whole. A company with small fluctuations in earnings over a long period of time can afford to have a higher Debt/Equity Ratio than a less stable firm. An unstable firm is likely to have periods of low earnings during which the risk of defaulting on loans is high.

3.3 MARKET VALUE ANALYSIS

The financial statement analysis provides a review of recent historic performance and a point-in-time picture of a firm's financial status. What is not discernible from this vantage is how pollution control costs would affect expectations of the future performance of the firm. To predict the future effects one needs a prospective look based on expected financial performance of the firm with and without pollution control expenses.

One way of doing this would be to project pro forma (predicted) financial statements into future years by extrapolating past behavior and performance trends. Certain items such as inventory value, accounts receivable, and accounts payable could be estimated from past performance of the management of the firm in terms of ratios to total sales or average length of collection or payment time, for example. Other items like sales and operating costs could be extended along recent trend lines. These would allow a permit writer to estimate what future balance sheets and income statements might look like. Unfortunately, this would require a detailed understanding of the firm's industry and market, including how sales and costs vary with inflation, who the competitors are, what new technologies are influencing the supply and demand for the product, and how production assets are tied to sales volume and costs. collecting this information would be a formidable task beyond the scope of the permit writer's interests or capabilities. Instead a proxy for this forward-looking approach is used--analysis of stock prices. This is the purpose of the second component of the firm-level analysis--the market value analysis.

Stock prices reflect the opinions of many analysts and participants in the stock market who set the price of a stock by their buying and selling behavior. In theory, the price of a corporate stock is a measure of the net present value (NPV) of the future cash flows (profitability) of the firm. The value of money over time is considered in net present value by reducing--or discounting--the estimated future cash flow to a lesser amount based on the length of time involved and an assumed or effective interest rate. Thus stock prices are indicators of investors' expectations of the future profitability of a firm. They constitute a single-number substitute for a series of projected future financial statements. Because there are many security analysts who conduct detailed

financial evaluations of firms for investors who value such information very highly, and many investors who act on that information, it can be assumed that the market price of a firm's stock is a good substitute for the more rigorous and time-consuming analysis.

Any cost associated with pollution control will have only negative value as an investment for a firm, because the costs will not produce any revenue and will only result in reductions in net income. This reduction in income would reduce the stock value. Assuming the stock price represents the per-share amount of profits available now and in the future, it thus provides an indication of the upper limit on the after-tax cost of pollution control that could be incurred by a firm before deficit operation.

The market value analysis is performed in three steps. The first is the calculation of the NPV of the pollution control investment. The second is the determination of the stock price adjusted for the cost of pollution control. The third step is the calculation of the Market-to-Book Ratio of the stock, with and without the cost of pollution control.

3.3.1 Net Present Value Cost of Pollution Control

3.3.1.1 Theory

Comparisons involving expenditures and/or receipts at different times over a span of years are valid only if all are expressed relative to one point in time. The most convenient point in time to use is the present, and net present value (NPV) of a flow of receipts and/or expenditures is the standard method employed. Future cash flows, whether positive or negative, are expressed as a present value by discounting the specific cash flow, at a given or assumed interest rate, over the period of time from the present to the time of occurrence of the cash flow. Cash flow in this context is the gross amount of money received or spent in a transaction. The cash flow determination does not consider such things as the form or source of the funds or taxes or credits that may be involved in the transaction. For example, money expended in the current year to purchase and install pollution control equipment is a negative cash flow. It is not subject to discounting because it occurs in the current year. Operating and maintenance costs for this equipment are also negative cash flows, and revenue

received from the sale of by-products recovered by this equipment would be positive cash flows. Both of these future cash flows would have to be discounted to be correctly included in aggregate cash flow estimates for pollution control systems of interest. These discounted cash flows plus the present cash flow are summed to obtain the net present value, which may be negative for expenditures or positive for receipts. The net present value (NPV) of the cost of pollution control equipment may be approximated as the initial cost of the equipment plus the present value of the operating expenses discounted at an interest rate equal to the cost of equity (see Section 2.1 for a further discussion of cost of equity). Worksheet 6 on page 34 of the Workbook is used to calculate the cost of equity and the present value of the pollution control equipment. This is done for the most recent year for which data are available. In this calculation, the O&M costs are also discounted at the cost of equity.

The estimate of the cost of equity is based on the sum of a risk-free interest rate, e.g. the rate on U.S. Treasury Bills, and a historical rate of return on stocks in excess of the risk-free rate. The latter is calculated for a specific firm using the Value Line beta (β). This value is used as a multiplier to reflect an estimate of the comparative financial risk associated with a specific firm in relation to all firms listed on the New York Stock Exchange (NYSE). A firm representing a higher risk would expect its cost of equity to be higher, hence its beta would be greater than the NYSE average of 1.0.

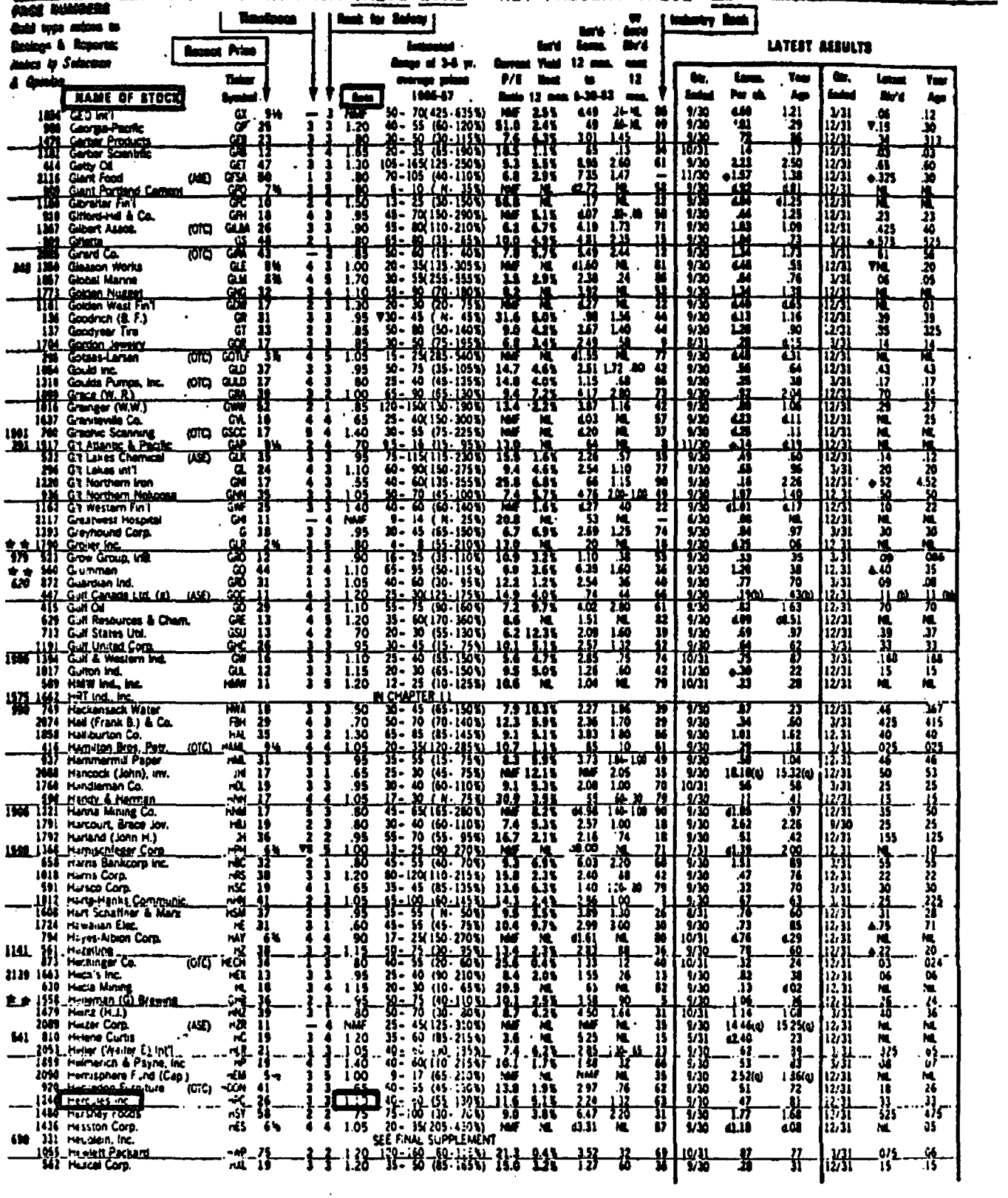
3.3.1.2 Calculation

The data needed to calculate the NPV of the pollution control equipment can be obtained from the Value Line report on the firm (see Exhibit 3-21) and Standard & Poor's Daily Stock Price Record. Information concerning the pollution control equipment itself (O&M cost, estimated life, and rate of growth O&M cost, for instance) must be developed by the permit writer or supplied by the firm. The NPV calculation is done on Worksheet 6 (page 34 of the Workbook), and the steps are as follows:

1. Multiply the capital cost of the pollution control equipment by 1 minus the investment tax credit factor or find the adjusted capital cost on Line 8a of Worksheet 4b. Enter this value on Line 1 of Worksheet 6 (page 34 of the Workbook).

Exhibit 3-21

GE—HE Page 18 — DATA FROM VALUE LINE - NET PRESENT VALUE — IT SURVEY — December 31, 19



79

2. Enter annual O&M expenditures for pollution control (from Line 6 of Worksheet 4b) on Line 2.

3. Record the operating life of the pollution control equipment (should not be greater than 10 years) on Line 3.

4. Record the rate of growth or inflation in O&M cost (in percent per year expressed as a decimal fraction) on Line 4.

5. Find the company beta (β) in the Value Line report for the firm. Record this value on Line 5.

6. Enter the risk-free rate of interest on Line 6. Use the current rate of return on six-month U.S. Treasury Bills to approximate the risk-free interest rate. This will be available from a local bank or the Federal Bank of the appropriate Federal Reserve District.

7. Mutiply Line 5 (company beta) by 0.08 and add this to Line 6 (risk-free interest rate) to get the discount rate. Record the result on Line 7. The 0.08 is the excess return on the stock market over the risk-free rate and it has historically been about eight percent.

8. Enter the value of recovered by-products from the pollution control equipment (if any) on Line 8. Use cost of production if recovered materials are produced at the specific plant and price as the value of raw materials are recovered. Prices of many chemicals and other substances are reported in the Chemical Marketing Reporter and other trade journals.

9. Using the following formula, calculate the present value of the O&M costs discounted and summed over the life of the pollution control equipment:

$$PVOM = \frac{(OM) \times \left(1 - \left(\frac{1+g}{1+r}\right)^{L}\right)}{1 - \left(\frac{1+g}{1+r}\right)}$$

where: PVOM = Present value of O&M costs
L = Life of equipment (Line 3)
OM = Annual O&M costs (Line 2)
g = Rate of growth in O&M costs (Line 4)
r = Discount rate (Line 7)

Enter the result on Line 9a.

10. Using the following formula, calculate the present value of recovered materials discounted and summed over the life of the pollution control equipment:

$$PVRM = \frac{(CR) \times \left(1-(1+r)^{L}\right)}{-r}$$

where: PVRM = Present value of recovered materials
L = Life of equipment (Line 3)
CR = Credits for product recovery (Line 8)
r = Discount rate (Line 7)

Enter the result on Line 9b.

11. Add Line 1 (adjusted capital cost) and Line 9a (present value of O&M costs) and subtract Line 9b (present value of recovered materials) to get the net present value of the costs of pollution control. Enter the result on Line 9c.

Exhibit 3-22 demonstrates this calculation using the sample firm data.

3.3.2 Adjusted Stock Price

3.3.2.1 Theory

Because the stock price reflects the net present value of expected future cash flows (profitability), subtracting the after-tax NPV of pollution control costs from the firm's market value provides an estimate of the impact of the equipment on the present value of future cash flows. In essence, the difference between market value and the NPV of pollution control costs is what the firm's market value would be if the control were required. Worksheet 7 on page 37 of the Workbook is used to perform this calculation.

3.3.2.2 Calculation

The data needed to calculate the adjusted stock price can be found in Moody's, Standard & Poor's Daily Stock Price Record, or Value Line. High and low stock prices for the year and the average number of shares outstanding can generally be found in the Financial and Operating Data section of Moody's (see Exhibit 3-23). This is the best source of these data. If the data are not available in Moody's, the permit writer should check the other sources. The stock price data in Standard & Poor's are expressed as 25-7, 22-1, etc., which means 25-7/8, 22-1/8, etc. The permit writer must go through an entire year's data to find the annual high and low stock prices in Standard & Poor's. The calculation is done for the most recent year and the steps are as follows:

Exhibit 3-22

WORKSHEET 6

NET PRESENT VALUE COST OF POLLUTION CONTROL
($1000)

		Most Recent Year of Company Data Year 1982
1.	Capital Cost of Pollution Control Adjusted for ITC Worksheet 4b, Line 8a	8,500
2.	Annual Operating and Maintenance Cost (OM) Worksheet 4b, Line 6	1,000
3.	Estimated Life of Equipment in Years (L)	5
4.	Expected Rate of Growth in O&M cost (g)	0.05
5.	Company Beta (β)	1.10
6.	Risk-Free Rate (r)	0.0944
7.	Discount Rate (r) Line (6) + (0.08 x Line (5))	0.0953
8.	Credits for Product Recovery (CR)	0
9a.	Present Value of O&M Costs (PVOM) $PVOM = \frac{(OM) \times \left(1-\left(\frac{1+g}{1+r}\right)^{L}\right)}{1-\left(\frac{1+g}{1+r}\right)}$	4,603
9b.	Present Value of Recovered Materials (PVRM) $PVRM = \frac{(CR) \times \left(1-(1+r)^{L}\right)}{-r}$	0
9c.	Present Value of Pollution Control Costs Line (1) + Line (9a) - Line (9b)	13,103

was $41,100,000 in 1982 and $37,300,000 in 1981.

