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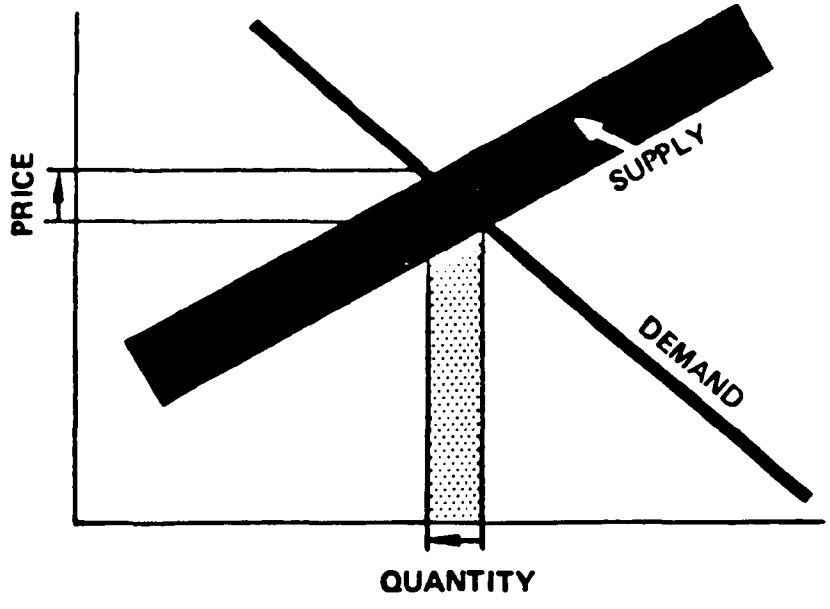
Electrical and Electronic Components Industry Phase II



Economic Impact Analysis of the Electrical and Electronics Components Industry Phase II

FINAL REPORT

by

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EPA Contract No. 68-01-6426
(Work Assignment #9)

to

Office of Analysis and Evaluation
U.S. Environmental Protection Agency
401 M Street, SW, (WH-586)
Washington, DC 20460

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This document is an economic impact assessment that was prepared during the development of the recently-issued effluent guidelines. The report is being distributed to EPA Regional Offices and state pollution control agencies and directed to the staff responsible for writing industrial discharge permits. The report includes detailed information on the costs and economic impacts of various treatment technologies. It should be helpful to the permit writer in evaluating the economic impacts on an industrial facility that must comply with effluent limitation guidelines or water quality standards.

The report is also being distributed to the EPA Regional Libraries, and copies are available from the National Technical Information Service (NTIS), 5282 Port Royal Road, Springfield, Virginia 22161 (703/487-4600).

If you have any questions about this report, or if you would like additional information on the economic impact of the regulation, please contact the Economic Analysis Staff in the Office of Water Regulations and Standards at EPA Headquarters:

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PREFACE

This document is a contractor's study prepared for the Office of Water Regulations and Standards of the Environmental Protection Agency (EPA). The purpose of the study is to analyze the economic impact which could result from the application of new source and pretreatment standards issued under Sections 301, 304, 306 and 307 of the Clean Water Act for two subcategories of the Electrical and Electronic Components Industry.

The study supplements the technical study (EPA Development Document) supporting the issuance of these regulations. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports certain standards and limitations based upon an analysis of the feasibility of these standards in accordance with the requirements of the Clean Water Act. Presented in the Development Document are the investment and operating costs associated with various control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the application of various control methods and technologies. This study investigates these impacts in terms of effects upon production and employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Water Regulations and Standards of EPA. This report was submitted in fulfillment of Contract No. 68-01-6426 by Meta Systems Inc. The analysis was completed November 1983.

Section 1

Executive Summary

I. Introduction

This study is concerned with two industry subcategories that are part of the Electrical and Electronic Component industry. The two subcategories are Cathode Ray Tubes and Luminescent Coatings. Cathode ray tubes (CRTs) are used in a variety of equipment such as television receivers, scientific instruments, oscilloscopes, computers, industrial controls and military hardware.* Luminescent coatings are used in the manufacture of all types of CRTs and also in the manufacture of fluorescent lamps, mercury lamps, lasers, instrument panels, postage stamps, laundry whiteners and specialty paints.

The 1972 Federal Water Pollution Control Act (and subsequent litigation) and the Clean Water Act of 1977, require EPA to develop a program and adhere to a schedule in promulgating effluent limitations guidelines, new source performance standards and pretreatment standards for 65 groups of "priority" pollutants for 21 major industries. Several wastewater treatment alternatives were developed for the two industry subcategories in response to federal legislation. As required by the Clean Water Act, this study presents the projected economic impacts of complying with the final regulations as well as with other options considered, but not selected, by EPA for the final regulations.

II. Industry Profile

Color TV picture tubes and other CRTs are but two of a large number of products associated with the electronics industry which includes electronic

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* The cathode ray tube subcategory is subdivided into two industry segments--color TV picture tubes and other CRTs--for purposes of the impact analysis.

components, consumer, industrial and military electronics, communications equipment and systems. Overall factory sales of electronic systems and components were $114 billion in 1981 of which $24.4 billion (21.4 percent) was electronic components that include solid state devices ($7.8 billion), passive components such as resistors and capacitors ($2.9 billion), and electron tubes. Sales of electron tubes of all types amounted to $2.0 billion of which approximately $1.0 billion was in power and special purpose tubes (which include CRTs other than color TV picture tubes).

In the Standard Industrial Classification (SIC) system, electron tubes of all types are classified within SIC 3671. Luminescent coatings are not classified as part of the electronics industry but fall primarily within SIC 2819, a large group of miscellaneous industrial inorganic chemicals, not elsewhere classified.

Over the past decade, 1971-1981, the value of U.S. production of color TV picture tubes increased at an average annual rate of 1.2 percent in real terms. According to industry forecasts, the outlook is that sales of color TV picture tubes will increase at a rate averaging 6.9 percent annually, in current dollars; in real terms, this should result in 1984 sales of $1.08 billion (expressed in 1982 dollars, based on an average annual rate of inflation of 5.5 percent).

For other CRTs, the value of production, in real terms, grew at an average annual rate of eight percent between 1972 and 1981. Industrial and military type CRT sales amounted to $118 million in 1981, equivalent to 35 percent of all sales of electro-optical products; military and industrial portions cannot be separately identified in the available information. In 1984, the value of sales is expected to be 30.6 percent greater than in

1982, expressed in constant 1982 dollars; this will result from an average annual rate of real growth of 14.3 percent.

Production growth in both industries is projected to generally follow the overall business cycles, based upon historical data and performance forecasts. Although production growth is expected to fluctuate in the future, 1982 is clearly a very poor growth year due to the current economic slump and neither industry is expected to return to this low point through 1990. Thus, while the treatment cost data are developed for 1982, the economic impact analysis is performed using production levels and sales projected to 1984, but indexed to 1982 dollars. 1984 is the year in which compliance expenditures will begin and it is expected to be a more typical year for the industry than 1982. Values are indexed to 1982 dollars to allow comparisons with technical costing data, based on that year.

Employment in the electron tube industry overall (SIC 3671) increased only slightly (0.05 percent annually) over the past decade; in 1981 total employment was 43,500 and of these 60 percent were production workers. In the current decade, 1980 to 1990, the Bureau of Labor Statistics forecasts rising employment, at a rate of 1.7 to 2.5 per year.

Prices of color TV picture tubes in 1980 averaged $90 (all sizes) for U.S.-made tubes compared to $56 for imports, almost all of which come from Japan; differences in average prices were due in part to the fact that U.S.-made picture tubes account for a greater share of the large screen sizes. For other CRTs, industrial and military types ranged in price from under $100 to well over $1,000 with an average of $193 per tube in 1981.

Foreign trade in color TV picture tubes is linked to foreign trade in television receivers. Imported tubes have been increasing over the last

five years and in 1981 the number of tubes increased by 67 percent over 1980. The U.S. Tariff Act of 1980 invoked anti-dumping measures for Japanese-made TV sets. Whether or not the anti-dumping measure for imported sets will be relaxed, or continued, is currently under evaluation by the U.S. government. This decision, as well as other potential import limiting measures for electronic products, could affect the growth of U.S. production of color TV picture tubes. The value of imports of other CRTs has also been growing. In 1981 imports accounted for an estimated 24 percent of U.S. sales of other CRTs. Balance of trade has been positive for color TV picture tubes with CRTs and for electron tubes of all types. However, for picture tubes, the balance has declined from $60 million in 1977 to $49 million in 1980 and to $12 million in 1981; for other CRTs the balance has increased from $11.6 million to $37.9 million in 1981.

Five firms, with seven plants, are known to manufacture color TV picture tubes in the U.S., not including those who recondition used tubes; the firms are RCA, Zenith, General Electric, North American Philips and Sony. Fourteen companies, with seventeen plants, produce CRTs other than TV picture tubes, including two of the largest (Tektronix and Hewlett Packard) who use much of their CRT production captively. Five firms (representing five plants) are known to manufacture luminescent coatings: RCA, General Electric, Westinghouse, GTE-Philips and U.S. Radium Company.

III. Economic Impact Methodology

The methodology consists of seven steps which address the following points: (1) baseline estimates for the three industry segments, (2) measures of treatment cost impacts at the industry, plant and firm levels, (3)

potential plant closures, (4) production and employment effects, (5) foreign trade implications, (6) new sources and (7) implications for small businesses.

III.1 Baseline Estimates and Measures of Impact

Impacts at the industry level, as well as at the firm and plant level, result from treatment costs incurred by the plants. Estimates of value and quantity of production and profit--without additional treatment costs--serve as a baseline against which the impacts of treatment costs are estimated. The baseline estimates are made for 1984 but in 1982 dollars because treatment costs were estimated in 1982 dollars. Different methods are used to estimate industry-wide baseline values for each industry segment (color TV picture tubes, other CRTs and luminescent coatings) because available data are different with regard to (1) time periods for which data are reported and (2) level of data aggregation for the different segments.

Industry-wide impacts for each subcategory are considered assuming that additional costs are absorbed by manufacturers. Thus baseline prices are unchanged but profits decline. If some of these costs can be passed on in the form of price increases, then the analysis is overestimating impacts on profitability.

Three of the financial ratios reported in Dun and Bradstreet are used to judge the financial health of firms whose plants incur additional treatment costs. The ratios which are examined for both the baseline and impact projections are: (1) current assets to current liabilities, (2) sales to net working capital, and (3) return on assets.

Five plant-level impact measures are used in the analysis. Four of these are ratios of annual treatment costs relative to (1) plant sales, (2) plant manufacturing cost, (3) plant-level profit, and (4) firm-level profit. The fifth is a ratio of the capital investment portion of treatment cost to yearly capital investment by each plant. Plant sales are obtained from the EIS (Economic Information Systems) data file. Firm-level profit for publicly-owned companies is obtained from Form 10-K reports and Moody's Industrial Manual. The denominators of the other three ratios are estimated from a set of derived factors, multiplied by 1984 plant sales. The factors are average 1977 values of manufacturing cost per dollar of sales, plant-level profit per dollar of sales, and annual capital investment per dollar of sales; sales and value of shipments are assumed to be synonymous. Factors for other years were calculated to verify the 1977 figures. The factors are calculated from the 1977 Census of Manufactures at the four-digit SIC level of aggregation that is most appropriate for each industry subcategory. For example, a 1984 estimate of the manufacturing cost for a color TV picture tube plant is estimated as the 1984 plant sales multiplied by the manufacturing cost-to-sales ratio in 1977 computed for SIC 3671--electron tubes, all types. This approach treats each plant as if it operated with the same ratio of manufacturing cost-to-sales and plant profit to sales and capital investment to sales as described by the average for the four-digit SIC group. The approach was employed because, other than sales, no financial information is available for individual plants.

Two appendices supplement the impact analysis. Appendix A is a sensitivity analysis performed on the 1984 sales estimates and on the plant profits estimates. For this analysis, the impact measures are re-examined

under both a ten percent increase and a ten percent decrease in annual sales. This insures that the conclusions drawn based on the impact measures account for any errors made in projecting plant sales. In addition, the impact measures are also re-estimated with a ten percent decrease in plant profits, to allow for the possibility that the costs of manufacturing inputs rise faster than the five to six percent inflation rate assumed (which would be reflected in a decrease in profits).

Appendix B addresses the costs of compliance with the total toxic organics (TTO) limitations. A sensitivity analysis is carried out to determine if any of the impact measures are affected by the addition of TTO compliance costs. As information on existing plants shows that all plants currently have a solvent management program in place, only the incremental cost to comply with the TTO limitation (not the total cost of a solvent management program) by improving the current program is examined. In general, costs of improved management techniques are offset by solvent resale. Some plants may have to haul away their solvents under the Resource Conservation and Recovery Act (RCRA) requirements. Since it was not possible to determine which plants, if any, will fall under these requirements, the sensitivity analysis assumes these "worst case" costs for all plants which are not known to be already in compliance.

III.2 Closure Analysis

Highly impacted plants are first identified by examining the values of the impact measures, the financial ratios of the parent company, and other characteristics known about some of the firms. A solvency analysis is then performed on the highly impacted plants to determine whether or not they

will close. The solvency analysis involves estimating and comparing the present value of cash flow after treatment costs to the salvage value of equity for the plant. A proxy for cash flow is estimated from unadjusted profit obtained from 1977 census data minus treatment costs and taxes. The salvage value is computed using financial ratios from the Small Business Administration's FINSTAT data and sales information for each plant. Using the results of the solvency analysis for the highly impacted plants, judgments are made about the possibility of plant closure.

III.3 Production, Employment and Foreign Trade

Since it is assumed that there is no pass through of treatment costs, it is possible that there will be no impacts on total industry production, because there will be no price-related demand changes. However, there might be production changes if plants were to close due to reduced profits, and there were no corresponding increase in production at other locations to replace that which would be lost. As information concerning the likelihood of such expansion is not readily available, production and employment impacts are evaluated in relation to the closure analysis and as a result of the possible shutdown of specific product lines or plants.

Foreign trade impacts are also evaluated in relation to production changes resulting from possible plant closures. As a worst case analysis, it is assumed that production is moved to foreign firms or overseas U.S. plants and that exports decrease in proportion to total subcategory production decreases resulting from possible closure.

III.4 New Sources

This analysis examined whether more stringent wastewater treatment requirements for new sources compared to existing plants could result in

additional costs sufficient to act as a barrier to new firms entering the industry or to existing manufacturing firms who might build new plants. Whether or not current capacity can handle increased demand is not considered here because no information is available on current plant capacity and utilization for any of the three industry segments.