At Dec. 31, 1982, minimum rental payments under noncancellable leases [illegible] $436,450,000 of which $25,050,000 is 1983, $19,000,000 in 1984, $19,100,0[illegible] $16,750,000 in 1986, and $13,600,000 i[illegible]

At Dec. 31, 1982, Co. was contingently liable as guarantor of notes payable of affiliated companies, aggregating $22,350,000.

Co. has adopted a Restricted Stock Incentive Plan providing for awards of up to a total of 600,000 shares, based on certain terms and conditions.

(e) Property, plant and equipment are stated at cost. For financial accounting purposes, Co. depreciates major portion of its processing facilities, using a modified declining bal-

Exhibit 3-23

DATA FROM MOODY'S - ADJUSTED STOCK PRICE

[illegible]ilities is de-[illegible]maining use-[illegible] method.

[illegible]nual periods. Remaining facilities of Co. and facilities of consolidated subsidiaries are depreciated or amortized principally on straight-line method.

Maintenance, repairs, and minor renewals are charged to income; major renewals and betterments are capitalized. Upon normal retirement or replacement, cost of property (less proceeds of sale or salvage) is charged to accumulated depreciation.

Auditor's Report

The following is an excerpt from the Report of Independent Auditors, Coopers & Lybrand, [illegible]d in 1982 Annual Report.

"[illegible]inion, the financial statements re[illegible]ve present fairly the consolidated [illegible]sition of Hercules Incorporated and subsidiary companies as of December 31, 1982 and 1981, and the consolidated results of their operations and changes in their financial position for the years ended December 31, 1982, 1981 and 1980, in conformity with generally accepted accounting principles consistently applied during the period except for the change in 1981, with which we concur, in the method of accounting for foreign currency translation, as described in Note 2 to the consolidated financial statements."

FINANCIAL & OPERATING DATA

Statistical Record	1982	1981	1980	1979	1978	1977	1976
Earned per share—							
—com. & com. eq. on yr. end. shs.	[1]$2.16	[6]$3.09	[1]$2.59	[4]$3.89	[3]$2.36	[2]$1.36	[2]$2.16
—com. & com. eq. on avge. shs.	[1]$2.22	$3.09	[1]$2.60	[4]$3.89	[3]$2.36	[2]$1.36	[2]$2.44
Dividends declared—		$1.26	$1.20	$1.07½	$1.00	$1.00	$0.85
Price Range—common	28¾-16⅞	26⅝-18¾	25-15⅛	22¾-16½	18⅝-12¼	28½-14¾	38-24
Conv. sub. deb. 6¾s, due 1999	85%-80%	85-67	83¾-65	84½-73	87-76	102½-82¼	117-93¾
Notes, 8¼s, 1983	99¾-93⅛	96¼-87⅛	97-82½	98¼-86½	103-94	105⅛-101¾	106¾-101
Net tangible assets per sh.—common	$24.14	$24.70	$23.69	$22.18	$19.[illegible]	$17.68	$17.34
Times charges earned:							
Before income taxes	3.11	3.02	4.68	9.13	6.68	4.29	7.38
After income taxes	2.71	3.92	4.05	6.42	4.30	2.78	4.39
No. of shares—							
—common, yr end	44,611,710	42,514,428	42,445,478	42,383,028	42,383,028	42,383,028	42,383,028
—common, average	43,211,839	42,508,368	42,420,225	42,383,028	42,383,028	42,383,028	42,332,752
Financial and Operating Ratios							
Current assets÷current liabilities	2.23	2.55	1.95	1.94	1.89	2.20	2.23
% cash & securities to current assets	4.36	3.13	4.64	7.18	8.19	4.85	5.40
% inventory to current assets	47.04	47.64	42.59	40.93	44.80	49.60	47.41
% net current assets to net worth	39.99	49.15	38.29	40.13	40.64	43.23	42.22
% property depreciated	55.59	55.03	53.64	54.63	53.78	53.07	51.17
% ann. depr. & amort. to gross prop.	5.79	5.89	6.08	6.25	6.60	6.11	6.23
Capitalization:							
% long term debt	28.59	30.18	24.89	22.89	26.56	30.31	30.55
% common stk. & surplus	71.41	69.82	75.11	77.11	73.44	69.69	69.45
Sales÷inventory	6.70	6.68	7.37	7.30	6.14	5.71	5.93
Sales÷receivables	6.49	6.48	5.95	5.76	5.86	6.22	5.96
% sales to net property	267.30	299.47	284.79	303.46	272.51	235.38	228.19
% sales to total assets	123.37	136.11	131.52	133.17	121.91	114.91	111.58
% net income to total assets	4.92	6.83	6.03	9.80	6.47	3.92	7.47
% net income to net worth	9.12	12.98	11.29	18.25	12.62	7.65	14.39
Analysis of Operations	%	%	%	%	%	%	%
Sales, less disc., etc.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cost of goods sold	82.66	80.86	82.04	79.01	77.17	79.33	76.87
Sell., gen. & adm. exp.	12.73	11.35	11.73	11.97	13.26	13.37	13.10
Balance	4.61	7.79	6.23	9.02	9.57	7.30	10.03
Other income	1.78	.83	0.80	3.38	1.18	0.85	4.53
Total income	6.39	8.62	7.03	12.40	10.75	8.15	14.56
Interest & debt expense	2.05	1.72	1.30	1.36	1.61	1.90	1.97
Net income before income taxes, etc.	4.34	6.90	5.53	11.04	9.14	6.25	12.59
Income & franchise taxes	0.82	1.88	0.94	3.68	3.83	2.84	5.90
Extraordinary gain	0.47	.....	.....	.....	.....	.....	.....
Net income	3.99	5.02	4.59	7.36	5.31	3.41	6.69

[1]Includes $0.66 nonrecurring gains. [2]Includes $0.14 plant write-down. [3]Includes $0.11 plant write-down. [4]Includes $0.62 gain on sale of pigment and methanol assets. [5]Includes $0.13 loss from terminating operations at joint-venture terephthalate plant at Middleburg. [6]Includes $0.27 write-down of facilities and investments. [7]Includes $0.25 extraordinary gain.

LONG TERM DEBT

1. Hercules Inc. 8¼% notes, due 1983:

Rating—A2

AUTH.—$100,000,000; outstg., Dec. 31, 1982, $100,000,000.
DATED—Apr. 1, 1975. DUE—Apr. 1, 1983.
INTEREST—A&O 1 to holders registered M&A 15.
TRUSTEE—Citibank, N.A., NYC.
DENOMINATION—Fully registered, $1,000 or any integral multiple thereof.
CALLABLE—As a whole or in part at any time on or after Apr. 1, 1981 on at least 30 but not more than 60 days' notice at 100, plus accrued interest.
SINKING FUND—None.
SECURITY—Not secured. Co. nor any restricted subsidiary may create, assume or guarantee any secured debt without making effective provision for securing the notes (and any other indebtedness of, or indebtedness guaranteed by, Co. or such restricted subsidiary then entitled thereto) equally and ratably with such secured debt, except for (i) certain mortgages, pledges, liens or encumbrances in connection with the acquisition or construction of property by Co. or a restricted subsidiary, (ii) certain mortgages on property of Co. or a restricted subsidiary on which new plants are constructed if, in the opinion of the board of directors, such property was substantially unimproved for its intended use prior to such construction, (iii) mortgages, pledges, liens or encumbrances on property existing at the time of acquisition thereof, whether or not assumed by Co. or a restricted subsidiary, (iv) mortgages, pledges, liens or encumbrances on property, shs. of stock or indebtedness of any corporation existing at the time such corporation becomes a restricted subsidiary, (v) mortgages, pledges, liens or encumbrances on property of a corporation existing at the time such corporation is merged into or consolidated with Co. or a restricted subsidiary or at the time of a sale, lease or other disposition of the properties of a corporation or firm as an entirety or substantially as an entirety to Co. or a restricted subsidiary, (vi) mortgages, pledges, liens or encumbrances on property of Co. or a restricted subsidiary to secure indebtedness owing to Co. or a restricted subsidiary, (vii) mortgages on property of Co. or a restricted subsidiary in favor of the United States of America or any State thereof, or in favor of any other country, or any agency, instrumentality or political subdivision thereof, to secure certain payments pursuant to any contract or statute or to secure indebtedness incurred for the purpose of financing all or any part of the purchase price or the cost of construction of the property subject to such mortgages, (viii) reservations or exceptions contained in any instruments under which Co. or a restricted subsidiary owns or acquires any property and under the terms of which any vendor, lessor or assignor reserves or excepts an interest in oil, gas or any other mineral or the proceeds thereof, (ix) conveyances or assignments under the terms of which Co. or a restricted subsidiary conveys or assigns an interest in oil, gas or other mineral or the proceeds thereof, (x) liens on any property owned by Co. or a restricted subsidiary, or in which Co. or a restricted subsidiary owns an interest, to secure payment of Co.'s or such restricted subsidiary's proportionate part of the expenses of developing or conducting operations for the recovery, storage, transportation or sale of the mineral resources of such property, or (xi) any extension, renewal or replacement (or successive extensions, renewals or replacements), in whole or in part, of any mortgage, pledge, lien or encumbrance referred to in the foregoing clauses (i to x), inclusive. Notwithstanding the above, Co. and one or more restricted subsidiaries may, without securing the notes, issue, assume or guarantee secured debt which would otherwise be subject to the foregoing restrictions, provided that, after giving effect thereto, the aggregate amount of such secured debt then outstg. (not including secured debt permitted under the foregoing exceptions) and the aggregate "value" of sale and leaseback transactions (other than such transactions in connection with which indebtedness has been, or will be, retired in accordance with the following provision) at such time does not exceed 5% of shareholders' ownership.

The indenture will provide that no consolidation or merger of Co. and no sale of all or substantially all of its property shall be made with or to another corporation having any obligations secured by mortgage if any important property owned by C[illegible]ediately prior thereto would become subject to the lien of such mortgage, unless the notes shall be secured by a direct lien upon all such important property, prior in rank to all liens other than any theretofore existing thereon, subject to applicable priorities of payment.

SALE & LEASEBACK PROVISION—Sale and leaseback transactions by Co. or any restricted subsidiary of any important property will be prohibited unless (a) the property involved is property which could be mortgaged without equally and ratably securing the notes, or (b) an amount equal to the proceeds of sale or the fair value of the property sold (whichever is higher) is applied to the retirement of indebtedness for money borrowed by Co. or a restricted subsidiary, which was recorded as funded debt as of the date of its creation and which, in case of such indebtedness of Co., is not subordinate and junior in right of payment to the prior payment of the notes.

Co. will not itself, and will not permit any restricted subsidiary to, transfer any important property to any unrestricted subsidiary, without retiring indebtedness as summarized in clause (b) of the preceding paragraph.

INDENTURE MODIFICATION—Indenture may be modified, except as provided, with consent of 66⅔% of notes outstg.

LISTED—On New York Stock Exchange.

PURPOSE—Proceeds to reduce domestic short-term borrowings.

OFFERED—($100,000,000) at 100 (proceeds to Co., 99.30) on Mar. 26, 1975 thru Lehman Brothers, Inc. and Merrill Lynch, Pierce, Fenner & Smith, Inc. and associates.

2. Hercules, Inc. convertible subordinated debenture 6¼s, due 1999:

Rating—A3

AUTH.—$100,000,000; outstg., Dec. 31, 1982, $50,000,000.
DATED—Aug. 15, 1974. DUE—June 30, 1999.
INTEREST—J30 & D31 to holders registered J&D 15.
TRUSTEE—Bankers Trust Co., NYC.
DENOMINATION—Fully registered, $1,000 or any integral multiple thereof.
CALLABLE—As a whole or in part at any time on at least 30 but not more than 60 days' notice to each June 29, as follows:

1. Obtain the high and low stock prices for the most recent year from Moody's, Value Line, or Standard & Poor's. Record the values on Lines 1a and 1b of Worksheet 7 (page 37 of the Workbook).

2. Obtain the average number of shares outstanding during the most recent year from Moody's, Value Line, or Standard & Poor's Daily Stock Price Record. Record the value on Line 2.

3. Multiply Lines 1a and 1b (high and low stock prices) by Line 2 (number of shares outstanding) to get the high and low market values of the firm. Record the results on Lines 3a and 3b.