Two cases for new TV tube and other CRT plants are considered representing costs for new indirect and direct dischargers. Case A analyzes the impact of the incremental treatment cost between Option 2 and Option 3 for new indirect dischargers because existing indirect dischargers will be required to attain a level of treatment equivalent to PSES-2. Case B analyzes the impact of the total treatment cost for Option 3 for new direct dischargers because no regulation is being promulgated for existing direct dischargers. This is a conservative assumption since, in fact, existing dischargers do have control technology in place. Five model plant sizes are used for the new source analysis for color TV picture tubes and other CRTs, ranging from 10,000 gpd wastewater flow to 500,000 gpd. The three larger sizes, from 100,000 to 500,000 gpd, best represent new TV tubes plants.

Three model plant sizes were selected for new luminescent coatings plants ranging from 10,000 gpd to 500,000 gpd. Only one case is evaluated for coatings plants since new plants will be required to achieve NSPS and PSNS wastewater treatment levels equivalent to BAT-2 and PSES-2, and existing plants will not be required to attain any higher level of treatment over current, in place, treatment.

Production, sales and unit values estimates are approximated for the model plants using data for existing plants. Judgments are made about

whether the additional cost for new sources poses an economic disadvantage to entry into the three industry segments.

III.5 Small Business Analysis

Under the Regulatory Flexibility Act of 1980, the EPA must consider the effects of the regulations on small businesses. The distribution of treatment costs incurred by different size firms is estimated to identify the potential impacts on those firms considered to be small businesses.

IV. Effluent Limitations Guidelines, Options and Costs

Under the Clean Water Act of 1977, the EPA program is to set a number of different kinds of effluent limitations and standards designated as follows:

- o Best Practicable Control Technology Currently Available (BPT);
- o Best Available Technology Economically Achievable (BAT);
- o Best Conventional Pollution Control Technology (BCT);
- o New Source Performance Standards (NSPS);
- o Pretreatment Standards for Existing Sources (PSES) and for New Sources (PSNS).

EPA estimated a total of 29 plants are covered by the proposed regulation. Treatment technologies appropriate for CRTs and luminescent coatings are developed in the final Development Document.

IV.1 Treatment Options

For cathode ray tube plants, the three treatment options* are:

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* The technology description of each numbered option presented here is not, in all cases, the same as the description of the same option presented in the preamble and Final Development Document. Economic option 2 is the same as technical options 2 and 4. EPA is analyzing them together because EPA has determined that facilities can meet the regulations through their combined application. A sensitivity analysis of solvent disposal costs for option 4 is presented in Appendix B.

Option 1: No additional treatment required; specific conditions are met that allow exclusion of regulatory requirements.

Option 2: Solvent management to control total toxic organics, chromium reduction with the use of sulfuric acid and sodium bisulfite, chemical precipitation and clarification of all metals--bearing process wastes, sludge de-watering and pH adjustment.

Option 3: Option 2 plus multimedia filtration.

For luminescent coatings plants, there are two options:

Option 1: No required treatment.

Option 2: Chemical precipitation and clarification of all metals-bearing process wastes using lime, a coagulant and a polyelectrolyte, sludge de-watering and pH adjustment.

The treatment options applied to each regulation and the specific designations are shown in Table 1-1.

Table 1-1. Treatment Option by Regulation and Type of Discharger

Option	Existing Direct*	Existing Indirect	New Source Direct	New Source Indirect
1	BPT/BAT-1	PSES-1	NSPS-1	PSNS-1
2	BPT/BAT-2	PSES-2	NSPS-2	PSNS-2
3**	BPT/BAT-3	PSES-3	NSPS-3	PSNS-3

* BPT, BCT, and BAT all apply to existing direct dischargers.

** Applies only to the CRT subcategory (including TV tubes and other CRTs).

IV.2 Treatment Costs for Existing Plants

Option 1 would require no additional treatment of wastewater effluents. For existing sources, model plant treatment technology is developed and costed; the estimates are applied to existing plants by making adjustments to account for actual flow size and treatment currently in place.

Table 1-2 summarizes the cost information for the plants included in the study. Of the 29 total plants, three are direct dischargers, twenty-five are indirect dischargers, and one discharges no wastewater. Information on flow and treatment are not available for one indirect discharger. The treatment costs for the two major industry subcategories are summarized by direct and indirect dischargers and by option. Option 3 does not apply to the Luminescent Coatings subcategory.

Table 1-2. Summary Table for Existing Sources

	Number of Plants by Industry Subcategory			
	Luminescent Coatings Plants		CRT Plants	
	Direct	Indirect	Direct	Indirect
Total Number of Plants*	2	2	1	23 ***
Incurring Costs at:				
Option 1	0	0	0	0
Option 2	2	2	0	17
Option 3	NA	NA	0	21
Treatments Costs ($000)**				
Option 1				
Capital Costs	0	0	0	0
Total Annual Cost	0	0	0	0
Option 2				
Capital cost	5.00	118.10	0	6,491.30
Total Annual Cost	27.40	82.64	0	3,433.30
Option 3				
Capital Cost	NA	NA	0	7,682.95
Total Annual Cost	NA	NA	0	3,922.70

NA = Not applicable.

* For Luminescent Coatings, there is one zero discharging facility.

** Dollars are 1982 $.

*** Information not available to perform the analysis for one plant.

IV.3 Treatment Costs for New Sources

Treatment costs for new sources are summarized in Table 1-3 for the various model plant sizes. The costs shown are incremental with respect to raw waste load treatment technology.

Table 1-3. Treatment Costs by Option for New Sources (NSPS and PSNS)*

Subcategory	Model Plant Flow Size (gpd)	Per Plant Total Annual Costs ($000) Option 2	Option 3
Luminescent Coatings	10,000	58.99	61.39
	100,000	318.75	343.25
	250,000	583.85	636.15
CRTs	10,000	69.35	71.5
	50,000	162.10	168.70
	100,000	351.40	375.90
	200,000	571.10	618.40
	500,000	826.30	921.10

* PSNS compliance costs are the incremental compliance costs from option 2 and 3.

IV.4 Selected Options

The EPA has selected the options (summarized in Table 1-4) for the final regulations. For existing CRT plants, that selection is Option 2. For new CRT sources, Option 3 is selected. For new luminescent coatings plants, Option 2 is selected. Option 1 (i.e., no new regulations) was selected for the existing direct discharger CRT plant, and for existing direct and indirect discharger coatings plants.

Table 1-4. Selected Options for Final Rules

	Luminescent Coatings Plants	CRT Plants
Existing Sources		
BPT/BCT/BAT	BPT/BAT-1	BPT/BAT-1
PSES	PSES-1	PSES-2
New Sources		
NSPS	NSPS-2	NSPS-3
PSNS	PSNS-2	PSNS-3

V. Results of the Analysis

V.1 Baseline Estimates

At the industry level, the 1984 baseline estimates are shown in Table 1-5 for the three industry segments.

Table 1-5. 1984 Baseline Estimates
(1982$)

	Color TV Picture Tubes	Other CRTs	Luminescent Coatings
Production Quantity (million units)	13.4	.690	NA
Value of Production (Millions $)	1076.65	147.48	379.8
Unit value ($ per CRT)	80.15	213.83	NA
Industry Profit (million $)	374.7	67.55	145.5

NA = Not available.

At the firm level, the financial health of ten publicly-owned companies whose plants may incur treatment costs were judged by the three financial ratios. (Seven other firms are not publicly-owned and therefore the necessary data are not available.) Several firms have relatively low solvency ratings (current assets to current liabilities) but no marked weakness in the other two ratios (net sales to net working capital and return on total assets) that are indicators of management efficiency and profitability. Return on assets has been low for several years for all but one of the firms, but none of the firms are judged to be in serious financial difficulty.

V.2 Impact Estimates: Industry-Wide

At the industry level, impacts are estimated assuming that treatment costs are fully absorbed by manufacturers. The results summarized in Table 1-6 show that Option 2 and Option 3, estimated baseline average profits decrease no more than 1.80 and 1.89 percent, respectively (which occur in the industry segment Other CRTs).

Table 1-6. 1984 Industry-Wide Impacts
(1982$)

Industry Segment	1984 Baseline (Millions 1982$)	1982 Impacts (Percent*) Option 2	Option 3
Color TV Picture Tubes			
Value of Production	1,076.65	0	0
Industry Profit	374.7	-.62%	-.73%
Other CRTs			
Value of Production	147.48	0	0
Industry Profit	67.55	-1.80%	-1.89%
Luminescent Coatings			
Value of Production	379.8	0	NA
Industry Profit	145.5	-.08%	NA

* Percent change from Baseline Estimate.

V.3 Impact Estimates: Firm Level

At the firm level, treatment cost impacts on the financial health of publicly owned companies are imperceptible. For example, RCA has three plants that incur cost under Option 3, however, the total annual cost of $973 thousand has no significant effect on the financial ratios, given that total assets of the firm are $7.8 billion.

V.4 Impact Estimates: Plant Level

V.4.1 Color TV Picture Tubes. Three existing plants would incur costs under selected Option 2, and six under Option 3. Except for two plants

(Zenith, Melrose Park, Illinois, which is closing according to a recent announcement and ECG Philips, Ottawa, Ohio), all the impacts based on annual costs are small, less than two percent. These impacts are annual treatment cost to: a) sales, b) manufacturing cost, c) plant level plant profit, and d) firm's net income. The capital investment portion of treatment cost is less than 21 percent of annual plant investment for Option 3, excluding the Zenith and Philips plants.

V.4.2 Other CRTs. Fourteen plants incur treatment costs under selected Option 2 and fifteen under Option 3. Except for four relatively small plants, all impacts are small. Two of these are owned by one firm, Thomas Electronics. The most impacted plant is the Thomas Electronics plant in Los Angeles. It shows an annual treatment cost-to-sales ratio of just under 3.25 percent for either Option 2 or 3; the ratio of annual treatment cost to manufacturing cost is 4.99 percent, and for annual treatment cost to plant profit it is 7.06 percent for Option 3. The capital cost for treatment is 1.54 to 1.61 times as great as the annual plant investment for Option 2 and Option 3, respectively.

V.4.3 Luminescent Coatings. Four of the five existing plants would incur a cost under Option 2. All of the impact measures are small, less than two percent. Under the selected Option 1, no treatment costs are incurred.

V.5 Closure Analysis

Table 1-7 summarizes the results of the impact and solvency analyses which are discussed below.

Table 1-7. Summary of Impact and Solvency Analysis Results

Industry Segment	Total Number of Plants Analyzed*	Number of High Impact Plants	Number of Expected Closures
Color TV Tubes	7	1	0
Other CRTs	16	4	0
Luminescent Coatings	5	0	0

* One Other CRT plant not analyzed due to lack of data.

V.5.1 Color TV Picture Tube Plants. One plant owned by Philips in Ottawa, OH (with sales of $49 million) has significant profitability impacts as a result of this regulation. Financial data show that the parent firm is financially strong and thus will probably carry the associated treatment capital investment costs ($1.35 million for Option 2 and $1.54 million for Option 3).

Based on the impact measures and the above observations, no plant closures are anticipated as a result of treatment costs. It should be noted that plant-level impacts are expressed with reference to plant sales. However, a plant may have multiple product lines, and if treatment costs were allocated only to those lines which incur the costs, the impacts may be understated for that product line. Sales data on a product line basis are not available for TV picture tube plants (or for plants in the other two industry subcategories). However, the impacts presented here are still valid as plant-wide impacts.

V.5.2 Other CRT Plants. Two plants owned by Thomas Electronics (in Los Angeles, CA and Clyde, NY) and one owned by Litton Industries (in Tempe, Arizona) show the highest values of impacts. Another plant, Dumont Electronics (in Clifton, New Jersey) also has relatively high impact measures.

Both of the Thomas Electronics plants [with sales of $2.2 million (CA) and $3.1 million (NY)] are small relative to a third plant in Wayne, NJ (with $12 million sales). It is conceivable that the firm might consider closing one or both of these plants as a result of this regulation and consolidate CRT manufacturing at the NJ plant. Financial data for this privately-owned company are not available so it was not possible to analyze its financial base to determine if it has adequate capital availability to finance the necessary capital investments ($123.6 thousand for Option 2 and $129.4 thousand for Option 3 for each of the three plants).

Impact ratios for the Litton Industries plant (with sales of $3.9 million) are moderately high. The financial analysis shows that Litton has an adequate financial base to afford the wastewater treatment expenditures (capital investment of $123.6 thousand for Option 2 and $129.4 thousand for Option 3) and, given the rapidly growing CRT market, will probably choose not to close the plant.

A fourth plant, Dumont Electronics, Clifton, New Jersey (with sales of $17.6 million) is borderline according to the impact measures. Since Dumont Electronics is a privately owned firm no analysis could be made of its financial strength.

V.5.3 Luminescent Coatings. None of the plants are considered as closure candidates because no regulation is being written for existing plants.

V.5.4 Solvency Analysis. The solvency analysis is applied to the three plants (the Thomas Electronics plants in NY and CA and the Dumont plant) with high impact measures and for which no financial analysis of the firm was possible. The results of the analysis show that for each of these plants, the present value of cash flow is much greater than the salvage value of the plant. Thus, the plants are worth more if they remain open. As a result, no plant closures are expected.

V.5.5 Reliability of the Impact Ratios. The factors used for estimating the impact ratios have been calculated for several other years. There are no significant differences between factors for later years and the 1977 factors which were used.

V.6 Production and Employment Impacts

As mentioned earlier, production and employment impacts are evaluated in relation to the closure analysis. Three small CRT plants are identified as having significant profitability impacts. The solvency analysis showed that these plants are not expected to close but it is possible that production and employment reductions could take place as a result of this regulation. It is likely that these reductions would not remain over the long-term but, given the rapidly growing CRT market, would merely be temporary adjustments as production is picked up by expansion at other sites owned by the same firm or by other firms. Thus, while the industry-wide geographical distribution of production (and employment) may change, no significant reductions in total output are anticipated.

V.7 Foreign Trade

Foreign trade projections are always difficult to make because there are so many international factors involved, such as interest rates and government restrictions, which are hard to predict. Thus, what actually happens may be very different from what is estimated.

The foreign trade assessment is a worst case analysis based on the closure analysis discussed earlier. If the three CRT plants identified in that analysis were to reduce production, then foreign trade in the other CRT subcategory could be affected. However, historical data show this balance of trade to be steadily improving. Given this favorable outlook, it is probable that even if these plants did reduce output, that production would be expanded elsewhere in the U.S. and, therefore, foreign trade would not be seriously impacted.

V.8 New Sources

Impacts on new sources are summarized in Table 1-8 and discussed below.

Table 1-8. Summary of Impacts on New Sources

Industry Segment	Discharger	Range of Annual Treatment Cost to Sales %	Maximum Percentage of Annual Treatment Cost to Average Unit Value
New Color TV Tubes	Indirect (PSNS-3)	0.04-0.14	0.2
	Direct (NSPS-3)	0.35-2.14	2.1
New Other CRTs	Indirect (PSNS-3)	0.01-0.04	0.1
	Direct (NSPS-3)	0.11-1.29	1.3
New Luminescent Coatings	Direct and Indirect (NSPS-2) (PSNS-2)	0.6-7.8	NA

NA = Not applicable.

V.8.1 New TV Tube Plants. As mentioned earlier, two cases are considered in analyzing new color TV tube plants. For Case A (indirect dischargers), the annual treatment cost estimated per tube ranges from $0.03 to $0.10, which is less than 0.2 percent of the average unit value, $70.44, for color TV picture tubes. Annual treatment cost-to-sales ranges from 0.04 to 0.14 percent, depending on plant size and the relationship between flow and production value. For Case B (direct dischargers), the annual treatment cost per tube ranges from $0.25 to $1.50. At most, this represents 2.1 percent of the unit value. Annual treatment cost-to-sales ranges from 0.35 to 2.14 percent. All existing TV tube plants have wastewater treatment flows of 200,000 gpd or greater. For new plants of the same sizes, annual treatment cost-to-sales would be 1.76 percent or less. Thus, for both cases, the costs are judged to be small enough not to pose a barrier for new plants entering the industry.

V.8.2 New Other CRT Plants. Two cases are also analyzed for new CRT plants. For Case A (indirect dischargers), the annual treatment costs estimated per CRT range from $0.02 to $0.10, which is less than 0.1 percent of the average unit value. Annual treatment cost-to-sales ranges from 0.01 to 0.04 percent.

In Case B (direct dischargers), total costs are estimated and the treatment costs are larger (up to $2.87 per CRT for a small plant with low production). The average product value ($222.00) associated with other CRTs means that, based on the lowest production level, the annual treatment cost per tube is only 1.3 percent of the average unit value. Where the tube values are lower than average, the impacts will be proportionately higher but will not pose severe impacts. Annual treatment cost to sales ranges from 0.11 to 1.29 percent. Thus, for either Case A or Case B the impacts are

small and not likely to pose a major disadvantage for new plants entering the industry.

V.8.3 New Luminescent Coatings Plants. Annual treatment cost as a percent of plant sales ranges from 0.6 to 7.8 percent depending on plant size and the relationship between flow and production value. Based on larger plant sizes (i.e., 100,000 gpd or greater) and on an average value per unit of flow, annual treatment costs are 4.2 percent or less of production value.

The conclusions are: 1) the additional cost burden will not discourage new plants being built by large firms whose product lines are very likely to be vertically integrated with coating production; and 2) treatment costs for small plants, not vertically integrated with CRT or electric lamp manufacturing may possibly dissuade a new entry into the industry.

V.9 Small Business Analysis

The selected options for promulgation are not expected to have a significant impact on small facilities in this industry. The thirteen largest firms incur 95.2 percent of the total annual treatment costs for Option 2 and 95.5 percent for Option 3. For these firms, 1982 sales range from $27 billion for General Electric to $13.3 million for Thomas Electronics.

The small businesses in the study incur 4.76 percent of the total annual treatment costs for Option 2 and 4.47 percent for Option 3. The Dumont plant, however, incurs most of it, as its costs are 4.57 percent and 4.30 percent of the totals for Options 2 and 3, respectively. Therefore, EPA

does not believe that this regulation will cause significant impacts to a substantial number of small entities.

VI. Limits of the Analysis

The results of the analysis depend on several major assumptions and on the accuracy of the data used in the calculations. These are discussed next.

VI.1 Plants With Multiple Product Lines

There is a lack of information on product lines for each existing plant, particularly sales data on product lines affected by treatment cost. Therefore, treatment cost ratios are based on plant sales. If additional wastewater treatment is needed for only cathode ray tubes or luminescent coatings and the plant has other product lines, then the impacts are underestimated on a per product line basis, although they are still valid as a measure of each plant's ability to pay. However, no public comments were received on how to improve the estimates used.

VI.2 Impact Measure Derivations

Impact measures, other than treatment cost to sales ratio, are based on aggregated data at the four-digit SIC level and the data are not up-to-date. Individual plants are analyzed as if they operated with the average values (of sales to manufacturing cost, sales to plant profit, sales to annual plant investment) for the four-digit SIC group for the three industry subcategories. In addition, the averages are calculated from 1977 Census of Manufacturers data. However, averages calculated for later years showed no significant differences when compared with the 1977 factors.

VI.3 Discount Factors

Annual costs are based on a 13 percent discount rate and a five-year life for the capital investment portion of treatment costs. Two alternative discount rates, 10 and 16 percent, were also analyzed. For color TV picture tubes and other CRTs, annual treatment costs are changed by five percent or less from those used in the study. The impact ratios are altered by no more than 0.06 percentage points for color TV tubes and by no more than 0.16 percentage points for other CRTs. None of the conclusions stated earlier would change if the alternative discount rates had been used.

VI.4 Small Companies

Small plants are likely to be privately owned. Privately owned firms are not required to provide financial data for public use, therefore financial ratios cannot be calculated to help in judging the financial condition of small companies and the potential severity of impacts.

This limitation notwithstanding, an analysis was conducted to determine whether small firms bear disproportionate impacts. Six firms out of the nineteen firms in the study which employ fewer than 250 persons are considered small for this analysis. These firms incur 4.76 percent of Option 2 and 4.47 of Option 3 annual treatment costs. The thirteen largest firms incur 95.2 percent of Option 2 annual treatment costs. For Option 3, the thirteen largest firms incur 95.5 percent of the annual treatment costs.

VI.5 Import Policies

If U.S. levels of production decline, existing plants may be more adversely impacted than the estimates show because costs will be spread over a lower base. Imports of TV picture tubes have increased annually in recent

years; but the future trend is uncertain. The tubes are used in TV sets and anti-dumping regulations imposed on Japanese sets by the U.S. may or may not continue. New regulations that apply to the picture tubes as well as the TV sets could also affect U.S. production, although pressure for such regulation has not been observed.

VII. Sensitivity Analysis

The results of the sensitivity analysis on the plant sales estimates are as follows. For the Color TV picture tube subcategory, the impact measures did not change enough to affect the status of any plant. Three plants in the Other CRT group, however, have impact ratios which differ enough that initial judgments made about them could change. With a 10 percent decrease in plant sales, two plants (Dumont and Litton) are much more severely impacted. For a 10 percent increase in sales, the Thomas Electronics plant in New York would have much less severe profitability impacts. The luminescent coatings plants are not affected by a change in the sales estimates and no different conclusions could be made.

The sensitivity analysis concerned with possible high manufacturing input costs showed that no impact measures were significantly affected and that no conclusions would be changed.

The worst case analysis of TTO compliance costs produced the following results. Only one TV picture tube plant might incur such a cost and its effect on the impact measures for the plant is almost imperceptible. For the other CRT plants, the costs for TTO removal are also very small, and so are the changes in impact measures.

Section 2

Industry Profile

I. Industry Definition

This study is concerned with three segments of manufacturing that are part of, or related to, the electronic tube industry. The three segments include the manufacture of (1) color television picture tubes--a particular type of cathode ray tube, (2) other cathode ray tubes and (3) luminescent coatings.

Color TV tubes produce images by controlling a stream of electrons which strike a surface coated with phosphors resulting in luminescence. Other cathode ray tubes (i.e. other than color TV tubes) use these same principles for display and for the storage of data in many different types of equipment such as scientific and engineering instruments, oscilloscopes, industrial controls, computers, word processors and military equipment such as radar, fire control and navigation systems. Luminescent coatings are used in the manufacture of cathode ray tubes (CRT) and also in fluorescent lamps.

There are many types of electronic tubes other than CRTs such as radio and television receiving tubes, power tubes and a wide variety of special purpose tubes. However, the effluent discharges resulting from their manufacture are controlled under other regulations.

II. Industry Overview

Color TV picture tubes and other CRTs are but two of a large number of products associated with the electronics industry. Before analyzing the

particular segments that are the focus of this study, an overview of the electronics industry is presented.

A rough breakdown of factory sales of electronic equipment, systems and components is shown in Table 2-1.[1/] Factory level sales of electronic components in 1981 accounted for $24.4 billion, or 21.4 percent of the $114 billion electronics industry total. Electron tubes are but one group of electronic components; tube sales totalled about $2.0 billion of which $1.1 billion is attributed to TV picture tubes, most of which were color tubes. (In 1981 about 11.1 million color TV tubes were sold, valued at $998.7 million.) Thus, color TV picture tubes account for approximately 50 percent of all electron tube sales, 4.5 percent of all electronic components and slightly less than one percent of total U.S. industry-wide factory sales of electronic equipment, systems and components.

Sales of power, transmitting and special purpose tubes amounted to $845 million in 1981. Electro-optical devices showed sales of $337 million and included other CRTs (other than TV picture tubes).

Five firms manufacture color television picture tubes (RCA, Zenith, GE, N.A. Philips and Sony). Fourteen firms make other CRTs including two large producers (Hewlett Packard and Tektronix), three fairly large producers and nine small producers. (Bureau of the Census information indicates that fourteen firms make industrial and military-type CRTs[2/]). Five firms produce luminescent coatings, based on information collected by EPA.

Employment in 1980 for electronic components (i.e., establishments classified in SIC 367) totaled 498,600 of which 336,600 were production workers. The electronic tube sector, all types (SIC 3671), accounts for eight percent of all employment in the components sector. In contrast, the semiconductor

Table 2-1

1981 Factory Sales of Electronic Systems and Components

	Billions of Dollars	Percent of Total
U.S. Industry Wide Factory Sales	114.0	100.0
Consumer Electronics (e.g. stereo equipment, TV sets)	11.4	10.0
Industrial Electronic Products, including computers & related products	43.5	38.2
Communications Equipment & Systems	34.7	30.4
Electronic Components	24.4	21.4
Electron Tubes	2.0	1.8
TV Picture Tubes* (color and monochrome)	1.1	0.9
Radio and TV Receiving Tubes	0.1	0.1
Power & Transmitter & Special Purpose Tubes	0.8	0.7
Solid State Products (e.g. transistors, diodes and rectifiers, integrated circuits, other semi-conductors	7.8	6.8
Passive Components (e.g. capacitors, resistors)	2.9	2.5
Other Components	11.6	10.2

Source: Derived from 1982 Edition Electronic Market Data Book, Electronic Industries Assoc. (EIA)

*Includes Imports of $71 million which EIA includes in U.S. Industry-Wide Factory Sales.

sector (SIC 3674) accounts for about 30 percent of all employment in the electronics component sector.

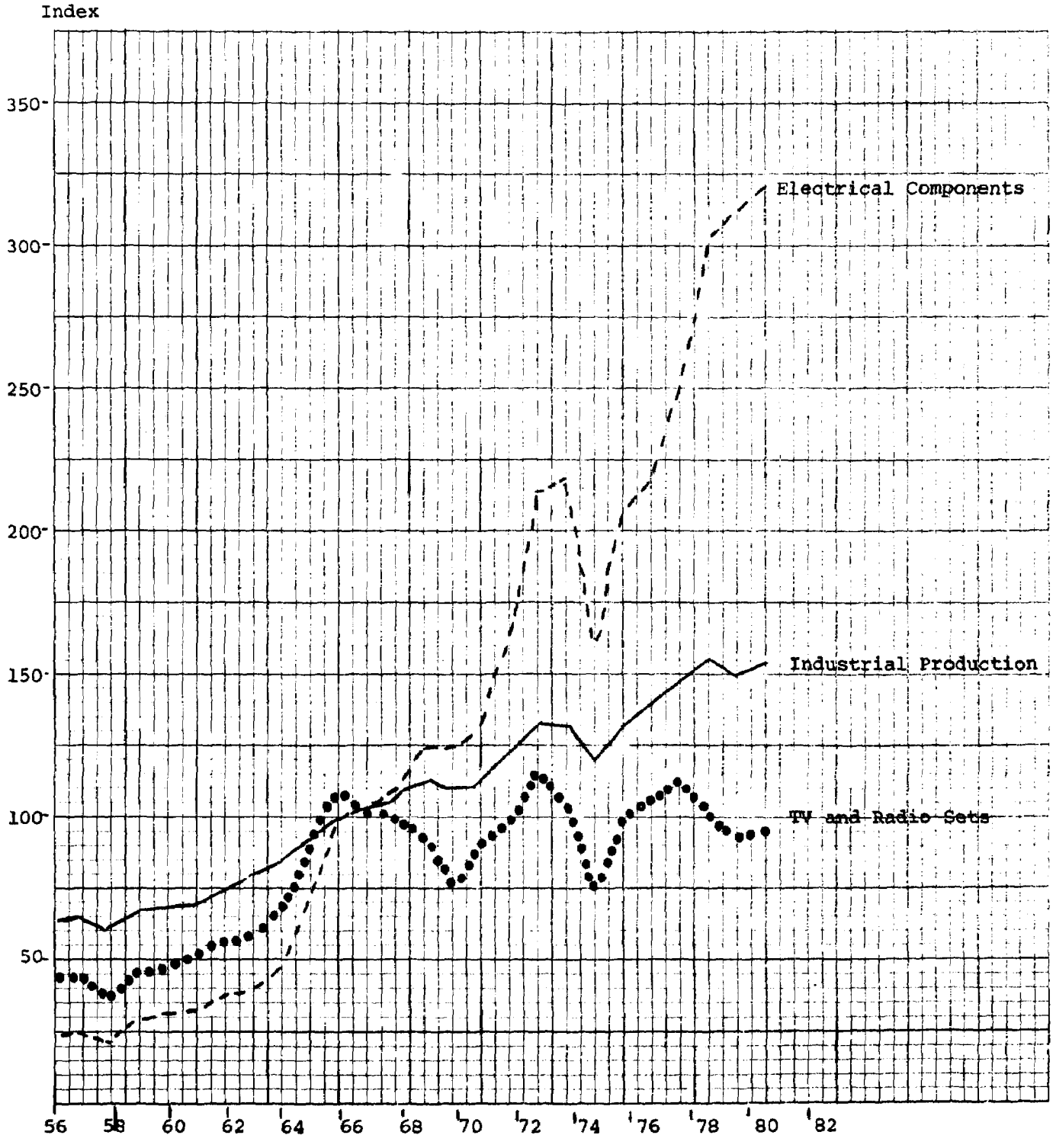
III. Growth History and Outlook

III.1 Industry Production and the Business Cycle

III.1.1. Historical Data. Figure 2-1 shows historical production index data for TV and Radio Sets and for Electrical Components, compared with the total industrial production index.[3/] As the figure indicates, production in both industries generally fluctuates similarly to the overall business cycles except that starting in the late sixties the fluctuations are much larger, especially for the electrical components industry. Production in both industries started out below overall industrial production but in the late sixties grew rapidly. TV and Radio Set production increased at a slower rate in the 1970's, and in the last ten years has not kept up with overall industrial production and has had wider fluctuations. Average annual growth from 1970 to 1980 has been 2.4 percent as compared with 3.2 percent for all industries. The electrical components industry has continued to grow very rapidly with large fluctuations. Its annual growth in the last ten years has been about five times faster than overall production, 15.3 percent compared with 3.2 percent.