4. Enter the NPV cost of pollution control (from Line 9c of Worksheet 6) on Line 4.

5. Enter the marginal tax rate for the firm (if available or use 0.46; can also be found on Line 3 of Worksheet 4b) on Line 5a.

6. Subtract Line 5a (marginal tax rate) from 1; enter result on Line 5b.

7. Multiply Line 4 (NPV cost of pollution control) by Line 5b to get the after-tax NPV cost of pollution control. Record the result on Line 6.

8. Subtract Line 6 (after-tax NPV cost of pollution control) from Line 3a (market value - high) or Line 3b (market value - low) to get the high and low market values adjusted for the after-tax NPV cost of pollution control. Record the results on Lines 8a and 8b.

9. Divide Line 7a (adjusted market value - high) or Line 7b (adjusted market value - low) by Line 2 (number of shares outstanding) to get the high and low stock prices adjusted for the after-tax NPV cost of pollution control. Record the results on Lines 8a and 8b.

10. Divide Line 6 (after-tax NPV cost of pollution control) by Line 3a (market value - high) or Line 3b (market value - low) to get a measure of the impact of the pollution control cost on the firm. It is expressed as what fraction the after-tax NPV pollution control cost is of the high and low market values of the firm. Record these values on Lines 9a and 9b.

An example of the above calculations using the sample firm data is shown in Exhibit 3-24.

Exhibit 3-24

WORKSHEET 7

ADJUSTED STOCK PRICE

	Most Recent Year of Company Data
	Year 1982
1a. Stock Price ($/share) - High	28.75
1b. Stock Price ($/share) - Low	16.875
2. Number of Shares Outstanding (X1000)	43,212
3a. Market Value ($1000) - High Line (1a) x Line (2)	1,242,345
3b. Market Value ($1000) - Low Line (1b) x Line (2)	729,203
4. NPV Cost of Pollution Control ($1000) Worksheet 6, Line 9c	13,103
5a. Marginal Tax Rate Worksheet 4b, Line 3	0.46
5b. 1 - Line (5a)	0.54
6. NPV Cost of Control After Tax ($1000) Line (4) x Line (5b)	7,076
7a. Adjusted Market Value ($1000) - High Line (3a) - Line (6)	1,235,269
7b. Adjusted Market Value ($1000) - Low Line (3b) - Line (6)	722,127
8a. Adjusted Stock Price ($/share) - High Line (7a) divided by Line (2)	28.59
8b. Adjusted Stock Price ($/share) - Low Line (7b) divided by Line (2)	16.71
9a. NPV Cost of Control After Tax as a Fraction of Market Value - High Line (6) divided by Line (3a)	0.0057
9b. NPV Cost of Control After Tax as a Fraction of Market Value - Low Line (6) divided by Line (3b)	0.0097

3.3.3 Market-To-Book-Ratio

3.3.3.1 Theory

The third part of the market value analysis is the calculation of Market-to-Book Ratio. This ratio measures the value the stock market places on a firm in relation to an estimate of the tangible asset value of the firm "on the books", i.e. the net worth of the firm. Net worth, or book value, is computed as total assets minus total liabilities. Book value is expressed per share as is the stock market price. Stockholders' equity is an alternative measure of net worth, as used on Worksheet 8 on pages 40 and 41 of the Workbook. The Market-to-Book Ratio is used to assess the trend in stock market evaluation of the firm over a period of time relative to the book evaluation for the same time. The effect of the cost of pollution control equipment on market evaluation is expressed as the net present value of the total cost after-tax subtracted from the current stock market price. The Market-to-Book Ratio is recomputed with market value adjusted as described previously. Changes in the ratio are indicators of the pollution control cost effects.

3.3.3.2 Calculation

The Market-to-Book Ratio is calculated using Worksheet 8 on pages 40 and 41 of the Workbook. The calculation is done for the three most recent years without the cost of pollution control and for the most recent year adjusted for the cost of pollution control. The data needed are available in Value Line Industry Surveys, Moody's (Exhibit 3-25), Standard and Poor's Industry Reports, or the firm's annual reports. The steps in the calculation of Market-to-Book Ratio are as follows:

1. Obtain the high and low values of the firm's stock from Moody's (see Exhibit 3-25), Value Line, or Standard & Poor's Daily Stock Price Record. Record values for the three most recent years on Lines 1a and 1b of Worksheet 8 (page 40 of the Workbook).
2. Enter stockholders' equity, from Line 6 of Worksheet 5, for the three most recent years on Line 2a.
3. Enter average number of shares outstanding for the three most recent years on Line 2b. This information can be found on Line 2 of Worksheet

was $41,100,000 in 1982 and $37,300,000 in 1981.

At Dec. 31, 1982, minimum rental payments under noncancellable leases $436,450,000 of which $25,050,000 1983, $19,000,000 in 1984, $19,10($16,750,000 in 1986, and $13,600,0(

At Dec. 31, 1982, Co. was contingently liable as guarantor of notes payable of affiliated companies, aggregating $22,350,000.

Co. has adopted a Restricted Stock Incentive Plan providing for awards of up to a total of 600,000 shares, based on certain terms and conditions.

(e) Property, plant and equipment are stated at cost. For financial accounting purposes, Co. depreciates major portion of its processing facilities, using a modified declining balance meth preciated ful lives. L...

Exhibit 3-25

DATA FROM MOODY'S - MARKET-TO-BOOK RATIO

cilities is demaining useful period

mitual periods. Remaining facilities of Co. and facilities of consolidated subsidiaries are depreciated or amortized principally on straight-line method.

Maintenance, repairs, and minor renewals are charged to income; major renewals and betterments are capitalized. Upon normal retirement or replacement, cost of property (less proceeds of sale or salvage) is charged to accumulated depreciation.

Auditor's Report

"The following is an excerpt from the Report of Independent Auditors, Coopers & Lybrand, ared in 1982 Annual Report.

'opinion, the financial statements re- above present fairly the consolidated ... position of Hercules Incorporated and subsidiary companies as of December 31, 1982 and 1981, and the consolidated results of their operations and changes in their financial position for the years ended December 31, 1982, 1981 and 1980, in conformity with generally accepted accounting principles consistently applied during the period except for the change in 1981, with which we concur, in the method of accounting for foreign currency translation, as described in Note 2 to the consolidated financial statements."

FINANCIAL & OPERATING DATA

Statistical Record	1982	1981	1980	1979	1978	1977	1976
Earned per share—							
—com. & com. eq. on yr. end. shs.	[7]$2.16	[5]$3.09	[3]$2.59	[4]$3.89	[2]$2.36	[2]$1.36	[1]$2.36
—com. & com. eq. on avge. shs.	[7]$2.22	[5]$3.09	[3]$2.60	[4]$3.89	[2]$2.36	[2]$1.36	[1]$2.44
Dividends per share—common	$1.12	$1.26	$1.20	$1.07½	$1.00	$1.00	$0.85
Price Range—common	28¾-16⅞	26¼-18¾	25-15¼	22¾-16¼	18⅝-12½	28½-14¾	38-24
Conv. subord. debs., due 1999	85¾-80⅜	85-81	83½-80	84¼-73	87-76	102½-82¼	117-93¼
Notes, 8¾s, 1983	99¾-93½	96¼-87¼	97-82½	98¼-86½	103-94	105⅝-101⅝	106⅜-101
Net tangible assets per sh.—common	$24.14	$24.70	$23.69	$22.18	$19.16	$17.68	$17.34
Times charges earned:							
Before income taxes	3.11	5.02	4.68	9.13	6.68	4.29	7.38
After income taxes	2.71	3.92	4.05	6.42	4.30	2.78	4.39
No. of shares—							
Outstanding at end	44,611,710	42,514,428	42,445,428	42,383,028	42,383,028	42,383,028	42,383,028
—common, average	43,211,839	42,508,368	42,420,225	42,383,028	42,383,028	42,383,028	42,332,752
Financial and Operating Ratios							
Current assets ÷ current liabilities	2.23	2.55	1.95	1.94	1.89	2.20	2.23
% cash & securities to current assets	4.36	3.23	4.64	7.18	8.19	4.85	5.40
% inventory to current assets	47.04	47.64	42.59	40.93	44.80	49.60	47.41
% net current assets to net worth	39.99	49.35	38.29	40.13	40.64	43.23	42.22
% property depreciated	55.59	53.03	53.64	54.63	55.78	53.07	51.17
% ann. depr. & amort. to gross prop.	5.79	5.89	6.08	6.25	6.60	6.11	6.23
Capitalization:							
% long term debt	28.59	30.18	24.89	22.89	26.56	30.31	30.55
% common stk. & surplus	71.41	69.82	75.11	77.11	73.44	69.69	69.45
Sales ÷ inventory	6.70	6.68	7.37	7.30	6.14	5.71	5.93
Sales ÷ receivables	6.49	6.48	5.95	5.76	5.86	6.22	5.96
% sales to net property	267.30	299.47	284.79	303.46	272.51	235.38	228.19
% sales to total assets	123.37	136.11	131.52	133.17	121.91	114.91	111.58
% net income to total assets	4.92	6.83	6.03	9.80	6.47	3.92	7.47
% net income to net worth	9.12	12.98	11.29	18.25	12.62	7.65	14.39
Analysis of Operations	%	%	%	%	%	%	%
Sales, less disc., etc.	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cost of goods sold	82.66	80.86	82.04	79.01	77.17	79.33	76.87
Sell., gen. & adm. exp.	12.73	11.35	11.73	11.97	13.26	13.37	13.10
Balance	4.61	7.79	6.23	9.02	9.57	7.30	10.03
Other income	1.78	.83	0.80	3.38	1.18	0.85	4.53
Total income	6.39	8.62	7.03	12.40	10.75	8.15	14.56
Interest & debt expense	2.05	1.72	1.50	1.36	1.61	1.90	1.97
Net income before income taxes, etc.	4.34	6.90	5.53	11.04	9.14	6.25	12.59
Income & franchise taxes	0.82	1.88	0.94	3.68	3.83	2.84	5.90
Extraordinary gain	0.47	.....	.....	.....	.....	.....	.....
Net income	3.99	5.02	4.59	7.36	5.31	3.41	6.69

[1]Includes $0.66 nonrecurring gains. [2]Includes $0.14 plant write-down. [3]Includes $0.11 plant write-down. [4]Includes $0.62 gain on sale of pigment and methanol assets. [5]Includes $0.13 loss from terminating operations at joint-venture terephthalate plant at Middleburg. [6]Includes $0.27 write-down of facilities and investments. [7]Includes $0.25 extraordinary gain.

LONG TERM DEBT

1. Hercules Inc. 8¾% notes, due 1983:

Rating—A2

AUTH.—$100,000,000; outstg., Dec. 31, 1982, $100,000,000.

DATED—Apr. 1, 1975. DUE—Apr. 1, 1983.

INTEREST—A&O 1 to holders registered M&A 15.

TRUSTEE—Citibank, N.A., NYC.

DENOMINATION—Fully registered, $1,000 or any integral multiple thereof.

CALLABLE—As a whole or in part at any time on or after Apr. 1, 1981 on at least 30 but not more than 60 days' notice at 100, plus accrued interest.

SINKING FUND—None.

SECURITY—Not secured. Co. nor any restricted subsidiary may create, assume or guarantee any secured debt without making effective provision for securing the notes (and any other indebtedness of, or indebtedness guaranteed by, Co. or such restricted subsidiary then entitled thereto) equally and ratably with such secured debt, except for (i) certain mortgages, pledges, liens or encumbrances in connection with the acquisition or construction of property by Co. or a restricted subsidiary, (ii) certain mortgages on property of Co. or a restricted subsidiary on which new plants are constructed if, in the opinion of the board of directors, such property was substantially unimproved for its intended use prior to such construction, (iii) mortgages, pledges, liens or encumbrances on property existing at the time of acquisition thereof, whether or not assumed by Co. or a restricted subsidiary, (iv) mortgages, pledges, liens or encumbrances on property, shs. of stock or indebtedness of any corporation existing at the time such corporation becomes a restricted subsidiary, (v) mortgages, pledges, liens or encumbrances on property of a corporation existing at the time such corporation is merged into or consolidated with Co. or a restricted subsidiary or at the time of a sale, lease or other disposition of the properties of a corporation or firm as an entirety or substantially as an entirety to Co. or a restricted subsidiary, (vi) mortgages, pledges, liens or encumbrances on property of Co. or a restricted subsidiary to secure indebtedness owing to Co. or a restricted subsidiary, (vii) mortgages on property of Co. or a restricted subsidiary in favor of the United States of America or any State thereof, or in favor of any other country, or any agency, instrumentality or political subdivision thereof, to secure certain payments pursuant to any contract or statute or to secure indebtedness incurred for the purpose of financing all or any part of the purchase price or the cost of construction of the property subject to such mortgages, (viii) reservations or exceptions contained in any instruments under which Co. or a restricted subsidiary owns or acquires any property and under the terms of which any vendor, lessor or assignor reserves or excepts an interest in oil, gas or any other mineral or the proceeds thereof, (ix) conveyances or assignments under the terms of which Co. or a restricted subsidiary conveys or assigns an interest in oil, gas or other mineral or the proceeds thereof, (x) liens on any property owned by Co. or a restricted subsidiary, or in which Co. or a restricted subsidiary owns an interest, to secure payment of Co.'s or such restricted subsidiary's proportionate part of the expenses of developing or conducting operations for the recovery, storage, transportation or sale of the mineral resources of such property, or (xi) any extension, renewal or replacement (or successive extensions, renewals or replacements), in whole or in part, of any mortgage, pledge, lien or encumbrance referred to in the foregoing clauses (i to x), inclusive. Notwithstanding the above, Co. and one or more restricted subsidiaries may, without securing the notes, issue, assume or guarantee secured debt which would otherwise be subject to the foregoing restrictions, provided that, after giving effect thereto, the aggregate amount of such secured debt then outstg. (not including secured debt permitted under the foregoing exceptions) and the aggregate "value" of sale and leaseback transactions (other than such transactions in connection with which indebtedness has been, or will be, retired in accordance with the following provision) at such time does not exceed 5% of shareholders' ownership.

The indenture will provide that no consolidation or merger of Co. and no sale of all or substantially all of its property shall be made with or to another corporation having any obligations secured by mortgage if any important property owned immediately prior thereto would become subject to the lien of such mortgage, unless the notes shall be secured by a direct lien upon all such important property, prior in rank to all liens other than any theretofore existing thereon, subject to applicable priorities of payment.

SALE & LEASEBACK PROVISION—Sale and leaseback transactions by Co. or any restricted subsidiary of any important property will be prohibited unless (a) the property involved is property which could be mortgaged without equally and ratably securing the notes, or (b) an amount equal to the proceeds of sale or the fair value of the property sold (whichever is higher) is applied to the retirement of indebtedness for money borrowed by Co. or a restricted subsidiary, which was recorded as funded debt as of the date of its creation and which, in case of such indebtedness of Co., is not subordinate and junior in right of payment to the prior payment of the notes.

Co. will not itself, and will not permit any restricted subsidiary to, transfer any important property to any unrestricted subsidiary, without retiring indebtedness as summarized in clause (b) of the preceding paragraph.

INDENTURE MODIFICATION—Indenture may be modified, except as provided, with consent of 66⅔% of notes outstg.

LISTED—On New York Stock Exchange.

PURPOSE—Proceeds to reduce domestic short-term borrowings.

OFFERED—($100,000,000) at 100 (proceeds to Co., 99.30) on Mar. 26, 1975 thru Lehman Brothers, Inc. and Merrill Lynch, Pierce, Fenner & Smith, Inc. and associates.

2. Hercules, Inc. convertible subordinated debenture 6½s, due 1999:

Rating—A3

AUTH.—$100,000,000; outstg., Dec. 31, 1982, $50,000,000.

DATED—Aug. 15, 1974. DUE—June 30, 1999.

INTEREST—J30 & D31 to holders registered J&D 15.

TRUSTEE—Bankers Trust Co., NYC.

DENOMINATION—Fully registered, $1,000 or any integral multiple thereof.

CALLABLE—As a whole or in part at any time on at least 30 but not more than 60 days' notice to each June 29, as follows:

7 (for the most recent year) and Moody's, Value Line, or Standard & Poor's Daily Stock Price Record. It should be noted that the number of shares outstanding can change from year to year so the values may not all be the same.

4. For each year divide Line 2a (stockholders' equity) by Line 2b (number of shares outstanding) to get book value per share. Enter the results on Line 2c.

5. For each year divide Line 1a (market value/share - high) or Line 1b (market value/share - low) by Line 2c (book value/share) to get the Market-to-Book Ratios. Record the results on Lines 3a and 3b and on Worksheet 14 (page 57 of the Workbook).

6. For the most recent year, enter high and low adjusted market values per share (from Lines 8a and 8b of Worksheet 7) on Lines 4a and 4b.

7. Divide Line 4a (adjusted market value/share - high) or Line 4b (adjusted market value/share - low) by Line 2c (book value/share) to get the Market-to-Book Ratios adjusted for the cost of pollution control. Record the results on Lines 5a and 5b and on Worksheet 15 (page 58 of the Workbook).

8. Evaluate the three-year trend in stock prices and Market-to-Book Ratios. Record results of this evaluation on Summary Line 1 (page 40 of the Workbook) and on Worksheet 14 (page 57 of the Workbook).

9. Evaluate the change in Market-to-Book Ratio due to the cost of pollution control. Record results of this evaluation on Summary Line 2 (page 41 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

Exhibit 3-26 shows a calculation of Market-to-Book Ratios using the sample firm data.

3.3.3.3 Interpretation

Two analyses are used to evaluate the Market-to-Book ratio. These are:

1. three-year trend; and
2. adjusted ratios.

These analyses are described below. The results and interpretation should be entered on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. Examples are provided in Chapter 5.

Critical values and industry averages are not used because Market-to-Book Ratios vary widely from industry to industry and from firm to firm. In addition, Market-to-Book Ratios may vary widely over the life cycle of a given firm.

Exhibit 3-26

WORKSHEET 8

MARKET-TO-BOOK RATIO
($)

		Three Most Recent Years of Company Data		
		Year 1982	Year 1981	Year 1980
1a.	Market Value per Share - High	28.75	26.375	25.0
1b.	Market Value per Share - Low	16.875	18.75	15.125
2a.	Stockholders' Equity ($1000)	1,175,655	1,100,147	1,009,746
2b.	Number of Shares Outstanding (X1000)	43,212	42,508	42,420
2c.	Book Value per Share Line (2a) divided by Line (2b)	27.21	25.88	23.80
3a.	M/B Ratio - High Line (1a) divided by Line (2c)	1.06	1.02	1.05
3b.	M/B Ratio - Low Line (1b) divided by Line (2c)	0.62	0.72	0.64
4a.	Adjusted Market Value per Share - High Worksheet 7, Line 8a	28.59		
4b.	Adjusted Market Value per Share - Low Worksheet 7, Line 8b	16.71		
5a.	Adjusted M/B Ratio - High Line (4a) divided by Line (2c)	1.05		
5b.	Adjusted M/B Ratio - Low Line (4b) divided by Line (2c)	0.61		

SUMMARY

1. Three-year trend in stock prices and Market-to-Book Ratios: Stock prices and Market-to-Book Ratios have been fairly constant over the past three years.

Exhibit 3-26 (continued)

WORKSHEET 8 (continued)

2. Change in Market-to-Book Ratios due to cost of pollution control: No noticeable changes in Market-to-Book Ratios due to pollution control costs.

The three-year trend indicates whether the Market-to-Book Ratio has increased, decreased, or remained the same in recent years. In general, a decreasing ratio is a negative sign because it indicates decreasing investor confidence in the earning potential of the firm. A stable or increasing ratio indicates investor confidence. However, two factors must be considered in using the Market-to-Book Ratio. First, stock prices frequently rise and fall in response to other factors other than the expected performance of the firm. As a result, changes in stock price, and consequently in the Market-to-Book Ratio, may be largely unrelated to the expected performance of the firm. Second, market prices may be affected by changes in dividend payments by the company, which may not be directly related to the financial health of the firm.

The adjusted ratio indicates the Market-to-Book Ratio that would be expected if the pollution control investment is made. The adjusted ratio will always be less than the unadjusted ratios. The reduction in the ratio is to be considered in relation to the recent trends of the ratio:

- does it seem to indicate that the cost will seriously jeopardize an already precarious corporate situation; or
- will it turn a marginally promising situation into a questionable one; or
- will the effect be no greater than the variation found in the recent past?

The adjusted ratio can also be considered in terms of the percent reduc tion from the unadjusted ratio. The significance of the reduction is a qualitative judgement, as is the comparison to recent trends. No precise guidelines are available as to what would constitute acceptable or un- acceptable impacts on the Market-to-Book Ratio. Substantial reductions or changes may be viewed as one set of adverse indicators to be considered with the other firm-level results discussed in this chapter.

CHAPTER 4

PLANT-LEVEL ANALYSIS

4.1 INTRODUCTION

The firm-level tests presented in Chapter 3 are relatively straightforward and depend on readily available data. However, these tests may not be sufficient to determine if an individual plant can maintain operations when faced with additional pollution control expenditures. Even though a firm could afford the additional cost, it may be more profitable to close a plant rather than install the pollution control equipment. Two conditions would indicate a need for plant-level analysis:

- the firm contends that investment in pollution control would make the plant unprofitable to operate; or
- the firm-level analysis indicates that investment in pollution control would have a serious detrimental effect on the firm's financial health.

The plant-level analysis described in this chapter is based on plant-specific costs and revenues and is designed to focus on potential plant shutdowns rather than total corporate ability to pay. An analysis of a plant's ability to pay for pollution control can be very complex because:

- plant-level financial data are usually confidential;
- the necessary data, particularly concerning the allocation of corporate overhead expenses, are not always collected by firms at the plant level; and
- non-standardized accounting procedures used internally by firms do not facilitate easy verification of reported cost and revenue items.

The plant-level tests are intended and designed as screening tests rather than rigorous and definitive evaluations of a plant's ability to afford pollution control costs. If the test results indicate that pollution controls would impose severe economic impacts, then a more detailed plant closure analysis would be necessary. This would entail working closely with the plant and corporate accountants to gather information on a variety of costs, revenues, and accounting procedures. Mathematical modelling of the plant's profitability may

be necessary. Information on salvage values of equipment as well as projections of future economic conditions may be desirable or required. A methodology for plant closure analysis is not presented in this document.

Three tests are presented in this chapter: the Earnings Test, the Gross Margin Test, and the Revenue Test. The choice of test to be used depends on the availability of data. The Earnings Test, which is the most accurate of the three tests, also requires the most data. The permit writer should use Exhibit 4-1 as a guide in determining which test to perform.

These tests are designed to be simple to perform. However, the data needed may not always be readily available or easily derived. The most significant data problems are summarized below.

- Corporate overhead expenses are not usually allocated to individual plants, and if they are, biases in the allocation method are not easily detected.
- Gross margin at the plant level may not be explicitly calculated and the components of gross margin may not be recorded.
- The components of cost of goods sold are subject to biases and misallocations.
- Transfer prices for inputs "purchases" by the plant from other parts of the company can be inflated to bias costs upward.
- Transfer prices that are assigned to intermediate products "sold" to other parts of the company may be artificially low, causing revenues to be biased downward.
- Average industry ratios of earnings before taxes (EBT) to gross margin and EBT to revenue may not reflect specific plant ratios.

Exhibit 4-1

GUIDANCE FOR USE OF PLANT-LEVEL TESTS

Test	Plant Data Needed	Worksheets Needed
Earnings Test	Total annual cost of pollution control; revenues; cost of goods sold; corporate overhead	9, 10, 11
Gross Margin Test	Total annual cost of pollution control; revenues; cost of goods sold	9, 10, (Lines 1-3), 12
Revenue Test	Total annual cost of pollution control; revenues	9, 10 (Line 1), 13

4.2 POLLUTION CONTROL COSTS AND EBT

Once the permit writer has obtained the available data from the plant, two items must be calculated before a plant-level test can be performed. These are the total annual cost of pollution control and the plant's earnings before taxes (EBT). These calculations are described in this section.

4.2.1 Total Annual Cost of Pollution Control

4.2.1.1 Theory

Any piece of pollution control equipment has two types of costs associated with it:

- Capital Cost - the cost of buying and installing the equipment; and
- Operating and Maintenance (O&M) Costs - the annual expenses necessary to maintain and operate the equipment.

The plant-level tests require comparisons of pollution control costs to annual income statement items, so it is necessary to put the lump sum capital cost in annual terms. A capital recovery factor (CRF) is used to annualize capital investment cost over the useful life of the equipment. This factor, when multiplied by the capital cost of the equipment, defines a series of annual cash flows. When these values are added to the annual O&M cost, the result is the total annual cost of the pollution control technology.

4.2.1.2 Calculation

The formula for the capital recovery factor is:

$$CRF = \frac{i(1 + i)^n}{(1+i)^n - 1}$$

where: CRF = Capital recovery factor
i = Cost of capital (or interest rate)
n = Life of pollution control equipment

Ideally, the cost of capital (i) would be calculated for every firm based on its debt/equity ratio, borrowing rate, market risk, and state and local tax rates. This

is discussed in more detail in Chapter 2 (Section 2.2.3.1). Because information needed to calculate the cost of capital for a firm can be very time-consuming to collect, the interest rate is usually substituted for the cost of capital. This is the value for interest rate on new debt used in Worksheet 3d (Line 3). As can be seen in the formula, the capital recovery factor is a function of the interest rate (or cost of capital) and the life of the pollution control equipment. Both of these items therefore will have a significant effect on the value of the capital recovery factor. If information on the interest rate and/or equipment life are uncertain or essentially unavailable to the permit writer, these items could be varied in a sensitivity analysis to assess their impact on the total annual costs. All of the data needed to calculate the total annual cost of the pollution control technology can be found on the worksheets which were used in the firm-level analysis. The calculation of the total annual cost is performed using Worksheet 9 on page 45 of the Workbook. The steps in the calculation are as follows:

1. Enter the capital cost of the pollution control technology (from Line 2a of Worksheet 1b on page 7 of the Workbook) on Line 1 of Worksheet 9 (page 45 of the Workbook).