The electronics industry segments which are of interest in this study, color TV picture tubes, other cathode ray tubes and luminescent coatings, are not specifically covered by the production indices shown in Figure 2-1. However, production of TV and radio sets is a fairly good end-use market indicator for color TV tubes. Electrical components include many products not covered by this study, the major one being semi-conductors and related

Figure 2-1. Historical Industrial Production Indices (1967 = 100)



Source: DRI Long-Term Review of the U.S. Economy

products. Since these products are doing very well, the electrical components production index trend may be more optimistic than one which only covers the products of interest here. However, the industry outlook for these subcategories remains strong (see below), and this index can be considered to provide a general indication of how the industry is doing. Luminescent coatings are used as a production input in each of the other subcategories covered here and because no more specific information is available on this sector, it is assumed to follow a trend that is the average of the other two.

III. 1. 2. Performance Forecasts. Table 2-2 shows forecasts to 1990 of the three industrial production indices shown in Figure 2-1 and discussed above. For each index, two forecasts have been made by DRI[3/], one smoothly following historical trends (Trendlong), and the other with more pronounced cycles (Cyclelong). As indicated by the annual growth rates compared at the bottom of the table, both industries have a healthy outlook. Both are expected to grow faster than the overall production rate from 1982 through 1985. TV and Radio Set production is expected to grow at 8.6 percent, which is much faster than its growth in the 1970 to 1980 period, and Electrical Component production is expected to grow at 8.1 percent, which is a considerably slower rate than previously. Production growth over the longer period from 1982-1990 is expected to be more moderate, 4.0 to 4.6 percent for TV and Radio Sets and 6.1 to 7.0 percent for Electrical Components, but still faster than overall production growth, 3.8 to 4.4 percent. Production growth in both industries is projected to generally follow the overall business cycles. Although production growth is expected to fluctuate in the future, as is especially evident from the Cyclelong forecasts, 1982 is clearly a very poor growth year due to the current economic slump and neither industry is expected to return to this low point through 1990. Thus, the economic impact

Table 2-2.

Industrial Production Indices Forecasts

	Industrial Production Index 1967=100		TV and Radio Sets Production Index 1967=100		Electrical Components Production Index 1967=100	
	Trendlong*	Cyclelong**	Trendlong	Cyclelong	Trendlong	Cyclelong
1982	139.0	139.0	82.1	82.1	311.4	311.4
	(-7.9)	(-7.9)	(-13.4)	(-13.4)	(-0.1)	(-0.1)
1983	142.5	142.5	86.5	86.5	318.3	318.3
	(2.5)	(2.5)	(5.3)	(5.3)	(2.2)	(2.2)
1984	153.8	153.8	95.9	95.9	359.6	359.6
	(7.9)	(7.9)	(10.9)	(10.9)	(13.0)	(13.0)
1985	163.1	163.1	105.0	105.0	393.2	393.2
	(6.0)	(6.0)	(9.5)	(9.5)	(9.3)	(9.3)
1986	170.7	176.6	112.1	117.0	424.1	442.8
	(4.7)	(8.3)	(6.7)	(11.4)	(7.9)	(12.6)
1987	178.7	184.6	116.1	123.8	452.0	482.1
	(4.7)	(4.5)	(3.6)	(5.8)	(6.6)	(8.9)
1988	185.8	174.7	118.2	109.2	482.7	446.3
	(4.0)	(-5.4)	(1.8)	(-11.8)	(6.8)	(-7.4)
1989	191.7	174.4	119.2	104.5	510.2	447.6
	(3.2)	(-0.2)	(0.9)	(-4.3)	(5.7)	(0.3)
1990	195.9	187.7	118.0	112.2	536.3	510.5
	(2.2)	(7.7)	(-1.0)	(7.4)	(5.1)	(14.1)
Average Annual Rate of Change (%):						
1982-85	(5.5)	(5.5)	(8.6)	(8.6)	(8.1)	(8.1)
1982-90	(4.4)	(3.8)	(4.6)	(4.0)	(7.0)	(6.1)
Comparison With Historical Data:						
1970-80	(3.2)	(3.2)	(2.4)	(2.4)	(15.3)	(15.3)

* Trendlong--projection of a smooth growth rate in the economy/industry, where potential output parallels historical output.

** Cyclelong--projected industry/economy growth, assuming the existence of business cycles, and major changes in the economy, resulting in a lessening of potential economic growth.

Source: DRI Long-Term Review of the U.S. Economy.

analysis is performed using projections for sales and production levels for 1984, the year in which compliance is expected and also a more typical year for the industry than 1982.

III.2 Factory Sales

III.2.1 Electron Tubes All Types (Including Color TV Tubes and CRT).

The growth history of electron tube sales (all types) has been sluggish since 1971. Analysis of this history differs depending on the data source. Data from the Electronic Industries Association (EIA) in Table 2-3A, shows that sales of electron tubes have increased at an annual current dollar rate which averages six percent since 1971 except for a downturn during the 1975 recession. In 1981, sales were $2.014 billion; over the 1972-81 period the data show that real growth (i.e., in constant dollars) averaged only 0.6 percent annually. According to the U.S. Department of Commerce data shown in Table 2-3B, value of product shipments of electron tubes grew at average annual rate of 3.6 percent from 1972 to 1981 (in current dollars)[4/] but in real terms, the value of shipments decreased at an average rate of 1.1 percent per year during that nine year period.*

A major reason for the sluggishness suggested by the historical trends from both industry and government data sources is the poor performance of the radio and television receiving tubes segment of the industry. This segment is being affected by a continuing shift to solid state technology. Increased import penetration into the US market is another important factor in the decline of receiving tubes. As a result, shipments of US-made receiving

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* Product price index applied to data in Table 2-3 to estimate constant dollar growth rates.

Table 2-3. Annual U.S. Manufacturer Sales of Electron Tubes, Selected Types, and Color Television Receivers

(Millions of Current Dollars)

Table 2-2A.

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Electron Tubes, All types	1094	1258	1338	1196	1071	1233	1296	1451	1586	1778	2014
Color Television Picture Tubes	470	590	676	569	463	586	586	682	761	912	999
Electro-Optical Devices*	80	112	133	138	149	173	215	268	307	307	337

Source: Reference 1; pp. 87, 88, 92.

Table 2-2B.

	1972	1977	1978	1979	1980	1981	1982
Electron Tubes, All Types	1189	1257	1428	1526	1680	1636	1718

Source: Reference 3; p. 237.

Table 2-2C.

1975	1976	1977	1978	1979	1980	1981
2268	2755	3289	3674	3685	4210	4349

Source: Reference 1, Page 6.

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* Includes Industrial and Military Cathode Ray Tubes.

tubes (expressed in current dollars) have decreased 10 percent annually since 1972.

The outlook, according to U.S. Department of Commerce projections, is that sales of electron tubes (total, all types) are expected to move in a downward trend at an inflation-adjusted rate of 0.4 percent per year through 1986.[4/] Industry forecasts show an annual (current dollar) growth rate of 5.7 percent in sales from 1981 to 1985.[5/] If a six to seven annual percentage rate of inflation is assumed, then the two projections are about the same. Using a sales value of $2.014 billion in 1981 and a 0.4 percent annual decline, the projected 1985 sales value is about $2.0 billion, expressed in constant 1981 dollars.

III.2.2 Color TV Picture Tubes. Color TV picture tube sales showed an eight percent annual (current dollar) growth during the 1971-81 period except for the 1975 drop, as presented in Table 2-3A. Expressed in constant dollars, this industry segment's sales increased by 1.2 percent per year.

Manufacturers' sales of color television receivers grew by 11 percent per year (in current dollars) from 1975 to 1981 while picture tube sales grew by 14 percent annually in the same period (see Table 2-3C). The color TV picture tube sales trend generally appears to follow that for receivers but with a higher rate of growth in value. The factors behind this trend can be seen in Table 2-4. Initial equipment sales grew rapidly in the late seventies (15 percent per year, in current dollars) but declined in 1981. Renewal sales and exports show a marked decline since the mid-seventies while imports have increased.

According to industry forecasts, the long-term outlook for color TV picture tubes is that annual sales are expected to grow at a rate of 6.9

Table 2-4. Annual Factory Sales of Color Television Picture Tubes by Market
(Thousands of Units and Dollars); United States, 1971-1981*

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Units											
Initial Equipment	5,647.6	6,950.7	7,824.1	6,548.5	5,205.2	6,186.1	6,821.7	8,181.0	9,124.0	10,623.1	10,048.1
Renewal	873.6	856.6	896.9	784.2	697.0	696.7	577.2	456.1	406.5	361.7	362.8
Export	222.1	622.3	976.9	845.8	871.2	1,484.4	1,139.4	958.8	973.3	940.0	675.7
Import	122.4	115.1	81.6	45.9	89.2	191.6	289.9	297.1	354.7	590.3	984.2
Total Units	6,865.7	8,544.7	9,779.5	8,224.4	6,862.6	8,558.8	8,828.2	9,893.0	10,858.5	12,515.1	12,070.8
DOLLAR VALUE:	474,000	595,212	679,025	571,219	469,202	598,414	601,543	699,002	783,228	944,782	1,051,639

*Excludes sales by local rebuilders.

Source: Reference 1, page 89.

percent (current dollars) from 1982 to 1986 and of 8.3 percent from 1982 to 1983.[5/] Allowing for an average annual rate of inflation of 5.5 percent, 1984 sales will be 3.5 percent greater than 1982 sales, in constant dollars. There is a growing demand for color television receivers for the consumer market due, in part, to the many new uses for the TV screen that are being developed. The color TV is the basic visual display device for several new television technologies such as home video games, video cassette recorders, and home computers.

There do not appear to be any technological innovations that would have an adverse impact on the TV picture tube market in the near future. Flat display tubes using semiconductor and/or liquid crystal technology have been demonstrated. However, substitution of such tubes for the cathode ray type tube will probably not occur until the 1990's.[6/]

III.2.3 Other Cathode Ray Tubes (CRT). Sales of electro-optical devices, which include cathode ray tubes for non-television uses, grew rapidly at an average annual rate of 13 percent per year from 1972 to 1981, as shown in Table 2-3A. Even when expressed in constant dollar terms, growth was substantial; an average rate of eight percent per year.

According to EIA estimates, industrial and military type CRTs represented about 35 percent ($118 million) of electro-optical factory sales in 1981.[1/] Using this $118 million estimate in conjunction with unit value of the factory level from the 1981 Annual Survey of Manufacturers, a 1981 average price is estimated at $210 to $225 per CRT, implying a production level of 550,000 to 600,000 units. (The 1981 Survey indicates 423,000 units with a value of $81.6 million.) Industry projections indicate that it can

safely be assumed that growth of CRT sales equalled or exceeded the trend of the larger, electro-optical segment of the industry.

The outlook for industrial and military CRTs is excellent; the industry forecasts the sales value will increase at an annual rate of 18.4 percent (in current dollars) from 1982 to 1986 and 25 percent from 1982 to 1983.[5/] Allowing for an average annual rate of inflation of 5.5 percent[3/], 1984 sales will be 35 percent greater than 1982 sales, in constant dollars. This is the segment of the electro-optical devices sector expected to achieve the highest growth rate.[5/] The current Administration's committment to increased expenditures for the Department of Defense, combined with a growing proportion of electronics equipment in military hardware, supports these growth projections. Increasing demand by business for the capabilities offered by data display devices (which allow easy access to information) will be another source of long-term growth in CRT sales. Expanded consumer use of personal computers and terminals is also expected to raise demand for CRTs. Color is an additional feature of CRT screens that will be in demand for such uses as computer terminals, arcade games and airline cockpit displays. Technologies like these will promote speedy growth of industrial-military CRT sales in the future. Display innovations, such as those using lasers, are not expected to hurt CRT sales and could expand them by stimulating the development of new, previously unattainable, applications.[1/]

III.3 Employment

Employment in the electron tube industry (SIC 3671) has increased slightly over the past ten years, at an average rate of 0.05 percent per year according to U.S. Department of Commerce and U.S. Department of Labor data. Table 2-5 shows total employment to be 43,500 in 1981 of which 26,700 were

Table 2-5. Average Annual Employment, Electron Tubes, All Types (SIC 3671), 1971-1981
(In Thousands)

	1971	1972	1973	1974	1975	1976	1977*	1978	1979	1980	1981
All Employees	43.3	47.1	49.7	44.0	37.8	37.6	36.7 (42.8)	42.6	44.0	45.5	43.5
Production Workers	31.9	34.0	36.4	32.7	27.3	27.8	27.5 (27.5)	28.0	28.2	28.4	26.7

* Data in parentheses for the year 1977 and for the following years are from the second source listed.

Sources: Reference 10, page 36E-7 (years 1971-1977); Reference 1, page 117 (years 1977-1981)

production workers. The same data sources indicate an historical decline in the number of production workers of 1.8 percent annually. The U.S. Industrial Outlook for 1982 reports an annual decrease in total employment in the electron tube industry of two percent between 1972 and 1981 and a decline of 2.3 percent per year in production workers over the same period.[4/]

Figures for the radio and television receiving tubes sector (SIC 36711) are not available, however, as mentioned earlier, this is a declining industry segment due to technological innovation and product substitution as well as import penetration.