2. Enter the interest rate on new debt (from Line 3 of Worksheet 3d on page 19 of the Workbook) on Line 2a.

3. Enter the estimated life of the pollution control equipment in years (from Line 3 of Worksheet 6 on page 34 of the Workbook) on Line 2b.

4. Calculate the capital recovery factor (CRF) using the following formula:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where : CRF = Capital recovery factor
i = Interest rate on new debt (Line 2a)
n = Estimated life of pollution control equipment in years (Line 2b)

Enter the result on Line 2c.

5. Multiply Line 1 (capital cost of pollution control equipment) by Line 2c (capital recovery factor) to get the annualized capital cost. Record the result on Line 3.

6. Enter the annual O&M cost for pollution control (from Line 6 of Worksheet 4b on page 25 of the Workbook) on Line 4.

7. Add Line 3 (annualized capital cost) and Line 4 (annual O&M cost) to get the total annual cost of pollution control. Enter the result on Line 5.

Exhibit 4-2 shows the calculation of total annual cost using the sample plant data.

4.2.2 Earnings Before Taxes

4.2.2.1 Theory

The three plant-level tests use items from the income statement of a plant. The basic components of a plant-level income statement are revenues, cost of goods sold, and corporate overhead, as shown in Exhibit 4-3. The plant should be able to provide some or all of this information.

Many companies do not keep records of revenues for each plant. Instead they maintain only cost records for the plant and record revenues and earnings at the division or firm level. However, most products have identifiable market prices. When revenues are not available for a plant, they can be calculated by multiplying the market price per unit of product by the number of units produced over the year to get total revenues. A permit writer can verify the prices for each product by checking with the appropriate trade journals. Sometimes, however, products produced at one plant are used as inputs to processes in another plant in the same firm. These products have no external market and are called "intermediate goods". To determine the "revenues" associated with these products, a transfer price needs to be assigned. The plant should be able to provide this information. It should be noted that a plant can bias revenue estimates downward and cause their financial condition to appear worse than it is by assigning an artificially low transfer price to intermediate goods. Because transfer prices are often developed by bargaining between plants within the firm, very little can be done to detect biased transfer prices.

Revenues which are unrelated to the product or services produced at the plant should not be included in plant revenues. Examples of such revenues are the sale of property or rental income. If the firm is unable to supply revenue data, or if revenues cannot be estimated by the permit writer, none of the plant-level tests can be performed.

Exhibit 4-2

WORKSHEET 9

TOTAL ANNUAL COST OF POLLUTION CONTROL
($1000)

1.	Capital Investment Cost (C) Worksheet 1b, Line 2a	10,000
2a.	Interest Rate on New Debt (i) Worksheet 3d, Line 3	0.14
2b.	Estimated Life of Pollution Control Equipment in Years (n) Worksheet 6, Line 3	5
2c.	Capital Recovery Factor (CRF) $CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$	0.291
3.	Annualized Capital Cost Line (1) x Line (2c)	2,910
4.	Annual O&M Cost Worksheet 4b, Line 6	1,000
5.	Total Annual Cost of Pollution Control Line (3) + Line (4)	3,910

Exhibit 4-3

INCOME STATEMENT COMPONENTS

REVENUES

- (Units of Product) x (Price per Unit)

COSTS OF GOODS SOLD

- Cost of materials
- Direct labor cost
- Production overhead cost (indirect labor, rent, heat, etc.)
- Extraordinary costs should not be included

GROSS MARGIN

- (Revenues) - (Cost of Goods Sold)

CORPORATE OVERHEAD

- Selling, general, and administrative expenses
- Interest expense
- R&D expense
- Depreciation on common property

EARNINGS BEFORE TAXES

- (Revenues) - (Cost of Goods Sold) - (Corporate Overhead)

The cost of goods sold includes the cost of materials, direct labor, and production overhead (indirect labor, rent, heat, etc.). Standard costs can be used in process industries like the chemicals industry to assign costs to each of those categories if necessary, but actual costs are more descriptive of the true cost of goods sold during the year. Extraordinary costs that are unusual in nature and occur infrequently (such as the purchase of equipment) should not be included in the cost of goods sold, nor should any items described in Exhibit 4-3 as corporate overhead.

Corporate overhead is the fraction of total corporate expenses that is allocated to an individual plant. There are a number of different bases by which firms allocate these expenses, and these expenses are often difficult to determine for a particular plant. Because of the relatively arbitrary nature in which corporate overhead expenses may be allocated, a firm could assign artificially large portions of corporate costs to a plant in order to misrepresent its earnings before taxes.

The income statement format in Exhibit 4-3 is based on "standard absorption costing." Under the standard absorption costing method, each unit of product produced absorbs a pro-rated share of both the fixed and variable costs of production during each accounting period. Most firms use the standard absorption costing method. However, many firms use the "variable costing" method. This costing method assigns only variable costs to the costs of goods sold. Fixed costs of production realized during an accounting period are treated as expenses of that period when determining net income, but are not included in cost of goods sold. Net income will be different under the two costing systems when production in a period does not equal sales of that period. Because the income statement format in Exhibit 4-3 is based on standard absorption costing, the permit writer should verify that the plant's cost and revenue data are recorded using the same method. If not, it is possible that the plant would record enough information to derive the data needed to complete the income statement.

4.2.2.2 Calculation

Earnings before taxes (EBT) are calculated for the most recent year by subtracting the cost of goods sold and the plant's share of corporate overhead

from the plant's revenues. Exhibit 4-4 shows the income statement data for a sample plant in the sample firm. These data are for a hypothetical plant, although they do represent realistic numbers. The calculation of EBT is done using Worksheet 10 on page 48 of the Workbook. The steps in the calculation are as follows:

1. Enter the plant's revenues for the most recent year on Line 1 of Worksheet 10 (page 48 of the Workbook).
2. Enter the cost of goods sold (excluding extraordinary items) for the most recent year on Line 2.
3. Subtract Line 2 (cost of goods old) from Line 1 (revenues) to get gross margin. Enter the result on Line 3.
4. Enter the plant's portion of the corporate overhead for the most recent year on Line 4.
5. Subtract Line 4 (corporate overhead) from Line 3 (gross margin) to get the plant's earnings before taxes (EBT). Enter the result on Line 5.

Exhibit 4-5 shows a calculation of the EBT for a plant using the sample plant data.

Exhibit 4-4

HYPOTHETICAL PLANT INCOME STATEMENT
($1000)

REVENUES	200,000
COST OF GOODS SOLD	
Cost of Materials	90,000
Direct Labor	38,000
Production Overhead	20,000
Extraordinary Costs	-0-
Total	148,000
CORPORATE OVERHEAD	
Selling, General, Administrative	15,000
Interest	2,000
Research and Development	7,000
Depreciation	18,000
Total	42,000

Exhibit 4-5

WORKSHEET 10

EARNINGS BEFORE TAXES (EBT) FOR PLANT
($1000)

		Most Recent Year of Company Data Year 1982
1.	Revenues	200,000
2.	Cost of Goods Sold	148,000
3.	Gross Margin Line (1) - Line (2)	52,000
4.	Corporate Overhead	42,000
5.	Earnings Before Taxes (EBT) Line (3) - Line (4)	10,000

4.3 PLANT-LEVEL TESTS

This section describes the three plant-level tests, which use the total annual cost of pollution control and EBT information calculated on Worksheets 9 and 10 to obtain an estimate of the impact of pollution control expenditures on plant operations. Only one of the plant-level tests needs to be performed. The permit writer should determine which test to perform based on the availability of the necessary data.

4.3.1 Earnings Test

4.3.1.1 Theory

The Earnings Test seeks to answer the question "Are earnings before taxes greater than zero?". The Earnings Test assumes that a plant will continue to be profitable if the EBT minus the total annual cost of pollution control is greater than zero. This test is strict but reasonable because a plant which can cover all fixed and variable costs with earnings before taxes will in the long run remain in operation. In the short run, plants are concerned with covering variable costs only and could operate with EBT less than zero. EBT of zero does not permit a plant to earn its entire required return on investment because depreciation alone will not supply the required return. However, because depreciation is a noncash expense, actual cash flow will be greater than zero even when EBT equals zero, and money would be available for reinvestment in assets. Thus, EBT of zero does not preclude a plant from taking advantage of growth opportunities and from earning future profits.

Although the Earnings Test is appropriate conceptually, it has some significant practical problems. Most importantly, corporate overhead expenses are not usually allocated to individual plants explicitly; instead they are assigned to division-level profit centers. If a plant or firm can provide corporate overhead expense data which relate to a specific plant, then this test should be performed. However, the permit writer must recognize that biases in the overhead allocations will be difficult to detect without a very detailed plant-level questionnaire.

4.3.1.2 Calculation

The Earnings Test is very straightforward to perform; the necessary data are obtained from Worksheets 9 and 10 on pages 45 and 48 of the Workbook, respectively. The test is done using Worksheet 11 on page 50 of the Workbook. The steps in the calculation are as follows:

1. Enter earnings before taxes (from Line 3 of Worksheet 10 on page 48 of the Workbook) on Line 1 Worksheet 11 (page 50 of the Workbook).

2. Enter the total annual cost of pollution control (from Line 5 of Worksheet 9 on page 45 of the Workbook) on Line 2.

3. Subtract Line 2 (total annual cost of pollution control) from Line 1 (EBT) to get the EBT adjusted for the cost of pollution control. Enter the result on Line 3 of Worksheet 11 (page 50 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

4. Indicate whether the adjusted EBT (from Line 3) is greater than, less than, or equal to zero on Summary Line 1 of Worksheet 11 (page 50 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

Exhibit 4-6 shows an Earnings Test calculation using the sample plant data.

4.3.1.3 Interpretation

Interpreting the result of the the Earnings Test involves comparing earnings before taxes (EBT) adjusted for the cost of pollution control to zero. If the adjusted EBT value is greater than zero, the plant should be able to absorb the annual costs of pollution control and still maintain positive EBT. This would mean that the financial impact due to the cost of pollution control would not be severe enough to cause the plant to become unprofitable. An adjusted EBT value of less than zero indicates that the annual costs associated with pollution control would have a negative economic effect on the plant. A grey area exists if the adjusted EBT value is zero (or close to zero). In this case a more detailed plant closure analysis would be needed. It should be noted that the other plant-level tests will <u>not</u> be helpful if the results of the Earnings Test are in the grey area. The interpretation of the Earnings Test, if it is the plant-level test performed by the permit writer, should be entered on Worksheet 15 on page 59 of the Workbook. An example is provided in Chapter 5.

Exhibit 4-6

WORKSHEET 11

EARNINGS TEST
($1000)

1.	Earnings Before Taxes (EBT) Worksheet 10, Line 5	10,000
2.	Total Annual Cost of Pollution Control Worksheet 9, Line 5	3,910
3.	Adjusted EBT Line (1) - Line (2)	6,090

SUMMARY

1. Is the adjusted EBT greater than, less than, or equal to zero? Adjusted EBT is greater than zero, plant should be able to afford pollution control.

If the Earnings Test cannot be performed because data which allocate corporate overhead to individual plants are not available, one of the two following tests--the Gross Margin Test or the Revenue Test--should be used for the plant-level analysis. Like the Earnings Test, both of these tests are based on the goal of maintaining an EBT value which is greater than zero.

4.3.2 Gross Margin Test

4.3.2.1 Theory

Gross margin (or gross profit) is equal to revenue minus the cost of goods sold. It is a measure of the profit at a plant before corporate overhead expenses have been deducted. Thus, the use of the Gross Margin Test avoids the difficult problem of determining what corporate overhead expenses are allocated to a plant. Since the cost of pollution control technology relative to EBT is the standard by which a permit writer decides whether the technology is economically achievable, the Gross Margin Test has been designed to provide a similar measure.

The Gross Margin Test measures the total annual cost of pollution control as a fraction of gross margin. If total annual pollution control costs exceed a defined range, then the technology may adversely affect the plant's profitability. The range is defined by the ratio of EBT to gross margin for a specific industrial sector or SIC code. If total annual pollution control costs exceed this range, the EBT may be less than zero and the technology could cause the plant to close.

The Gross Margin Test is easy to perform and it avoids the need for data on corporate overhead expenses. It still has limitations, however. First, it is only a substitute for the Earnings Test; actual EBT are not known. The EBT/gross margin ratio is only an industry average and may not accurately reflect the actual plant's situation.

Implicitly assumed in the Gross Margin Test is that plants cannot pass through any of the added pollution control costs to customers through higher prices. In this sense, the test is conservative because if prices could be raised then some of the impact could be reduced.

Although the problem of obtaining corporate overhead allocation data is avoided with the Gross Margin Test, the potential for misrepresenting revenues and plant costs still exists. If revenues include intermediate goods that are assigned transfer prices by the company, there is little the permit writer can do to check the accuracy of the prices. Thus, revenues could be biased downward. Costs can also be misallocated because of the variety of methods of inventory valuation. Standard costs are used most frequently and they are based on predetermined production levels. Actual year-end costs, rather than standard costs, should be requested, although the former may not be representative in unusual years.

4.3.2.2 Calculation

The data needed to perform the Gross Margin Test are obtained from Worksheets 9 and 10 (pages 45 and 48 of the Workbook, respectively) and Robert Morris Associates' Annual Statement Studies. Exhibit 4-7 shows an example of where to find the data in Morris. The Gross Margin Test is done using Worksheet 12 on page 52 of the Workbook. The steps in the calculation are as follows:

1. Enter the gross margin (from Line 3 of Worksheet 10 on page 48 of the Workbook) on Line 1 of Worksheet 12 (page 52 of the Workbook).
2. Enter the total annual cost of pollution control (from Line 5 of Worksheet 9 on page 45 of the Workbook) on Line 2.
3. Find the EBT data (called "Profit before taxes") for the appropriate SIC code in Morris' Annual Statement Studies. Enter the data for up to four firm sizes on Line 3a. (The data in Annual Statement Studies is presented for different firm sizes. The EBT/GM ratio is calculated for each firm size in the appropriate SIC code.)
4. Find the gross margin data (called "Gross profit") for the same SIC code in Morris. Enter the data for up to four plant sizes on Line 3b. The plant sizes for the industry EBT and the gross margin data should be the same.
5. For each plant size, divide Line 3a (industry EBT) by Line 3b (industry gross margin) to get industry EBT/gross margin (GM) ratios. Record the results on Line 3c.
6. Enter the lowest of the EBT/GM ratios (from Line 3c) on Line 3d.
7. Divide Line 2 (total annual cost of pollution control) by Line 1 (gross margin) to get the total annual cost of pollution control as a fraction

Exhibit 4-7

DATA FROM MORRIS - GROSS MARGIN TEST

MANUFACTURERS - PLASTIC MATERIALS & SYNTHETIC RESINS

SIC# 2821

Current Data

52(6/30/80-3/30/81) 0-1MM	1-10MM	10-50MM	50-100MM	84(10/1/81-3/31/82) ALL	ASSET SIZE / NUMBER OF STATEMENTS	6/30/77-3/31/78 ALL	6/30/78-3/31/79 ALL	6/30/79-3/31/80 ALL	6/30/80-3/31/81 ALL	6/30-3/31 ALL
24	68	18	6	116		120	116	144	127	116
%	%	%	%	%	**ASSETS**	%	%	%	%	%
8.6	4.8	3.5		5.6	Cash & Equivalents	6.2	6.7	6.8	6.2	5.6
35.5	29.5	28.9		30.1	Accts. & Notes Rec. - Trade(net)	28.0	29.8	28.5	29.5	30.1
19.7	22.7	24.9		22.4	Inventory	24.3	22.3	24.8	21.5	22.4
1.7	1.2	1.9		1.4	All Other Current	2.0	1.4	2.2	1.4	1.4
65.5	58.2	59.2		59.6	Total Current	60.6	60.1	62.3	58.5	59.6
25.2	33.6	32.6		31.8	Fixed Assets (net)	33.0	33.3	31.6	32.6	31.8
.1	1.6	.8		1.1	Intangibles (net)	.4	1.4	1.3	.8	1.1
9.1	6.6	7.5		7.6	All Other Non-Current	5.9	5.2	4.9	8.0	7.6
100.0	100.0	100.0		100.0	Total	100.0	100.0	100.0	100.0	100.0
					LIABILITIES					
7.0	8.8	9.7		8.4	Notes Payable-Short Term	10.1	8.0	8.7	8.3	8.4
4.1	3.2	2.7		3.2	Cur. Mat. L/T/D	3.7	3.3	4.1	3.4	3.2
24.1	19.7	16.4		19.7	Accts. & Notes Payable - Trade	18.3	17.8	20.4	19.2	19.7
4.6	6.8	6.7		6.1	Accrued Expenses	5.6	6.6	6.5	5.7	6.1
6.0	2.0	4.0		3.2	All Other Current	2.9	4.1	4.4	3.2	3.2
45.9	40.4	39.4		40.6	Total Current	40.7	39.8	44.2	39.7	40.6
16.1	18.5	25.2		18.7	Long Term Debt	17.1	18.4	17.7	19.4	18.7
5.5	2.8	3.0		3.6	All Other Non-Current	1.9	2.4	2.1	3.2	3.6
32.5	38.3	32.4		37.1	Net Worth	40.3	39.4	36.0	40.6	37.1
100.0	100.0	100.0		100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0
					INCOME DATA					
100.0	100.0	100.0		100.0	Net Sales	100.0	100.0	100.0	100.0	100.0
77.1	77.8	77.3		76.8	Cost Of Sales	75.7	76.2	75.8	76.3	76.8
22.9	22.2	22.3		23.2	Gross Profit	24.3	23.8	24.2	23.7	23.2
19.6	16.9	16.9		18.2	Operating Expenses	19.7	18.0	19.4	18.8	18.2
3.0	5.3	5.4		5.0	Operating Profit	4.6	5.8	4.8	5.0	5.0
1.0	1.3	2.8		1.4	All Other Expenses (net)	1.4	1.0	1.1	1.3	1.4
1.9	4.1	2.6		3.6	Profit Before Taxes	3.2	4.8	3.7	3.6	3.6
					RATIOS					
2.1	2.1	2.5		2.2		2.1	2.2	2.1	2.1	2.2
1.6	1.4	1.5		1.6	Current	1.5	1.6	1.5	1.5	1.6
1.0	1.1	1.1		1.1		1.2	1.2	1.1	1.1	1.1
1.5	1.2	1.2		1.3		1.3	1.3	1.3	1.3	1.3
1.1	.8	.8		.9	Quick	.9	1.0	.9	1.0	.9
.6	.6	.8		.6		.8	.7	.6	.7	.6
38 9.7	35 10.5	40 9.1		36 10.2		38 9.7	37 10.0	35 10.4	40 9.2	36 10.2
49 7.4	43 8.4	54 6.8		47 7.7	Sales/Receivables	47 7.8	47 7.7	46 7.9	48 7.5	47 7.7
64 5.7	58 6.3	68 5.4		56 6.3		62 5.9	62 5.9	55 6.6	59 6.2	58 6.3
33 16.1	29 12.7	37 10.0		29 12.4		42 8.7	29 12.6	34 10.8	33 11.2	29 12.4
37 9.8	42 8.6	50 7.3		43 8.5	Cost of Sales/Inventory	64 5.8	50 7.3	43 8.4	43 8.5	43 8.5
80 4.6	57 6.4	85 4.3		63 5.8		70 5.2	69 5.4	69 5.3	65 5.6	63 5.8
7.2	7.5	6.0		7.0		6.8	6.1	6.5	6.9	7.0
11.8	13.5	10.7		12.3	Sales/Working Capital	10.7	9.0	11.6	11.5	12.3
1.INF	32.7	31.1		32.3		22.9	29.5	33.9	22.3	32.3
5.1	8.2	3.7		7.6		9.8	13.2	7.8	8.7	7.6
(23) 2.2	(58) 3.1	(17) 2.0		(101) 2.8	EBIT/Interest	(95) 3.7	(83) 4.5	(115) 3.8	(105) 2.9	(101) 2.8
1.2	1.6	.9		1.4		1.6	2.2	1.6	1.2	1.4
8.3	8.7	6.3		7.9		7.7	7.4	6.7	7.7	7.9
(12) 2.7	(55) 4.0	(13) 2.6		(84) 3.8	Cash Flow/Cur. Mat. L/T/D	(87) 2.8	(78) 4.5	(90) 3.6	(93) 3.1	(84) 3.9
1.5	2.3	1.3		2.1		1.7	2.0	1.5	1.5	2.1
.4	.5	.7		.5		.4	.5	.4	.5	.5
.8	1.0	1.3		1.0	Fixed/Worth	.8	.8	.8	.7	1.0
2.0	1.6	2.1		1.7		1.4	1.5	1.5	1.4	1.7
1.0	.9	1.3		.9		.9	.8	.9	.8	.9
2.2	1.6	2.2		1.8	Debt/Worth	1.5	1.5	1.6	1.4	1.8
7.7	3.2	4.3		3.5		2.5	2.6	2.9	2.6	3.5
39.6	36.9	38.0		35.7	% Profit Before Taxes/Tangible Net Worth	35.7	41.8	39.4	32.2	35.7
(22) 25.6	(84) 24.0	16.5		(110) 23.4		(118) 22.6	(111) 25.3	(138) 24.0	(123) 18.8	(110) 23.4
5.7	10.6	-2.5		6.4		4.9	12.9	8.4	7.7	6.4
13.8	15.6	11.3		13.9	% Profit Before Taxes/Total Assets	14.8	16.4	15.3	13.8	13.9
8.3	8.8	6.0		7.3		6.1	10.2	8.2	8.0	7.3
1.2	3.0	-.6		1.5		1.9	4.1	2.7	2.1	1.5
17.4	13.2	9.1		13.4		10.4	10.2	12.7	11.3	13.4
13.2	7.2	6.1		7.4	Sales/Net Fixed Assets	6.3	6.8	7.9	6.6	7.4
7.7	4.0	4.0		4.3		3.7	4.2	4.6	4.3	4.3
3.3	2.9	2.4		2.9		2.4	2.7	2.7	2.8	2.9
2.7	2.2	2.0		2.2	Sales/Total Assets	2.1	2.1	2.2	2.1	2.2
1.9	1.8	1.4		1.7		1.7	1.8	1.8	1.8	1.7
.8	1.4	1.6		1.3		1.5	1.3	1.5	1.4	1.3
(23) 1.8	(83) 2.0	(17) 1.9		(108) 2.0	% Depr., Dep., Amort./Sales	(113) 2.3	(105) 2.3	(134) 2.1	(116) 2.1	(108) 2.0
2.7	3.3	2.8		3.2		3.7	3.9	3.4	3.5	3.2
1.7	.3			.5		.7	.4	.5	.5	.5
(15) 2.3	(24) .9			(46) 1.5	% Lease & Rental Exp/Sales	(56) 1.8	(45) 1.0	(72) 1.2	(58) 1.2	(46) 1.5
3.5	1.7			2.0		2.3	2.0	2.2	2.2	2.0
2.9	1.8			2.2		2.0	2.5	2.1	2.0	2.2
(16) 4.1	(26) 2.9			(43) 3.5	% Officers' Comp/Sales	(43) 4.1	(38) 4.0	(57) 4.0	(43) 3.6	(43) 3.9
6.5	4.3			4.7		5.8	6.5	7.6	6.5	4.7
34932M	571178M	761499M	638430M	1984039M	Net Sales ($)	1129219M	1204793M	1482251M	2539528M	1984039M
12720M	283180M	403163M	437520M	1106573M	Total Assets ($)	674728M	654930M	726973M	1364301M	1106573M

M = thousan MM = million

of gross margin. Enter the result on Line 4 of Worksheet 12 (page 52 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

8. Determine whether the total annual cost of pollution control as a fraction of gross margin (from Line 4) is greater than, less than, or equal to the lowest industry EBT/GM ratio (from Line 3d). Record the evaluation on Summary Line 1 of Worksheet 12 (page 52 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

Exhibit 4-8 shows an example of the Gross Margin Test performed using the sample plant data.

4.3.2.3 Interpretation

The Gross Margin Test compares the total annual cost of pollution control (expressed as a fraction of the plant's gross margin) to the industry's EBT (expressed as a fraction of the industry's gross margin). If the total annual cost of pollution control/plant gross margin ratio is less than the EBT/gross margin ratio for the industry, the plant will probably be able to afford the pollution control technology without experiency negative economic effects. Conversely, if the pollution control cost/plant gross margin ratio is greater than the EBT/gross margin ratio for the industry, the economic effects on the plant could be severe. A grey area exists if these two ratios are equal. In this case a more detailed plant closure analysis would be needed. The interpretation of the Gross Margin Test, if it is the plant-level test performed by the permit writer, should be entered on Worksheet 15 on page 59 of the Workbook.

If the data on cost of goods sold are not available and gross margin cannot be calculated for a plant, the Gross Margin Test cannot be performed. The Revenue Test, which is described in the next section, does not require any cost data and therefore avoids the use of information that may be unavailable or potentially biased.

Exhibit 4-8

WORKSHEET 12

GROSS MARGIN TEST
($1000)

1.	Gross Margin Worksheet 10, Line 3			52,000	
2.	Total Annual Cost of Pollution Control Worksheet 9, Line 5			3,910	
3.	Threshold Values - Industry EBT/GM Ratios				
		Plant Size #1	Plant Size #2	Plant Size #3	Plant Size #4
3a.	Industry EBT	1.9	4.1	2.6	
3b.	Industry Gross Margin	27.9	22.2	22.3	
3c.	Industry EBT/GM Ratios Line (3a) divided by Line (3b)	0.07	0.18	0.12	
3d.	Lowest EBT/GM Ratio	0.07			
4.	Total Annual Cost of Pollution Control as a Fraction of Gross Margin Line (2) divided by Line (1)	0.06			

SUMMARY

1. Is Line 4 greater than, less than, or equal to Line 3d? Because the total annual cost of pollution control as a fraction of gross margin is less than the industry's lowest EBT/GM ratio, the plant should be able to afford pollution control.