Based on historical trends, the outlook for employment in other parts of the electron tube industry such as color TV and other cathode ray tubes may be better than is apparent from the overall industry data. Bureau of Labor Statistics forecasts show increases in employment ranging from 1.7 to 2.5 percent per year between 1980 and 1990 for the electronics industry as a whole.[1/]

III.4 Prices

Based on the value of manufacturer's shipments, 1980 prices of color television tubes averaged $76 per unit for domestic tubes (this average reflects a range of $62 for 17 inch tubes to $92 for tubes 20 inches and over as shown in Table 2-6A), and $56 per unit for imported tubes. Considering all sizes of tubes, data from the EIA indicate that the price of tubes made in the U.S. in 1981 was $30, up 13 percent in one year while import prices declined. These data also reveal that increases in U.S. color TV picture tube prices averaged about three percent annually from 1972 to 1981 (in current dollars).

Table 2-6A. Average Factory Level Prices of Electron Tubes, Selected Types*

($/unit)

	1972	1977	1979	1980
Color Television Tubes:				
17 Inch and Under		58	56	62
18 and 19 Inch	69**	61	62	73
20 Inch and Over		74	81	92
Other Cathode-Ray Tubes:				
Industrial and Military	NA	83	169	197

Source: Reference 6. Table 4, (years 1979, 1980) and Reference 10, page p. 36E-23, (years 1972, 1977).

* Average prices based on value and quantity of shipments.

** Average, all sizes

Table 2-6B. Average Factory Level Prices of Electron Tubes, U.S. and Imports

($/unit)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Color Television Tubes:											
U.S.	70	70	70	70	68	70	69	71	72	76	90
Imports	35	44	36	53	67	65	54	56	62	56	54

Source: Reference 1, pp. 87, 88.

The average price of industrial and military-type cathode ray tubes was $197 in 1980. (With available production data it is not possible to estimate price differences between CRTs purchased for industrial use and those for military purposes.) As shown in the table, prices of color television picture tubes have increased, depending on tube size,(in current dollars) between two percent and eight percent per year, over the 1977 to 1980 period. Industrial-military CRTs rose 33 percent annually during the same period.

Import prices increased four percent per year from 1971 to 1981 (in current dollars) but have remained lower than U.S. prices, as shown in Table 2-6B. In 1981, for example, the average price of a color TV picture tube import was $54, or 60 percent of the U.S.-made average picture tube price. In constant dollars, between 1972 and 1982, import prices fell at an average annual rate of 2.3 percent while domestic prices fell at an average annual rate of 1.8 percent. (This is due, in part, to a different mix of tube sizes among imports compared to U.S-made tubes.) An important factor in the outlook for the TV picture tube market will be the impact of Japanese imports (see Foreign Trade).

The average color television receiver price (in current dollars and including both imports and U.S. made products) in 1981 was $377, in 1980 was $369 and in 1979 was $360, based on factory sales.[1/] This suggests that, at the factory level, color TV picture tube prices recently have been twenty to twenty-five percent of receiver prices. However, another source indicates that the ratio of TV picture tube price to TV set price at the retail level was about 40 percent several years ago.[8/] Costs of TV set components--other than the picture tube--are expected to decline due to the use of

integrated circuits and other innovations, therefore, the ratio of the picture tube to receiver price will probably start to increase.

III.5 Markets

Market data are available for the electron tube industry in terms of the value of purchases made by original equipment manufacturers (OEM), broken down into four categories:

- Commercial--business and government (civilian), transportation (other than consumer) and similar uses;
- Consumer--entertainment equipment, automotive electronics, appliances and home applications;
- Industrial--manufacturing, instrumentation, medical, process control, machinery and utilities; and
- Military and space.[8/]

The market category into which a component is classified is determined by the end user of the equipment that incorporates the component. Table 2-7 presents market data for electron tubes--all types, color television tubes, and other cathode ray tubes. The basis for the data shown differ from U.S. manufacturers sales data in several important ways: imports and distributors' margins are included, while exports, replacement components and captive production are excluded.[9/] Consider captive production, for example. The major portion, possibly all, of the output of two of the producers of industrial and military cathode ray tubes (Hewlett Packard and Tektronix) is for their own use, and therefore not included. Nevertheless, the relative importance of different markets can be roughly outlined.

For electron tubes, all types, the main market is industrial (35 percent), although consumer (29 percent) and military and space (24 percent) are very important. The fastest growing area since 1979 is the commercial

Table 2-7. Original Equipment Manufacturers' Purchases by End-Use Market,

Electron Tubes, Selected Types; United States, 1979-1982
($ million)

	1979	1980	1981	1982*	Percent of Total, 1982	Average Annual Growth %
Electron Tubes, All Types:						
Commercial	53	64	69	78	11.8	14
Consumer	217	194	193	190	28.7	-4
Industrial	201	218	232	234	35.3	5
Military and Space	131	141	147	160	24.2	7
Total:	602	617	641	662	100.0	3
Color Television Tubes:						
Commercial		1	1	2	1.1	41
Consumer	182	162	164	160	92.0	-4
Industrial	2	3	5	6	3.4	44
Military and Space	3	4	5	6	3.4	26
Total:	187	170	175	174	100.0	-2
Cathode Ray Tubes, Except TV:						
Commercial	42	51	56	62	55.4	14
Consumer	4	5	6	7	6.3	21
Industrial	13	18	22	24	21.4	23
Military and Space	12	14	16	19	17.0	17
Total:	71	88	100	112	100.0	16

Sources: Reference 8, p. 53 (year 1979);
* Reference 9, p. 104 as reported in Predicasts, Forecast Abstracts, pp. B-242, B-243 (years 1980-1982).

market which has grown at an average rate of 14 percent per year. Consumer uses declined at an average rate of four percent per year between 1979 and 1982.

By far the major market for color TV picture tubes is consumer uses (92 percent). However, this market share has declined at an average rate of four percent since 1979 while the other three markets (accounting for eight percent of TV picture tube OEM purchases) have grown rapidly.

For other cathode ray tubes, the average growth rate for all four markets is 16 percent. Industrial uses have grown more rapidly, 23 percent annually, than the others. The largest CRT market is commercial with over one-half the total value of purchases in 1982. The military and space CRT markets are also important and growing rapidly.

III.6 Foreign Trade

The history of foreign trade in color TV tubes is linked to foreign trade in color TV sets. The U.S. Tariff Act of 1980 invoked an anti-dumping order on the import of Japanese color TV sets. This order was continued in 1981 and complicates the outlook for color TV's in this country. Partly as a result of the anti-dumping order, Japanese firms have opened manufacturing plants in the U.S.

U.S. manufacturers of TV tubes desire stricter import rules and allege that they are adversely affected by the "dumping" practices of the Japanese tube manufacturers.[6/] The outcome of current litigation concerning TV sets and the past U.S. policy aimed at prohibiting dumping of foreign TV sets on the US market is uncertain and may affect TV picture tube imports. Talks between the U.S. and Japanese governments may encourage self-imposed

limitations on television picture tube exports by Japanese manufacturers, but long-term policies are unclear.

Annual imports of electron tubes--all types--have been steadily increasing, at an average rate of 18 percent, since 1977 (see Table 2-8). Imports of electron tubes and related products totaled $300 million in 1981, up 17 percent in current dollars over the 1980 value of $256.9 million. Imports were equal to 15 percent of U.S. sales in 1981.

Table 2-8. Annual Imports of Electron Tubes

Selected Types ($ million)
United States, 1977-1981

	1977	1978	1979	1980	1981
TV Picture Tubes, Color	$15.5	$16.6	$22.0	$33.3	$52.9
TV Picture Tubes, B/W	4.7	8.3	10.0	10.5	15.3
Cathode Ray Tubes, NES*	4.8	7.3	13.2	21.3	27.6
Parts of CRTs, Including Glass	38.8	50.3	75.5	76.8	86.7
Electron Tubes, All Types	156.0	183.4	232.0	256.9	300.0

*NES = Not elsewhere specified.

Source: Reference 7.

Imports of color TV picture tubes have been increasing by 36 percent per year from 1977 to 1981 (see Table 2-8). The 1981 value of picture tube imports, $53 million, was 59 percent higher than the 1980 value of $33 million (in current dollars). Sixty-seven percent more color TV picture tubes (i.e. units) were imported in 1981 (984.2 thousand) than in 1980 (590.3 thousand).[1/] Imports accounted for nine percent of the quantity and five percent of the value of annual U.S. factory level sales of color picture tubes in 1981. Almost all (97 percent) color picture tube imports come from Japan.

The value of imports of other cathode ray tubes increased 30 percent from $21 million in 1980 to $28 million in 1981 (see Table 2-8). The average annual increase over the period 1977-1981, expressed in current dollars, has been 55 percent. Imports were about 24 percent of U.S. sales of "Other CRTs" in 1981.

Exports of electron tubes have also been rising since 1977, at an average annual rate of 12 percent (see Table 2-9). This rate is lower than that of imports. Exports of electron tubes and related products totaled $377.3 million in 1981, four percent above the 1980 value of $361.1 million. The recent balance of trade for electron tubes is positive, as shown in Table 2-9. Exports equaled nineteen percent of US factory sales in 1981.

Table 2-9. Annual Exports of Electron Tubes

Selected Types ($ million)
United States, 1977-1981

	1977	1978	1979	1980	1981
TV Picture Tubes, Color	$75.7	$67.4	$80.9	$82.0	$65.8
TV Picture Tubes, B/W	1.2	1.8	1.7	1.2	1.3
Cathode Ray Storage Tubes	5.0	5.8	6.6	8.1	9.4
Cathode Ray Tubes, NES*	11.4	25.8	40.2	44.3	56.1
Parts, etc., NES* Including CRT Glass	63.7	65.8	101.2	100.1	108.3
Electron Tubes, All Types	239.1	256.2	327.8	361.1	377.3

*NES = Not elsewhere specified.

Source: Reference 7.

For electron tubes--all types--the balance of trade increased 5.8 percent between 1977 and 1980 and then declined 26 percent, in current dollars, between 1980 and 1981 (from $104.2 million to $77.3 million). The overall average annual growth rate from 1977 to 1981 was 1.4 percent.

Exports of color TV picture tubes equaled seven percent of the value of U.S. factory sales in 1981 and have had a mixed history (see Table 2-9). From 1977 to 1981 there was an average annual decline in exports of three percent with a 20 percent decline between 1980 and 1981 (from $82 million to $66 million, in current dollars). Imports of color TV tubes, on the other hand, increased between 1977 and 1981, and this has resulted in a five percent decline in the balance of trade over the past five years (see Table 2-10). The decline in color TV picture tube balance of trade between 1980 and 1981 was 73 percent.

Table 2-10. Balance of Trade of Electron Tubes
(1977-1981/$ Million)

	BALANCE OF TRADE		
Year	Color TV Tubes	Other CRTs*	Electron Tubes, All Types
1977	60.2	11.6	83.1
1978	50.8	24.3	72.8
1979	58.9	33.6	95.8
1980	48.7	31.1	104.2
1981	12.9	37.9	77.3

*Includes both Cathode Ray Storage Tubes and Cathode Ray Tubes, NES, from Tables 2-8 and 2-9.

Source: Reference 1.

Exports of other cathode ray tubes increased 25 percent in current dollars from $52.4 million in 1980 to $65.5 million in 1981 (see Table 2-9). Since 1977, exports have been increasing at an average annual rate of 41 percent. The value of other CRT exports came to 56 percent of US sales in 1981, a significant factor in this segment's market. The balance of trade of other CRTs is positive and increasingly favorable as shown in Table 2-9.

IV. Firms and Establishments in Scope of Study

There are five known firms in the US which make color television picture tubes. The five producers supply about 15 firms, including their own, which manufacture color TV sets.

Fourteen firms manufacture other CRTs with a significant part of their production used captively in the production of engineering and scientific instruments. Five firms produce luminescent coatings. The major companies are listed in Table 2-11 along with the plants included in this study; there are seven color TV picture tube plants, 16 other CRT plants and five luminescent coatings plants.

The firms that manufacture the color television tubes are all large, publicly owned companies which also manufacture color television receivers and therefore, in this respect are vertically integrated "downstream". Three firms (possibly four) make the basic glass enclosure, the raw material item that color television tubes are made from; the three are: Owens-Illinois, Corning Glass, and Lancaster Glass.[8/] Thus, none of the color TV tube manufacturers are vertically integrated "upstream" with respect to the basic glass enclosure. Two firms each have two color TV tube production plants.

Four of the firms produce an estimated 90 percent or more of total color TV picture tubes in the U.S. The top two firms are RCA and Zenith but their share of total production is not public information.

The industry segment producing other CRTs includes 14 firms of which two, Tektronix and Hewlett Packard, are large producers of CRTs; most, perhaps all, of their CRT production is for captive use in the electronic instruments they manufacture. Based on plant level sales data, five firms in the CRT

Table 2-11. Firm and Plant Characteristics for Industry Segments

Industry Segment	Firms	No. of Plants*	Ownership		Percent of Total Daily Plant Production*
			Public	Private	
Color TV Tubes	RCA	2	x		31
	Zenith	1	x		28
	BCG Philips	2	x		19
	GE	1	x		12
	Sony	1	x		10
				1984 Annual Sales ($ million)*	Percent of Total Annual Sales*
Other CRTs	Tektronix	1	x	712.4	53
	Hewlett Packard	1	x	122.1	10.8
	Datagraphix	1	x	96.2	8.5
	Westinghouse	1	x	94.0	8.3
	Clinton Electronics	1		x 53.8	4.8
	Litton Industries	1	x	3.9	.4
	Dumont Electron	1		x 17.6	1.6
	Thomas Electronics	3		x 17.3	1.5
	General Atronics	1	x	5.9	.5
	Video Display Corp.	1		x 2.7	.2
	Raytheon Co.	1	x	2.6	.2
	B-Scan Inc.	1		x 2.0	.2
	Special Purpose Tech.	1		x NA	NA
	Tex-Video Man.	1		x NA	NA
				Annual Sales ($ million)*	Percent of Total Annual Sales*
Luminescent Coatings	GTE (N.A. Philips)	1	x	253.2	47.6
	RCA	1	x	136.9	25.7
	Westinghouse	1	x	122.2	23.0
	GE	1	x	15.3	2.9
	U.S. Radium	1	x	3.6	.8

* Refers only to known plants.

Source: Data are from Final EPA Development Document; Form 10-K reports (ownership); Economic Information Systems data service (annual sales).

segment are medium-sized producers, while six are very small. Sales data are unavailable for two firms. Only one firm in the sample, Thomas Electronics, has multiple (three) plants. Five of the major CRT producers are publicly owned firms (Tektronix, Westinghouse, Hewlett-Packard, Datagraph, and Litton); Clinton Electronics is privately owned. Two of the other eight firms are publicly owned; the rest are private.