4.3.3 Revenue Test

4.3.3.1 Theory

The Revenue Test is one step simpler than the Gross Margin Test and is therefore less sophisticated. To perform the test, the total annual cost of pollution control is measured as a fraction of the plant's revenues. If total annual pollution control costs exceed a defined range, then the plant may not be able to afford the technology. The range is defined by the ratio of EBT to revenues for a specific industrial sector or SIC code. If total annual pollution control costs exceed this range, EBT may be less than zero and the technology might cause the plant to close.

The Revenue Test requires only information on plant revenues. As mentioned above, if individual plants do not record revenues, they can be calculated by multiplying the market or transfer price per unit of product by the number of units of product produced. The Revenue Test should be used when gross margin (or the data to calculate it) is not available for a plant because the plant's accounting system does not gather costs in the appropriate manner.

Because the Revenue Test requires very little information from the plant, it is easy to perform. However, it is also somewhat crude because it does not consider specific plant costs but depends almost entirely on industry average data. In addition, as with the other tests, biased information could be a problem because the firm or plant must provide transfer prices for intermediate goods.

4.3.3.2 Calculation

The data needed to perform the Revenue Test are obtained from Worksheets 9 and 10 (pages 45 and 48 of the Workbook, respectively) and from Morris. Exhibit 4-9 shows an example of where to find the data in Morris. The Revenue test is done using Worksheet 13 on page 54 of the Workbook. The steps in the collection are as follows:

1. Enter revenues (from Line 1 of Worksheet 10 on page 48 of the Workbook) on Line 1 of Worksheet 13 (page 54 of the Workbook).
2. Enter the total annual cost of pollution control (from Line 5 of Worksheet 9 on page 45 of the Workbook) on Line 2.

DATA FROM MORRIS - REVENUE TEST

MANUFACTURERS - PLASTIC MATERIALS & SYNTHETIC RESINS

SIC# 2821

Current Data: 52(6/30-9/30/81) | 84(10/1/81-3/31/82)

0-1MM	1-10MM	10-50MM	50-100MM	ALL	ASSET SIZE	6/30 77 3/31/78 ALL	6/30 78 3/31/79 ALL	6/30 79 3/31/80 ALL	6/30 80 3/31/81 ALL	6/30 81 3/31/82 ALL
24	68	18	6	116	NUMBER OF STATEMENTS	120	116	144	127	116
%	%	%	%	%	ASSETS	%	%	%	%	%
8.6	4.8	3.5		5.6	Cash & Equivalents	6.2	8.7	6.8	6.2	5.6
35.5	29.5	28.9		30.1	Accts. & Notes Rec. - Trade(net)	28.0	29.8	26.5	29.5	30.1
19.7	22.7	24.9		22.4	Inventory	24.3	22.3	24.8	21.5	22.4
1.7	1.2	1.9		1.4	All Other Current	2.0	1.4	2.2	1.4	1.4
65.5	58.2	59.2		59.6	Total Current	60.6	60.1	62.3	58.5	59.6
25.2	33.8	32.6		31.8	Fixed Assets (net)	33.0	33.3	31.8	32.6	31.8
1	1.8	.8		1.1	Intangibles (net)	4	1.4	1.3	.9	1.1
9.1	6.6	7.5		7.6	All Other Non-Current	5.9	5.2	4.9	8.0	7.6
100.0	100.0	100.0		100.0	Total	100.0	100.0	100.0	100.0	100.0
					LIABILITIES					
7.0	8.8	8.7		8.4	Notes Payable Short Term	10.1	8.0	8.7	8.3	8.4
4.1	3.2	2.7		3.2	Cur. Mat. L/T/D	3.7	3.3	4.1	3.4	3.2
24.1	19.7	18.4		19.7	Accts. & Notes Payable - Trade	18.3	17.9	20.4	19.2	19.7
4.6	6.8	6.7		6.1	Accrued Expenses	5.6	6.6	6.6	5.7	6.1
6.0	2.0	4.0		3.2	All Other Current	2.9	4.1	4.4	3.2	3.2
45.9	40.4	39.4		40.6	Total Current	40.7	39.8	44.2	39.7	40.6
16.1	18.5	25.2		18.7	Long Term Debt	17.1	18.4	17.7	19.4	18.7
5.5	2.8	3.0		3.8	All Other Non-Current	1.9	2.4	2.1	3.2	3.6
32.5	38.3	32.4		37.1	Net Worth	40.3	39.4	36.0	40.6	37.1
100.0	100.0	100.0		100.0	Total Liabilities & Net Worth	100.0	100.0	100.0	100.0	100.0
					INCOME DATA					
100.0	100.0	100.0		100.0	Net Sales	100.0	100.0	100.0	100.0	100.0
72.1	77.8	77.7		76.8	Cost of Sales	75.7	76.2	75.8	76.3	76.8
27.9	22.2	22.3		23.2	Gross Profit	24.3	23.8	24.2	23.7	23.2
24.9	18.9	16.8		18.2	Operating Expenses	18.7	18.0	19.4	18.8	18.2
3.0	6.3	5.4		5.0	Operating Profit	4.6	5.8	4.8	5.0	5.0
1.0	1.2	2.6		1.4	All Other Expenses (net)	1.4	1.0	1.1	1.3	1.4
1.9	4.1	2.8		3.6	Profit Before Taxes	3.2	4.8	3.7	3.6	3.6
					RATIOS					
2.1	2.1	2.5		2.2	Current	2.1	2.2	2.1	2.1	2.2
1.6	1.4	1.6		1.6		1.5	1.6	1.5	1.5	1.6
1.0	1.1	1.1		1.1		1.2	1.2	1.1	1.1	1.1
1.6	1.2	1.2		1.3	Quick	1.3	1.3	1.3	1.3	1.3
1.1	.8	.8		.9		.9	1.0	.9	1.0	.9
.8	.6	.6		.6		.6	.7	.6	.7	.6
38 9.7	35 10.5	40 9.1		36 10.2	Sales/Receivables	38 9.7	37 10.0	35 10.4	40 9.2	36 10.2
48 7.4	43 8.4	54 6.8		47 7.7		47 7.8	47 7.7	46 7.9	49 7.5	47 7.7
64 5.7	58 6.3	68 5.4		58 6.3		62 5.9	62 5.9	56 6.6	59 6.2	58 6.3
23 16.1	29 12.7	37 10.0		28 12.4	Cost of Sales/Inventory	42 8.7	29 12.6	34 10.8	33 11.2	28 12.4
37 9.8	42 8.6	50 7.3		43 8.5		54 6.8	50 7.3	50 7.3	43 8.4	43 8.5
60 6.1	57 6.4	85 4.3		63 5.8		70 5.2	68 5.4	69 5.3	65 5.6	63 5.8
7.2	7.5	6.0		7.0	Sales/Working Capital	6.8	6.1	8.5	6.9	7.0
11.8	13.5	10.7		12.3		10.7	9.0	11.6	11.5	12.3
1 INF	32.7	31.1		32.3		22.9	29.5	33.9	27.3	32.3
5.1	8.2	3.7		7.6	EBIT/Interest	9.8	13.2	7.8	8.7	7.6
(22) 2.2	(58) 3.1	(17) 2.0		(101) 2.8		(95) 3.7	(83) 4.5	(115) 3.8	(105) 2.9	(101) 2.8
1.2	1.9	.9		1.4		1.0	2.2	1.6	1.2	1.4
8.3	8.7	6.3		7.9	Cash Flow/Cur. Mat. L/T/D	7.7	7.4	6.7	7.7	7.9
(12) 2.7	(55) 4.0	(13) 2.6		(84) 3.0		(87) 2.8	(78) 4.8	(80) 3.6	(93) 3.1	(84) 3.0
1.5	2.3	1.3		2.1		1.7	2.0	1.5	1.5	2.1
.4	.5	.7		.5	Fixed/Worth	.4	.5	.4	.5	.5
.8	1.0	1.3		1.0		.8	.8	.8	.7	1.0
2.0	1.6	2.1		1.7		1.4	1.5	1.5	1.4	1.7
1.0	.9	1.3		.9	Debt/Worth	.9	.8	.9	.8	.9
2.2	1.8	2.2		1.8		1.5	1.5	1.6	1.4	1.8
7.7	3.2	4.3		3.5		2.5	2.8	2.8	2.8	3.5
39.6	36.9	38.0		35.7	% Profit Before Taxes/Tangible Net Worth	35.7	41.8	39.4	32.2	35.7
(22) 25.8	(64) 24.0	16.5		(110) 23.4		(118) 22.5	(111) 25.3	(138) 24.0	(123) 18.8	(110) 23.4
5.7	10.5	-2.5		8.4		4.3	12.9	8.4	7.7	8.4
13.8	15.6	11.3		13.9	% Profit Before Taxes/Total Assets	14.8	16.4	15.3	13.8	13.9
6.3	8.8	5.0		7.3		8.1	10.2	8.2	8.0	7.3
1.2	3.0	.6		1.5		1.9	4.1	2.7	2.1	1.5
17.4	13.2	9.1		13.4	Sales/Net Fixed Assets	10.4	10.2	12.7	11.3	13.4
13.2	7.2	6.1		7.4		6.3	6.8	7.9	6.6	7.4
7.7	4.0	4.0		4.3		3.7	4.2	4.6	4.3	4.3
3.3	2.8	2.4		2.8	Sales/Total Assets	2.6	2.7	2.7	2.8	2.9
2.7	2.2	2.0		2.2		2.1	2.1	2.2	2.1	2.2
1.9	1.8	1.4		1.7		1.7	1.6	1.8	1.5	1.7
.8	1.4	1.6		1.3	% Depr., Dep., Amort./Sales	1.8	1.3	1.5	1.4	1.3
(23) 1.8	(63) 2.0	(17) 1.9		(108) 2.0		(113) 2.3	(105) 2.3	(134) 2.1	(118) 2.1	(108) 2.0
2.7	3.3	2.8		3.2		3.7	3.9	3.4	3.5	3.2
1.7	.3			.5	% Lease & Rental Exp/Sales	.7	.4	.5	.5	.5
(15) 2.3	(24) .8			(46) 1.8		(56) 1.6	(43) 1.0	(72) 1.2	(58) 1.2	(46) 1.5
3.5	1.7			2.0		2.7	2.0	2.2	2.2	2.0
2.9	1.8			2.2	% Officers' Comp/Sales	2.0	2.5	2.1	2.6	2.2
(18) 4.1	(26) 2.9			(43) 3.5		(43) 4.1	(38) 4.0	(57) 4.0	(43) 3.6	(43) 3.6
6.5	4.3			4.7		5.8	6.3	7.6	6.5	4.7
34932M	571178M	741489M	636430M	1984039M	Net Sales ($)	1129218M	1204793M	1482251M	2649528M	1984039M
12720M	253180M	403163M	437520M	1106573M	Total Assets ($)	674729M	664930M	728973M	1364301M	1106573M

©Robert Morris Associates 1982

M = $thousand MM = $million

See Pages 1 through 12 for explanation of Ratios and Data

3. Find the EBT data (called "Profit before taxes") for the appropriate SIC code in Morris' Annual Statement Studies. Enter the data for up to four plant sizes on Line 3a.

4. Find the revenue data (called "Net sales") for the same SIC code in Morris. Enter the data for up to four plant sizes on Line 3b. The plant sizes for the industry EBT and revenue data should be the same.

5. For each plant size, divide Line 3a (industry EBT) by Line 3b (industry revenues) to get industry EBT/revenue ratios. Record the results on Line 3c.

6. Enter the lowest of the EBT/revenue ratios (from Line 3c) on Line 3d.

7. Divide Line 2 (total annual cost of pollution control) by Line 1 (gross margin) to get the total annual cost of pollution control as a fraction of gross margin. Enter the result on Line 4 of Worksheet 13 (page 54 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

8. Determine whether the total annual cost of pollution control as a fraction of gross margin (from Line 4) is greater than, less than, or equal to the lowest industry EBT/GM ratio (from Line 3d). Record the evaluation on Summary Line 1 of Worksheet 13 (page 54 of the Workbook) and on Worksheet 15 (page 58 of the Workbook).

Exhibit 4-10 shows an example of the Gross Margin Test performed using the sample plant data.

4.3.3.3 Interpretation

The Revenue Test compares the total annual cost of pollution control (expressed as a fraction of the plant's revenues) to the industry's EBT (expressed as a fraction of the industry's revenues). If the ratio of the annual cost of pollution control to the plant's revenue is less than the EBT/revenue ratio for the industry, the plant will probably be able to afford the pollution control technology without experiencing negative economic effects. Conversely, if the ratio of the pollution control cost to the plant's revenue is greater than the EBT/revenue ratio for the industry, the economic effects on the plant could be severe. A grey area exists if these two ratios are equal. In this case a more detailed plant closure analysis would be needed. The interpretation of the Revenue Test, if it is the plant-level test performed by the permit writer, should be entered on Worksheet 15 on page 58 of the Workbook.