The other CRT industry segment may be more competitive than the color TV picture tube segment, due to the larger number of producers making other CRTs. On the other hand, the products of each producer may be so specialized that competition is not a major factor in CRT prices. This suspicion is supported by the fact that CRT sales for military purposes account for a sizeable share of current sales and that share is increasing.

The CRT industry segment appears to be almost as concentrated as the color TV picture tube segment; the top four firms account for almost 87 percent of the total sales of the CRT plants included in the study. It should be noted that the available sales data are plant-wide sales and therefore may include sales of products other than CRTs made at the plants. As mentioned above, at least two of the firms are vertically integrated downstream, producing CRTs for use in scientific-engineering instruments and other products they manufacture.

The luminescent coatings industry segment is characterized by a few large, publicly owned firms. Each firm has a single plant for producing the coatings and most are vertically integrated from the production of the phosphors to their use in the manufacture of color television tubes, other CRTs or fluorescent lamps. RCA produces phosphors only for TV, Westinghouse only lamp phosphors, while the rest produce both. About 90 percent of total annual sales in the sample are attributed to three plants.

Of all plants in the three industry segments under study, 12 are located in the mid-Atlantic region, five in the Midwest, eight in the western region and one each in the southern and eastern regions of the U.S.

Employment in each of the four color TV tube manufacturing plants for which data are available is between 1000 and 2600 in tube production and up to 3000 in total plant employment. There is a wide range in employment levels in the other CRT plants in the sample. Of the nine plants for which data are available one (Tektronix) has 1000 CRT production employees and 12,000 total plant employees, one (Hewlett Packard) has 400 production workers in CRT and 2,300 total plant, one (Datagraphix) has 1,000 total plant employees, three plants have between 30 and 120 production workers and four very small plants have less than 20. Employment figures are not readily available for the luminescent coatings manufacturers.

Product diversification data at the plants are not available. Using very gross indicators (total employment versus product-specific employment and total wastewater flow versus product-specific flow), it appears that three color TV picture tube plants may make other products, two CRT plants are known to be diversified while five more may be, and two luminescent coatings plants probably make other products.

Section 2

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Section 3

Economic Impact Methodology

The economic impact methodology is performed in seven steps. First, the methods used to estimate a baseline projection for each of the three industry subcategories (color TV picture tubes, other CRTs and luminescent coatings) are discussed. Second, several measures are developed to analyze the impacts of treatment costs at the industry-level and the plant and firm level. Third, the approach used to analyze potential closures of existing plants resulting from treatment costs is described. In the fourth and fifth steps, the methods for estimating possible effects on production/employment and foreign trade are presented. Methods to estimate treatment cost impacts on new sources are discussed in the sixth step and in the last step the section concludes by describing how the analysis of impacts on small businesses is conducted.

I. Industry-wide Baseline

Estimates of future production value and quantities--without additional treatment costs--serve as a baseline against which the impacts from regulatory action are estimated. Baseline projections for 1984 are developed for new and existing facilities in each of the three industry subcategories: color TV picture tubes, other CRTs and luminescent coatings.

The baseline is defined for 1984 because this is when the effluent guidelines are expected to be implemented. Treatment costs have been estimated in 1982 dollars but 1982 is a particularly poor year in the business cycle for the industry, as discussed in Section 2, III.1. As real growth for the industry is anticipated over the next three to five years, it was determined that the best approach would be to estimate production

(quantity) and sales variables in 1982 dollars to correspond to the 1982 treatment cost estimates and then to project these estimates to 1984, using constant 1982 dollars. In this way we would capture expected real industry growth in the next few years in the baseline projections, and the estimate of adverse impacts on existing plants would be more realistic than if 1982 conditions were used.

The variables estimated in the baseline for TV picture tubes and other CRTs are: production value, quantity, unit prices and industry profit. For the luminescent coatings subcategory, production quantities are unknown and only total value of production and industry profit are projected.

Different methods are used to estimate baseline values for the three subcategories because available data are not consistent with regard to: (1) time periods for which data are reported by various sources, and (2) level of data aggregation in the different subcategories. The various methods for baseline estimation are discussed next.

I.1 Color TV Picture Tubes

The 1984 baseline values are projections in constant dollars of 1982 values estimated from 1980 and 1981 factory sales and quantities published by EIA (Electronic Industries Association, 1982 Edition, Electronic Market Data Book) and from the Department of Commerce's estimate of 1981-82 growth in value of production (1982 Industrial Outlook). The 1982 to 1984 projections are estimated from industry growth forecasts for 1983 and 1986 in current dollars from Electronics (January 13, 1983 issue) and from inflation rate forecasts by Data Resources, Inc. (DRI) (Long-Term Review of the U.S. Economy). In 1980, U.S. factory sales of color TV tubes was $911.5 million and in 1981 it was $998.7 million; a five percent increase in total value is

estimated between 1981 and 1982. A constant dollar growth rate of 3.5 percent is projected for 1982 to the 1984 baseline. The quantity of tubes manufactured in the U.S. was 11.93 million and 11.09 million in 1980 and 1981, respectively, as imported tubes increased by almost 400 thousand in that period. 1982 U.S. production is estimated at 11.5 million tubes which is the average of the preceding two years. Production growth is projected at 16.9 percent between 1982 and the 1984 baseline, based on forecasts of the production index for TV and Radio Sets from DRI.

The 1982 sales estimate (prior to projection to the 1984 baseline) for the industry subcategory was checked against plant sales listed in the EIS (Economic Information Systems) data files. Aggregate plant sales account for 77 percent of the production value for the industry subcategory.* The profit for the subcategory is estimated by applying a ratio of profit to value of production. The ratio is derived from aggregate statistics for the appropriate four-digit SIC group. (The derivation is discussed later under plant-level impacts.) The use of a profit to sales ratio in the methodology is common to the other two industry subcategories.

I.2 Other CRTs

For this subcategory, 1984 baseline projections are also constant dollar projections of 1982 values. The 1982 production values and quantities are estimated from 1979 and 1980 data published by the Department of Commerce's

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* Another method, used for the other CRT subcategory, was considered for color TV picture tubes. The 1979 and 1980 data reported by the Department of Commerce's Current Industrial Reports was used to calculate an annual growth rate in unit value and quantity. The method yielded a 1982 total value of production 1.75 times greater than aggregate sales of all seven plants (identified in the Final Development Document) whose sales are listed in the Economic Information Systems (EIS) data files on a plant-by-plant basis. Therefore, the more recent 1980-1982 production data published by the EIS was used.

Current Industrial Reports 1980, MA-36N (80)-1. The observed 1979-80 rates of increase in value and production identified under SIC 36713 are projected to obtain the 1982 estimates. The 1979-80 growth in production quantity was 19.5 percent and in unit value it was 16.0 percent in current dollars. A constant dollar growth rate of 30.6 percent in factory sales, derived from industry projections from Electronics and from DRI inflation forecasts, is projected from 1982 to the 1984 baseline. Production growth is projected at 38.5 percent between 1982 and the 1984 baseline, based on production quantity data for 1979 to 1981 from the Current Industrial Reports, MA36N(81)-1 and (80)-1.

The industry-wide production value for this subcategory in 1982 is much less than the aggregate plant sales listed in the EIS file for the CRT plants identified in the Final Development Document; at least one very large plant, owned by Tektronix--possibly two others, one owned by Hewlett Packard and one owned by Raytheon--have major product lines other than CRTs which cannot be separated out of the plant sales data.

I.3 Luminescent Coatings

In this industry subcategory, the Department of Commerce data were not used because coatings are indistinguishable within SIC 2819, a large miscellaneous group of inorganic chemicals not elsewhere classified. Therefore, industry-wide values for 1982 were estimated from plant data. Sales data for four of the five existing plants identified in the Final Development Document are listed in the EIS data file. For the fifth plant, employment information was provided by EPA and an average sales value per employee was applied to obtain annual sales. The average sales value per employee was based on the EIS sales and employment data for three plants which ranged from

$70,000 to $80,000 per employee. (A fourth plant showed $155,000 per employee but was not used for purposes of calculating an average value because the plant's SIC classification indicates that metal working rather than coatings is the dominant manufacturing activity.)

To estimate the 1982 value for the total industry subcategory, the employment estimates for all five plants were aggregated and then multiplied by the average value per worker to calculate the value of total production. A constant dollar growth rate of 10.1 percent was then applied to this value to project the 1984 baseline value. The growth rate used was based on the assumption that since luminescent coatings are used in the production of TV tubes, other CRTs and electric lamps, that their sales growth should follow the growth in the end-use markets. As no data were available on the breakdown of production by end-uses, one-half was assumed to be used for electric lamps and one-half was equally divided between TV tubes and other CRTs. Projections used for the latter two products are the same as discussed above in I.1 and I.2. The growth rate for electric lamps was estimated from value of shipments data for 1977 and 1982 from the Department of Commerce, Current Industrial Reports M36D (82)-6 and (83)-1.

II. Impact Projections

II.1 Industry-wide Impact

The ability of the industry to pass on treatment costs in the form of higher prices depends on the strength of demand, the ability of foreign-based manufacturers to take away U.S. market share, and the distribution of treatment costs among producers. Although demand is expected to continue to be strong in this industry, both foreign competition and U.S. overseas production are important factors affecting its future well being. Due to

these considerations only one impact projection is made. Treatment costs are not passed through but are assumed to be absorbed by the producers resulting in profit reductions.

II.2 Plant-Level and Firm-Level Impacts

Five impact measures are derived to estimate the plant-level impacts of additional treatment costs. (In addition, several standard financial ratios reported by Dun and Bradstreet that are used to estimate the financial health of firms (see Section II.3, below) are used to aid in the evaluation of firms whose plants incur treatment costs.)

The five plant-level impact measures selected are:

1. ratio of annual treatment cost to plant sales;
2. ratio of annual treatment cost to plant-level profit;
3. ratio of annual treatment cost to plant manufacturing conversion costs;
4. ratio of annual treatment cost to profits of the firm; and
5. ratio of capital investment portion of treatment cost to annual plant investment.

These measures are used to judge the severity of additional treatment costs. More than one measure of impact is desirable because accurate information at the plant level is limited, and confidence is not high in any one measure. Available plant-level data do not include profits, production costs and other financial data that are useful for the evaluation of impacts. In addition, there was no 308 Survey* covering the manufacturing subcategories addressed in this study. Therefore the impact measures were derived using publicly available data in conjunction with a number of assumptions necessary

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* A 308 Survey is a questionnaire sent to firms by the EPA under Section 308 of the Clean Water Act to gather technical and financial information for an industry subcategory.

for the plant-level analysis. The remainder of this discussion outlines the assumptions and data used to develop the impact measures.

II.2.1 Annual Treatment Cost to Sales. This measure provides a simplified screening criterion for identifying plants that may be severely impacted (ratios of annual treatment costs to sales, greater than, say, two or four percent of plant sales have been used in other EPA impact analyses for this purpose). Estimates of 1984 plant-level sales were obtained from the EIS (Economic Information Systems) data base. The EIS sales figures are estimated values for 1982 based on input-output tables from the Department of Labor. These 1982 values were projected to 1984 in constant 1982 dollars, using the growth rates discussed in Part I, above, for each category. Annual treatment cost to sales ratios were obtained simply by dividing annualized treatment cost for a given plant by the estimated plant sales.

II.2.2 Annual Treatment Cost to Plant-Level Profit. This measure can provide another relevant way to judge the ability of a plant to absorb additional treatment cost. If annual treatment cost is a significant portion of plant profits, and the additional costs cannot be recovered with higher prices for the plant's products, then the plant may be a candidate for closure. Plant level-profit is approximated by an industry-wide ratio, explained next. Ideally, the calculations should consider a profit stream over several years. For the impact projections, the plant-level profit ratio is estimated for one year as described below. Industry subcategory ratios for several other recent years have also been estimated for comparison purposes for use in the closure analysis.

Because plant-level profit is not known, we have developed a ratio of profit to sales at the four-digit SIC group level based on data in the Census

of Manufactures.* The profit is calculated as the residual of value added by manufacturing, less wages and depreciation. The profit ratio is obtained by dividing the residual by the value of shipments (value of shipments is considered synonymous with plant-level sales). The value of the residual in the numerator ideally should be reduced further to account for other costs such as royalty payments, licensing fees, plant utilities and maintenance costs exclusive of plant labor. However, these costs cannot be identified in the source data, therefore the residual is referred to as "unadjusted profit".

A ratio of unadjusted profit to sales was obtained at the four digit SIC code level using the 1977 census data* and then applied to 1984 plant level sales to approximate 1984 plant level unadjusted profit. As mentioned earlier, the ratio is also used at the industry subcategory level to estimate industry profits. In equation form, the relationships are as follows:

$$UP = f_{up} \times S_p$$

where

UP = unadjusted profit, plant-level

S_p = plant-level sales in 1984

f_{up} = unadjusted profit to sales ratio computed at the 4-digit SIC code level for 1977

$$= \frac{[(\text{value added}) - (\text{wages}) - (\text{depreciation})]}{[\text{value of shipments}]}$$

For color TV picture tubes, SIC 3671 was used to calculate the unadjusted profit ratio. For the Other CRTs subcategory, the average of four different unadjusted profit ratios was used; the ratios used are from SIC 3671--Electronic Tubes, all types, SIC 3811--Engineering, Scientific Instruments,

* 1977 Census of Manufactures, U.S. Department of Commerce, Bureau of the Census.

SIC 3825--Instruments to Measure Electricity, and SIC 3829--Measuring and Control Devices, not elsewhere classified. The four SIC groups were used because cathode ray tubes are not only sold as distinct items made by manufacturers classified in SIC 36713, but are also incorporated into instrument packages sold by manufacturers classified in the other three SIC groups. For luminescent coatings, industrial inorganic chemicals not elsewhere classified (SIC 2819) is used to derive the ratio. The unadjusted profit ratios derived from 1977 data are as follows:

Color TV picture tubes	f_{up}	=	0.348 (SIC 3671)
Other CRTs	f_{up}	=	0.458 (average of four SIC groups)
Luminescent Coatings	f_{up}	=	0.383 (SIC 2819)

II.2.3 Annual Treatment Cost to Manufacturing Conversion Cost. This measure considers annual treatment cost as if it were an additional production cost, necessary in the conversion of raw materials into products that are shipped by the plant. The conversion costs are those included in value added by manufacturing (excluding resales which involve no manufacturing activity) as defined by the Department of Commerce,* plus cost of energy and contract work.

As explained above for the unadjusted profit ratio, a manufacturing conversion cost to sales ratio was calculated at the four digit SIC level for 1977. The ratio was then applied to specific plant sales in 1984. In equation form, this is:

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* 1977 Census of Manufactures, Appendix A.

$$MCC = f_{mc} \times S_p$$

where

MCC = manufacturing conversion cost at the plant level

f_{mc} = manufacturing conversion cost ratio computed at the 4-digit SIC code level for 1977

$$= \frac{[(\text{value added by manufacturing}) - (\text{value of resales}) + (\text{fuels}) + (\text{purchased electrical energy}) + (\text{contract work})]}{[(\text{value of shipments}) - (\text{value of resales})]}$$

For each of the three subcategories, the same SIC groups identified earlier were used to obtain the averages. The values are as follows:

Color TV picture tubes	$f_{mc} = 0.597$
Other CRTs	$f_{mc} = 0.647$
Luminescent coatings	$f_{mc} = 0.632$

II.2.4 Annual Treatment Cost to Firms' Profit. Manufacturing plants (or establishments) are often organizationally treated as independent profit and loss centers by the parent firm. That is, the plant manager is responsible for developing a sales plan and a budget, and then carrying out all activities (such as operating the facility, purchasing raw materials, maintaining a work force, marketing the product, etc.) so that a profit results at year end. However, if capital investment is required for plant modification or new equipment, the necessary funds may be appropriated from a higher organizational level than the plant. Assuming the outlays are relatively modest, it is reasonable for the firm to consider financing the new investment from its earnings rather than by borrowed capital. Therefore it is useful to consider how additional plant treatment costs compare to the net income of the parent firm. To make this comparison, the annual treatment cost is divided by the

reported net income* for the firm. This calculation is possible only for those firms that are publicly-owned and are required to report.

II.2.5 Capital Requirement to Plant Investment. The total capital cost (TCC) for treatment is compared to an annual investment estimate at the plant level. An annual plant investment ratio for each of the three industry subcategories is estimated for one year based on data reported in the 1977 Census of Manufactures at the four-digit SIC level. Industry subcategory ratios for several other years are estimated for the closure analysis. The same SIC groups discussed earlier for each of the three industry subcategories are used here. The plant investment for each subcategory is related to value of shipments to derive a ratio as follows:

$$CAP = f_{cap} \times S_p$$

where

CAP = Capital investment, plant-level (one year)

f_{cap} = ratio of plant investment to plant-level sales computed at the four-digit SIC code level for 1977.

$$= \frac{\text{[new capital expenditures]}}{\text{[value of shipments]}}$$

The derived values of the ratio for the industry subcategories are:

Color TV picture tubes	$f_{cap} = 0.0327$
Other CRTs	$f_{cap} = 0.0361$
Luminescent coatings	$f_{cap} = 0.0541$

* Form 10-K, Securities and Exchange Commission, Washington, D.C. and Moody's Industrial Manual.

II.3 Financial Ratios

Production of the electronic components relevant to this study are often a small part of a firm's total output. Therefore, it is difficult to assess the impact of treatment costs on the firm except for the crude measure of annual treatment cost to net income discussed above. However, it is possible to gauge the relative health of a firm (without considering treatment costs) by using financial ratios. Three ratios have been selected for this analysis:

1. Current assets to current liabilities ("current ratio");
2. Sales to net working capital; and
3. Return on assets.

Before describing the ratios, it is important to note their limitations.

II.3.1 Limitations. Generally, the use of ratio analysis is a series of necessary, but not sufficient, tests. As the analyst finds satisfactory ratios, he moves on to the next test. When an unsatisfactory ratio is found, the factors involved are flagged for further investigation. The way that further investigation proceeds depends a great deal on the access to accounts and records usually considered to be proprietary by the firm. Even experienced analysts sometimes have difficulty getting to the root cause of an unsatisfactory trend revealed by a financial ratio.

The trends identified using the financial ratios represent the relationships of two financial items but the information provided is rather superficial since it does not shed light on the relative behavior of the two items. As an example, assume a rise in a firm's "current ratio" (current assets divided by current liabilities--a basic indication of a company's ability to meet payment obligations from current assets). It is not

sufficient to know the ratio increased; it is more important to know why. The cause could be:

1. A rise in current assets and a decline in current liabilities;
2. A rise in both current assets and current liabilities but with current assets moving at a faster relative rate; and
3. A decline in both but with a more rapid decline of current liabilities.

In ratio analysis work, another important and most difficult problem is to establish norms of satisfactory or unsatisfactory relationships. The quality of a company's management, its policies, operations, competitive position, and future plans must also be carefully considered. Information concerning many of these factors are not as readily available as are financial statements. In addition, the impact of economic, technological and environmental factors, acquisitions and divestitures as well as many other factors must be considered. Temporary distortions in financial ratio trends can be very significant as, for example, when North American Philips acquired General Telephone and Electronics' television set business in 1981.

II.3.2 Recommended Ratios. The financial relationships of each of the publicly held firms associated with manufacturing activities in the three subcategories are calculated to obtain a relatively broad view of the financial health of the firm. Particular attention is directed towards a firm's ability to incur additional debt without a major change in its financial structure. The following ratios are used in the analysis:

Current Assets to Current Liabilities. Current assets are the sum of cash, notes and accounts receivable (less reserves for bad debt), advances on merchandise, merchandise inventories, and listed federal, state and municipal securities not in excess of market value. Current liabilities is the total

of all liabilities falling due within one year. This is perhaps the most common test of short-term solvency. Normally a ratio of 2 to 1 or better is considered good.

Sales to Net Working Capital. The sales figure is divided by net working capital. This provides a guide as to the extent the company is turning over its working capital and the margin of operating funds. It is a good measure of both efficiency and profitability.

Return on Assets. Profit after taxes is divided by total assets. This ratio is a key indicator of the profitability of a firm. It matches operating profits with the assets available to earn a return. Firms that have been effectively managed will have a relatively high return while the returns of less well-run businesses will be relatively low.

These three ratios are indicators of solvency, ability to meet short and long term debt, how well a company uses and controls its assets, profitability, and lastly, how successfully a business is earning a return for its owners.

III. Closure Analysis

III.1 High-Impact Plant Identification

It is possible that a plant, or product line within a plant, may close due to the burden of additional treatment cost. Lacking information about product line diversification at each plant as well as production value for each product line, a high confidence closure analysis is not feasible. Instead, judgments are made about highly impacted plants by examining the values of the impact measures, the financial ratios of the parent company and other characteristics known about some of the firms. In addition, industry

subcategory impact ratios for annual treatment cost to plant-level profit and for capital requirement to plant investment for other recent years in addition to 1977 are examined for comparison purposes to account for any error that may be caused by using data from a single year.

Three sensitivity analyses supplement the impact analysis. The first is a sensitivity analysis performed on the 1984 sales estimates and on the plant profits estimates. For this analysis, the impact measures are re-examined under both a ten percent increase and a ten percent decrease in annual sales. This insures that the conclusions drawn based on the impact measures account for any errors made in projecting plant sales. This analysis is discussed in Appendix A. In the second sensitivity analysis, the impact measures are also re-estimated with a ten percent decrease in plant profits. This allows for the possibility that the costs of manufacturing inputs may rise faster than the five to six percent inflation rate which has been assumed throughout the study. Such cost increases would be reflected in a decrease in profits. This analysis is also included in Appendix A.

The third sensitivity analysis addresses the cost of compliance with the total toxic organics (TTO) limitations. It is carried out to determine if any of the impact measures are affected by the addition of TTO compliance costs. As information on existing plants shows that all plants currently have a solvent management program in place, only the incremental cost to comply with the TTO limitation (not the total cost of a solvent management program) by improving the current program is examined. In general, costs of improved management techniques are offset by solvent resale. Some plants may have to haul away their solvents under the Resource Conservation and Recovery Act (RCRA) requirements. These costs are estimated at $1,200 annually per plant. Since it was not possible to determine which plants, if any, will

fall under these requirements, the sensitivity analysis assumes these "worst case" costs for all plants which are not known to be already in compliance. This analysis is discussed in Appendix B.

III.2 Solvency Analysis

Once the high impact plants have been identified by the impact analysis described above, a solvency analysis is carried out to determine whether or not a plant will close due to the additional treatment costs. This analysis compares the present value of cash flow to the salvage value of the equity of the plant. If the present value (PV) of the cash flow is greater than the salvage value of the plant, then the plant is worth more open and operating than it is closed. However, if the salvage value is greater than the PV of the cash flow, the better alternative, from the owner's point of view, is to close the plant and sell it for the salvage value. If the PV of cash flow is nearly equal to the salvage value, then other factors must be considered to determine whether the plant will close.

The PV cash flow is the sum of the cash flow over the lifetime of the plant. It is equivalent to the amount of money, if invested today, that is necessary to be able to draw off each year an amount equal to the cash flow of the plant. It is calculated as follows:

$$PV\ (CF) = \sum_{i=1}^{n} \frac{CF}{(1+r)^i} = CF\ \frac{[1-(1+r)^{-n}]}{r}$$

where n is the life of the investment, CF is the cash flow of the plant after treatment costs, and r is the rate of return on the investment. The life of the investment, n, is assumed to be 15 years. An eight percent value is used

for r, a rate that currently prevails in the marketplace. As a means for comparison, a 10 percent rate is also used.

Since data are unavailable to estimate plant level cash flow for the industry subcategories included in this analysis, unadjusted profit is used as a proxy. Unadjusted profit at the plant level is obtained as described in Section II.2.2, above. Annual treatment costs for Option 3 (as a worst case) for the plant are then subtracted. As the cash flow-salvage value comparison is an after-tax analysis, unadjusted profit is further reduced by one-half as a conservative estimate of after-tax cash flow.

An accurate estimate of salvage value requires detailed plant level financial data that is unavailable for this study. A reasonable substitute has been derived from the Small Business Administration's FINSTAT data. This data base is obtained from Dun & Bradstreet's Financial Profiles data base. The data of interest to us are from SIC 3671 (Radio, TV Electron Tubes, SIC 3672 (Cathrode Ray TV Tubes), and SIC 3673 (Trans, Ind Elec. Tubes). From this data, two ratios were calculated to estimate salvage value. The first ratio is total assets to sales, the second is current liabilities to total assets. The ratios were ranked from smallest to largest and the ratio at the 75th percentile (with a value of .67) is used to represent the industry-wide assets to sales ratio. The median of the current liabilities to assets ratio (with a value of .27) is used as the industry-wide value. Taking these two values overestimates both the salvage value and the salvage value of equity which makes this analysis quite conservative.

Using these values, the plant specific salvage values were calculated in the following manner:

$S_e = S - L$

where:

S_e = salvage value of equity

S = salvage value of the plant

L = current liabilities of the plant

and:

S = .67 x sales x .60

L = (.67 x sales) x .27

in which:

.67 = industry-wide assets to sales ratio

.27 = industry-wide current liabilities to assets ratio

.60 = a factor to reflect the fact that any plant is probably only 60 percent convertible to another use.

Judgments are made about closure possibilities by considering the results of the solvency analysis as well as other information known about the plants and firms.

IV. Production and Employment Impacts

Reductions in total industry output could result if cost increases due to treatment are passed on in the form of higher prices and the demand is sensitive to the price change. However, since this impact analysis assumes no pass through of costs, treatment costs are absorbed by the manufacturers, and profits are reduced. Since there is no change in price, it is possible that there will be no change in total industry production. Therefore the uncertainty concerning change in total production involves plant closures. If there are plant closures due to reduced profits, then total production may be reduced if there is not a corresponding increase in production at other locations to replace production lost due to closures. Since information

concerning the likelihood of such expansion is not readily available, production and employment impacts are evaluated in relation to the closure analysis and as a result of the shutdown of specific product lines or plants.

V. Foreign Trade Impacts

Judgments about foreign trade are difficult because factors other than treatment costs are important, but currently are subject to major uncertainty. These factors have resulted in: (1) U.S. firms opting to close plants here, and transferring their production overseas to other plants owned by the U.S. parent firm; (2) foreign-owned firms opting to open plants in the United States; and (3) increasing imports from foreign companies. Since no pass through of treatment costs is assumed, then foreign trade impacts are not related to price changes but to production changes resulting from plant closures or product line shutdowns. Foreign trade impacts are evaluated in relation to the closure analysis; as a worst case analysis, it is assumed that production lost as a result of closure is moved to foreign firms or overseas U.S. plants, and that exports decrease in proportion to total subcategory production decreases resulting from closure.

VI. New Sources

The additional costs that a new source might incur if higher treatment requirements are imposed, compared to existing sources, could pose a barrier to new firms entering the industry or to existing firms which might otherwise build new plants. The baseline situation of whether or not there will be sufficient demand to attract new plant investments is not addressed. That issue depends to a large degree upon information on current industry capacity and the intensity with which it is utilized, which are not available.

Therefore, the analysis concentrates on the first issue concerning potential barriers to entry into the three industry subcategories.

To estimate the possible cost disadvantage for new sources, costs associated with higher treatment levels are postulated for new sources and compared to unit costs and to sales values. The incremental cost for the higher level of treatment is attributed to the treatment requirements promulgated for new sources.

VI.1 New TV Tube and Other CRT Plants

Two cases for new TV tube and other CRT plants are considered using treatment costs relative to raw waste load. Case A analyzes the impact of the incremental treatment cost between Option 2 and Option 3 because existing indirect dischargers will be required to attain a level of treatment equivalent to PSES-2.

Case B analyzes the impact of the total treatment cost for Option 3 because no regulation is being promulgated for existing direct dischargers. Therefore, a new direct discharger would incur an incremental cost equal to the total cost between no treatment (i.e., raw waste load) and a level of treatment equivalent to BAT-3.

Five model plant sizes are used for the new source analysis for color TV picture tubes and other CRTs, ranging from 10,000 gpd wastewater flow to 500,000 gpd. The three larger sizes, from 100,000 to 500,000 gpd, best represent new TV tubes plants. The plant sizes--specified in terms of wastewater flow--are based on the range of plants identified in the Final Development Document. The wastewater flows are related to model plant production using a range of production to flow relationships. The relation-

ship between quantity of tubes produced and wastewater flow for six of the existing color TV picture tube plants ranges from 10 to 30 tubes per thousand gpd with an average of 20; these values, derived from flow and production data obtained from EPA, are applied to both TV picture tube and other CRT new model plants, since no production to flow data are available for existing other CRT plants.