Exhibit 4-10

WORKSHEET 13

REVENUE TEST
($1000)

1. Revenues
   Worksheet 10, Line 1 — 200,000

2. Total Annual Cost of Pollution Control
   Worksheet 9, Line 5 — 3,910

3. Threshold Values - Industry EBT/Revenue Ratios

	Plant Size #1	Plant Size #2	Plant Size #3	Plant Size #4
3a. Industry EBT	1.9	4.1	2.6	
3b. Industry Revenues	100.0	100.0	100.0	
3c. Industry EBT/ Revenue Ratios Line (3a) divided by Line (3b)	0.02	0.04	0.03	
3d. Lowest EBT/ Revenue Ratio	0.02			

4. Total Annual Cost of Pollution Control as a Fraction of Revenues
   Line (2) divided by Line (1) — 0.02

SUMMARY

1. Is Line 4 greater than, less than, or equal to Line 3d? Because the plant's total annual cost of pollution control as a fraction of revenues is equal to the lowest industry EBT/revenue ratio, the Revenue Test cannot be used to conclude whether the plant can afford pollution control.

CHAPTER 5

ANALYSIS OF TEST RESULTS

5.1 INTRODUCTION

Chapters 3 and 4 discussed several measures of financial health and described how they could be interpreted. The insights provided by these tests must be intergrated to evaluate the economic effect of pollution controls on a firm or plant. The purpose of this chapter is to assist the permit writer with integrating the results of the firm-level and plant-level analyses and interpreting them as a whole.

In some instances all of the test results will suggest the same evaluation. If all tests uniformly indicate that a firm is financially healthy and can afford pollution control equipment, the economic effect is clearly acceptable. Similarly, if all tests indicate poor financial condition, the economic effect would probably not be acceptable. Unfortunately, the results of each test are unlikely to agree with regard to the financial condition of the firm, and some total evaluation or tradeoff among test results will be necessary.

This chapter provides a framework for evaluating such conflicting results. Explanation of all possible combinations is not possible within the scope of this text. This methodology, therefore, does not provide a "cookbook" format to follow in evaluating conflicting results. However, it provides an understanding of the interactions among the tests that will assist the permit writer in evaluating some of the possible combinations.

5.2 SUMMARY OF TEST RESULTS

The first step in interpreting the firm-level tests together and in conjunction with the plant-level analysis is to summarize the test results. This is done by entering the numerical results and summary comments for each test on Worksheets 14 and 15 on pages 57 and 58 of the Workbook. This is included in the step-by-step instructions for performing each test, so that by the time the permit writer has completed all of the necessary firm-level and plant-level tests, Worksheets 14 and 15 should be complete. Exhibits 5-1 and 5-2 show these two worksheets completed using the sample firm and plant data.

The next step in summarizing the test results involves completing Worksheet 16 on page 59 of the Workbook. This is done by comparing the test results on Worksheets 14 and 15 with the guidelines shown in Exhibit 5-3. Each test is given an overall summary result in the form of a "+" or "-" sign. Exhibit 5-4 shows the test results summarized in this way for the sample firm and plant data.

Exhibit 5-1

WORKSHEET 14

THREE-YEAR TREND WITHOUT POLLUTION CONTROL COSTS

	Year 1982	Year 1981	Year 1980	Industry Comparison
Liquidity Ratios				
Current Ratio	2.2	2.5	2.0	close to or better than upper quartile
Quick Ratio	1.2	1.3	1.1	always higher than median
Solvency Ratios				
Fixed-Charge Coverage Ratio	5.5	7.6	7.7	not applicable
Beaver's Ratio	0.24	0.27	0.26	not applicable
Leverage Ratio				
Debt/Equity Ratio	0.49	0.55	0.47	much better than rest of industry
Market-to-Book Ratio	0.62-1.06	0.72-1.02	0.64-1.05	not applicable

Exhibit 5-2

WORKSHEET 15

RESULTS FOR MOST RECENT YEAR

Firm-Level Tests	Without Pollution Control Costs	With Pollution Control Costs	Change/ Industry Comparison
Liquidity Ratios			
Current Ratio	2.2	2.2	no change/at ind. upper quartile
Quick Ratio	1.2	1.2	no change/near industry upper quartile
Solvency Ratios			
Fixed-Charge Coverage Ratio	5.5	5.39	little change
Beaver's Ratio	0.24	0.24	no change
Leverage Ratio			
Debt/Equity Ratio	0.49	N/A	much lower than industry
Market-to-Book Ratio	0.62-1.06	0.61-1.05	little change
Plant-Level Tests[1]			
Earnings Test	N/A	well above zero	N/A
Gross Margin Test	N/A	------	N/A
Revenue Test	N/A	------	N/A

N/A - not applicable

[1] one of the three plant-level tests should be performed

Exhibit 5-3

GUIDELINES FOR TEST RESULTS

Firm-Level Tests	Positive	Grey Area	Negative
Liquidity Ratios			
Current Ratio	> 2.0	N/A	< 2.0
Quick Ratio	> 1.0	N/A	< 1.0
Solvency Ratios			
Fixed-Charge Coverage Ratio	> 2.0	1.5 - 2.0	< 1.5
Beaver's Ratio	> 0.2	0.15 - 0.2	< 0.15
Leverage Ratio			
Debt/Equity Ratio	declining	N/A	increasing
Market-to-Book Ratio	high/increasing	N/A	low/decreasing
Plant-Level Tests			
Earnings Test	> 0	N/A	< 0
Gross Margin Test	> lowest industry EBT/GM ratio	N/A	< lowest industry EBT/GM ratio
Revenue Test	> lowest industry EBT/revenue ratio	N/A	< lowest industry EBT/revenue ratio

N/A - not applicable

Exhibit 5-4

WORKSHEET 16

OVERALL RATING (WITH POLLUTION CONTROL COSTS WHERE APPLICABLE)

Firm-Level Tests

Liquidity Ratios	
Current Ratio	+
Quick Ratio	+
Solvency Ratios	
Fixed-Charge Coverage Ratio	+
Beaver's Ratio	+
Leverage Ratio	
Debt/Equity Ratio	+
Market-to-Book Ratio	constant

Conclusion:

Plant-Level Tests[1]

Earnings Test	+
Gross Margin Test	
Revenue Test	

Final Conclusion:

+ = positive test result or economic effect not negative

- = negative test result or economic effect

[1] one of the three plant-level tests should be performed

5.3 INTERPRETATION OF RESULTS

The results of the financial analysis are interpreted and conclusions are drawn for the firm-level tests as a group and then in conjunction with the plant-level test result to determine the overall economic effect of pollution control expenditures. When these evaluations have been made, the results are entered in the "conclusions" sections of Worksheet 16 and final conclusions noted. Interpretation of the firm-level and plant-level test results will be discussed in the next two sections.

5.3.1 Interpretation of Firm-Level Tests

In some instances, all of the firm-level test results will suggest the same conclusion. Such results provide a clear picture of the economic effects of the pollution control requirement. For example, the economic effects would almost certainly be acceptable for a firm with:

- Liquidity Ratios relatively high;
- Solvency Ratios high;
- Leverage Ratios low; and
- Market-to-Book Ratio high.

More typically, test results for a firm will include a combination of positive and negative indicators. No firm rules can be stated for evaluating conflicting results from different types or ratios. However, the general pattern of results is often apparent upon inspection. A financially weak firm will have several negative indicators among the firm-level tests. Similarly, a financially sound firm may have one or two negative indicators but will have a positive overall pattern. These general trends should be noted in evaluating the economic effects of pollution controls. Following are examples of four common combinations of ratios that may appear to be conflicting with some explanations for interpreting each.

Positive Indicator: Liquidity Ratios High

Negative Indicator: Solvency Ratios Low
Debt/Equity Ratio High

In general, if Liquidity Ratios are high, indicating that the pollution control equipment can be paid for with cash and equivalent current assets, the purchase of such equipment should be considered to have a negligible economic effect. The exception to this is when the Liquidity Ratios have recently increased, the Debt/Equity Ratio has increased, and Solvency Ratios have decreased. These changes may indicate that the firm has recently borrowed money to invest in a new business opportunity and is holding that money temporarily as cash or marketable securities. This can be verified if debt has recently increased on the balance sheet. If the firm were required to spend this cash on pollution control, an investment with no return, instead of investing in the new business opportunity, they would either have to forfeit the business investment or issue bonds or borrow to pay for it. In this case, rely on the interpretation of the Solvency Ratios to determine economic effects. This is shown as Example #1 in Exhibit 5-5. The conclusion would be that an investment in pollution controls would probably cause the firm financial hardship. Examples #2 through #4 in Exhibit 5-5 show variations on this example of the firm-level test results and the conclusions that would be drawn.

Positive Indicator: Debt/Equity Ratio Low
Negative Indicator: Market-to-Book Ratio Low

This combination of indicators probably means that the firm's assets (expressed in these ratios as stockholders' equity and book value of the firm's stock) have been overvalued for some reason. If these assets were not overvalued, the Debt/Equity Ratio (which was a positive indicator) would be higher--a less positive indicator. Place emphasis on the Liquidity and Solvency Ratios to determine the economic effect of a pollution control option. Examples #5 and #6 in Exhibit 5-5 show two situations based on these indicators and the firm-level conclusions that would be drawn when the Liquidity and Solvency Ratios are included.

Positive Indicator: Debt/Equity Ratio Low
High Bond Ratings

Negative Indicator: Solvency Ratios Low

Solvency Ratios (Fixed-Charge Coverage Ratio and Beaver's Ratio) measure the ability of average cash flows to cover payments on bonds and long-term debts.

Exhibit 5-5

EXAMPLES OF TEST RESULTS

	Example:									
Firm-Level Tests	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Liquidity Ratios										
Current Ratio	+	+	-	-	+	-	ND	+	-	+
Quick Ratio	+	+	-	-	+	-	ND	+	-	+
Solvency Ratios										
Fixed-Charge Coverage Ratio	-	+	+	-	-	+	-	-	-	-
Beaver's Ratio	-	+	+	-	-	+	-	-	-	-
Leverage Ratio										
Debt/Equity Ratio	-	-	-	+	+	+	+	ND	ND	ND
Market-to-Book Ratio	ND	ND	ND	ND	-	-	ND	+	+	-
Conclusion:	-	+	-	-	+	-	+[1]	+	-	+
Plant-Level Tests[2]										
Earnings Test / Gross Margin Test / Revenue Test	-	+	ND	+	-	+	ND	ND	-	+
Final Conclusion:	-	+	-	?	?	?	+[1]	+	-	+

[1] if bond ratings are above Ba/BB

[2] one of the three plant-level tests should be performed

+ = positive test result or economic effect not negative

- = negative test result or economic effect

ND = no data

? = results indeterminate - plant closure analysis needed

Low ratios, therefore, could mean that cash flow may be inadequate to cover debt. If the Debt/Equity Ratio is also low and, more importantly, if bond ratings are high (both indicating low risk of defaulting on debt) low Solvency Ratios can be ignored. In general, bond ratings are good indicators of default risk and they can be relied upon over the Solvency Ratios. Moody's Industrial Manual and Standard and Poor have bond-rating services that assign a firm's bonds to one of nine rating categories:

Moody's	Standard & Poor
Aaa	AAA
Aa	AA
A	A
Baa	BBB
Ba	BB
B	B
Caa	CCC
Ca	CC
C	C

Aaa and AAA are the best ratings, assigned to bonds with the smallest degree of investment risk. Thus, if other indicators are positive, trade off low Solvency Ratios against a high bond rating (above Ba/BB) and conclude that the firm can afford pollution control. This is shown in Example #7 in Exhibit 5-5.

Positive Indicator: Market Value of Stock Not Declining
Liquidity Ratios Above Cutoff

Negative Indicator: Solvency Ratios Declining

If Solvency Ratios are lower than in previous years while other indicators show steady or improving conditions, it could be due to the lagging effect of a new investment on the income statement. For example, if long-term debt is increased and stock is issued to purchase new process equipment, the following balance sheet items are affected:

- Long-Term Debt -- increased;
- Common Stock -- increased; and
- Property, Plant, and Equipment -- increased.

Payments on the loan as a result of the purchase are expenses that occur on the income statement, causing a decrease in net income.

Because the capital outlay for process equipment does not immediatley produce an increase in revenues, the Solvency Ratios (which use income statement items in the numerator and balance sheet items in the denominator) would indicate worse financial conditions than before the purchase. These ratios are misleading, however, because the new process equipment will increase income in future periods and perhaps improve the firm's financial condition. Rely on the Liquidity Ratios and market value of the stock to draw conclusions. This set of conditions and variations on it are shown in Examples #8 through #10 in Exhibit 5-5, along with the conclusions that would be drawn concerning the firm-level analysis.

5.3.2 Interpretation of Plant-Level Test

The final step in interpreting the results of the financial analysis is assessing the result of whichever plant-level test is performed in conjunction with the conclusion reached for the firm-level analysis. Obviously, this only needs to be done if a plant-level analysis was deemed necessary and was performed. If the firm-level analysis indicates that the firm can pay for pollution control and the plant-level test result indicates likewise, the final conclusion should be that there would be no negative effect due to an investment in pollution control. If both the firm-level and plant-level analyses indicate a negative economic effect due to a pollution control investment, the conclusion should be that the plant could not afford the technology and that a less costly technology should be evaluated. A more detailed closure analysis would be necessary if the conclusions of the firm-level and plant-level analyses disagree with each other. Various combinations of firm-level and plant-level results and the appropriate final conclusions are shown in Exhibit 5-5. Exhibit 5-6 shows the firm-level and final conclusions using the sample firm and plant data.