Based on 250 days per year of plant operation, annual production levels are estimated for the five model plants for the low, average and high values of 10, 20 and 30 tubes per thousand gallons per day. The annual treatment cost is then divided by the annual tube production estimates to obtain the cost per unit.

To convert the level of production to annual sales in 1986, the value per tube is projected for 1986. Since there are no industry projections for other CRT tubes as a group, the value per tube is calculated using historical data from 1979 to 1981 acquired from the U.S. Department of Commerce Current Industrial Reports. Production increased an average of 17.7 percent and the value of production increased at 26 percent per year over this period. Using a 5.5 percent inflation rate, the average value per other CRT tube in 1986 is estimated to be $222 (1982$). The average value per color TV tube is calculated using industry projections of an increase in value of 6.9 percent and an increase in production of 8.08 percent. This yields a 1986 value per tube of $70.44 in 1982 dollars. The annual treatment cost is then compared to the projected 1986 value of production (based on the $222 and the $70.44 average values per CRT and TV tubes, respectively) for each model plant. The capital investment portion of the model plant treatment cost is also considered in judging the potential impacts of treatment requirements on new sources.

VI.2 New Luminescent Coatings Plants

Three plant sizes were selected covering the range from small (10,000 gpd) to large (500,000 gpd). New plants will be required to achieve NSPS and PSNS wastewater treatment level equivalent to BAT-2 an PSES-2 and existing plants will not be required to attain any higher level of treatment over current, in place, treatment. Therefore, the additional treatment cost burden for new sources relative to existing plants is the total treatment cost of Option 2.

In contrast to the new source TV tube and other CRT analyses (where there is some information available on plant production quantities and wastewater flow), there is no information on plant production quantities for luminescent coatings plants to obtain a relationship between flow and output quantities. Based on two of the five existing plants where total plant output appears to be only one product, luminescent coatings, a range of plant sales from $304 to $1,682 (average, $993) per thousand gallons of wastewater flow is obtained. Using this crude relationship between wastewater flow and sales and the industry projected growth rate discussed in Section I.3, above, a 1986 sales value (in 1982 dollars) is estimated for the model plants. Annual treatment cost-to-sales ratios are computed and used to assess impacts on new sources.

VII. Small Business Analysis

The Regulatory Flexibility Act of 1980 requires that the effects of regulations on small businesses be considered. The analysis considers the distribution of treatment costs among firms, using company sales and employment to describe the size of the firm. Defining a small firm as one

with fewer than 250 employees, the proportion of total treatment costs borne by small and large firms is calculated and compared.

Section 4
Effluent Limitations Guidelines, Options and Compliance Costs

I. Introduction

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Section 101 (a)). To implement the Act, EPA was to issue effluent limitations guidelines, pretreatment standards, and new source performance standards for industrial dischargers. The Act included a timetable for issuing these standards. However, EPA was unable to meet many of the deadlines and, as a result, in 1976, it was sued by several environmental groups. In settling this lawsuit, EPA and the plaintiffs executed a court approved "Settlement Agreement." This Agreement required EPA to develop a program and adhere to a schedule in promulgating effluent limitations guidelines, new source performance standards, and pretreatment standards for 65 "priority" or toxic pollutants and classes of pollutants for 21 major industries (see Natural Resources Defense Council, Inc., v. Train, 8 ERC 2120 (D.D.C. 1976), modified, 12 ERC 1833 (D.D.C. 1979).

Many of the basic elements of this Settlement Agreement program were incorporated into the Clean Water Act of 1977. Under the Act, the EPA program is to set a number of different kinds of effluent limitations and standards. The following is a brief summary:

Best Practicable Control Technology Currently Available (BPT)

BPT applies to existing direct dischargers. The limitations are generally based on the average of the best existing performance at plants of various sizes, ages and unit processes.

Best Available Technology Economically Achievable (BAT)

BAT also applies to existing direct dischargers. These limitations, in general, represent the best existing performance in the industrial subcategory or category.

Best Conventional Pollutant Control Technology (BCT)

BCT replaced BAT for the control of conventional pollutants (BOD_5, TSS, oil and grease and pH). The Clean Water Act requires that BCT limitations be assessed in light of a two part "cost-reasonableness" test.

New Source Performance Standards (NSPS)

NSPS apply to new facilities which discharge directly into the Nation's waterways and are based on the best available demonstrated technology.

Pretreatment Standards for Existing Sources (PSES) and for New Sources (PSNS)

PSES and PSNS control the discharge of pollutants which pass through, interfere with, or are otherwise incompatible with the operation of a publicly owned treatment works (POTW). These limitations are to be technology-based, with PSES analogous to BAT and PSNS to NSPS.

The role of this report is to analyze the economic impact of water pollution controls on two subcategories of the electronics industry, Cathode Ray Tubes, and Luminescent Coatings. As required by the Clean Water Act, this study presents for consideration the projected economic impacts of complying with promulgated regulations and alternatives EPA considered in their development.

II. Treatment Technology Options

A total of 29 plants are covered by the final regulation. Treatment technologies appropriate to the two subcategories are developed in the Final Development Document in Section 7. The treatment technologies considered are summarized below:

II.1 Cathode Ray Tubes Subcategory

Option 1: No required treatment. The Clean Water Act and the Settlement Agreement allow exclusion of regulatory requirements under specific conditions. Thus, this is a zero cost option because current treatment of wastewater is sufficient.

Option 2: Solvent management to control total toxic organics, chromium reduction with the use of sulfuric acid and sodium bisulfite, chemical precipitation and clarification of all metals-bearing process wastes, sludge de-watering and pH adjustment.

Option 3: Option 2 plus multimedia filtration.

II.2 Luminescent Coatings Subcategory

Option 1: No required treatment.

Option 2: Chemical precipitation and clarification of all metals-bearing process wastes using lime, a coagulant aid and a polyelectrolyte, sludge de-watering and pH adjustment.

These treatment options apply to each regulation. The specific designations of options by regulation appear in Table 4-1.

Table 4-1. Treatment Option by Regulation and Type of Discharger

Option	Existing Direct*	Existing Indirect	New Direct	New Indirect
1	BPT/BAT-1	PSES-1	NSPS-1	PSNS-1
2	BPT/BAT-2	PSES-2	NSPS-2	PSNS-2
3**	BPT/BAT-3	PSES-3	NSPS-3	PSNS-3

* BPT, BCT, and BAT all apply to existing direct dischargers. However, BCT limitations are not being set more stringent than BPT for this industry. Hereafter, the treatment options will be referred to as BAT-1, BAT-2, etc., for simplicity.

** Option 3 applies only to the Cathode Ray Tubes subcategory.

III. Current Treatment and Treatment Costs

III.1. Current Treatment

EPA contacted or visited as many of the existing facilities as possible to determine current treatment practices. Table 4-2 summarizes the treatment in place determinations.

III.2 Treatment Costing

This part covers the estimation of treatment costs for new and existing sources. In all cases, Option 1 is excluded from treatment costing because it would require no treatment of wastewater effluents.

Table 4-2. Current Treatment-in-Place for Existing Sources

Subcategory	Number of Plants	Option 1 BAT-1 or PSES-1	Option 2 BAT-2 or PSES-2	Option 3 BAT-3 or PSES-3
Luminescent Coatings	5			
Direct	2	2	2*	NA
Indirect	2	2	1*	NA
Zero	1	NA	NA	NA
Cathode Ray Tubes**	24			
Direct	1	1	1	1
Indirect	23	23	5	1
Zero	0	NA	NA	NA

* Some plants have partial treatment in-place for Option 2.

** EPA has no treatment or flow information for one plant in the CRT subcategory.

NA = Not applicable.

III.2.1. Treatment Costs for Existing Sources. Model plant costs are developed in Section 9 of the Final Development Document. The detailed discussion of assumptions and of cost sources appears in that section. From those model plant costs (which are calculated for a variety of flow sizes), specific plant costs are determined based on EPA's knowledge of the flow size and existing treatment at each facility. EPA realizes that actual costs at each facility may differ depending upon raw waste pollutant concentrations, geographical considerations, etc.

Monitoring of wastewater is required for direct and indirect dischargers. Therefore, for these plants, $2,500 for capital investment and $13,000 per year for operation and maintenance is included in the treatment cost for monthly monitoring for total toxic organics (TTO). An additional $7,500 per year is included for monitoring the remaining pollutants three times a week.

Since monthly limitations (which do not include TTO) are based on 10-day sampling, these costs overestimate the cost of the expected monitoring requirements. For plants that are zero dischargers, there are no monitoring costs.

Tables 4-3A and 4-3B summarize the estimated treatment costs for existing sources; annual costs shown are calculated as the sum of the investment cost annualized over five years at a discount rate of 13 percent, plus the yearly operation and maintenance cost.

Table 4-3A

BAT Treatment Costs by Option and Subcategory
($000)

Subcategory	Number of Plants	Number of Plants Incurring Costs		Capital Investment		Total Annual Costs	
		Option 2	Option 3	Option 2	Option 3	Option 2	Option 3
Luminescent Coatings	2	2	NA	5.00	NA	27.4	NA
CRTs	1	0	0	0	0	0	0

Table 4-3B

PSES Treatment Costs by Option and Subcategory
($000)

Subcategory	Number of Plants	Number of Plants Incurring Costs		Capital Investment		Total Annual Costs	
		Option 2	Option 3	Option 2	Option 3	Option 2	Option 3
Luminescent Coatings	2	2	NA	118.1	NA	82.64	NA
CRTs	23	17	21	6,491.30	7,682.95	3,433.30	3,922.70

NA = Not applicable.

III.2.2 Treatment Costs for New Sources Because it is difficult to project the type of facility that may be built in the future, three model sizes of plants were costed for the luminescent coating subcategory and five model plant sizes were costed for the CRT subcategory. All treatment costs are estimated with respect to raw waste load. The model plant treatment costs are shown in Table 4-4; the estimates include the same per plant monitoring costs discussed earlier.

Table 4-4. Model Treatment Costs by Option for NSPS and PSNS*
($000)

Subcategory	Model Plant Flow Size (gpd)	Capital Investment Option 2	Capital Investment Option 3	Total Annual Costs Option 2	Total Annual Costs Option 3
Luminescent Coatings	10,000	100.5	106.33	58.99	61.39
	100,000	636.3	695.4	318.75	343.25
	250,000	1,180.1	1,306.2	583.85	636.15
CRTs	10,000	123.6	129.43	69.35	71.75
	50,000	289.6	305.4	162.1	168.70
	100,000	701.3	760.4	351.4	375.9
	200,000	1,151.2	1,265.5	571.1	618.4
	500,000	1,578.5	1,807.0	826.3	921.1

* PSNS compliance costs are the incremental cost from Option 2 to Option 3.

Section 5

Results of Analysis

I. Baseline Analysis

I.1 Industry-Wide by Subcategory

Table 5-1 shows the 1984 baseline estimates for three industry segments: color TV picture tubes, other CRTs and luminescent coatings. For TV picture tubes and other CRTs, baseline values are shown for production quantity, value of production, unit price and industry profit. For the luminescent coatings, production quantities and unit prices are not known and only total value of production and industry profit are estimated.

Table 5-1

1984 Baseline Estimates by Industry Segment
(1982 $)

	Color TV Picture Tubes	Other CRT	Luminescent Coatings
Production Quantity (million units)	13.43	.69	NA
Value of Production (million $)	1,076.65	147.48	379.8
Average unit value ($ per tube)	80.15	213.83	NA
Industry Profit (million $)*	374.7	67.55	145.5

Notes:

NA = not available.

*Industry profit based on ratio of unadjusted profit to value of shipments at the 4-digit SIC level; the ratios are:

0.348 for color TV picture tubes
0.458 for other CRT
0.383 for luminescent coatings

Sources:

For Color TV picture tubes, References 1, 3, 4, 5.

For Other CRTs, References 3, 5, 6.

For Luminescent coatings, Reference 2.

For color TV picture tubes, 13.4 million picture tubes is the estimated 1984 production with a value of $1.08 billion based on an average unit value of $80.15 per tube. Unadjusted profit is estimated at $374.70 million (based on the unadjusted profit to sales ratio of 0.348 derived in Section 3).

For other CRTs, 1984 production is estimated at 0.69 million units with a value of $147.48 million based on an average unit value of $213.83 per tube. The unadjusted profit for this industry subcategory is estimated at $67.55 million (based on an unadjusted profit to sales ratio of 0.458 derived in Section 3).

For luminescent coatings, total value of production in 1984 is estimated at $379.8 million. The unadjusted profit for this subcategory is estimated at $145.5 million (based on the unadjusted profit to sales ratio of 0.383 derived in Section 3).

I.2 Financial Ratio Analysis of Firms

Financial ratios discussed in Section 3 were calculated for the 10 corporations in this study whose financial statements were available. Results are shown in Table 5-2. Five of these firms produce color TV picture tubes, five produce other CRTs, and four of these tubes manufacturers also produce luminescent coatings. Financial statements are unavailable for the smaller firms which are primarily privately held.

Based on the analysis of one year (1981) alone, not one of these firms appears financially weak, although Sony and Tektronix are at, or somewhat below, the median in all three ratios. Each firm has also been evaluated using data covering several years (two to five depending on the data available), shown in Table 5-2. When the ratios are averaged over several

Table 5-2

Financial Ratio Trend Analysis

Firm's Subcategory and Firm	Ratio Code*	Average Ratio	(Ratio Values) 1982	1981	1980	1979	1978
Color TV Tubes							
General Electric**	1	1.3	1.27	1.24	1.3	1.37	
	2	11.26	12.03	13.16	10.89	8.94	
	3	8%	8%	8%	8%	8%	
NA Philips** (Formerly GTE)	1	2.69	2.72	2.48	2.86		
	2	3.45	3.76	3.63	2.95		
	3	5%	4%	6%	5%		
RCA**	1	1.52	1.17	1.78	1.49	1.45	1.69
	2	9.52	16.57	10.59	7.11	7.47	5.86
	3	4%	3%	1%	4%	5%	6%
Sony	1	1.37	1.30	1.72	1.27	1.18	
	2	6.41	5.70	5.79	6.51	7.64	
	3	6%	4%	6%	10%	2%	
Zenith	1	2.37	2.22	2.13	2.76		
	2	4.28	4.65	4.42	3.76		
	3	2%	-3%	2%	4%		
Other CRT							
Hewlett Packard	1	2.32	2.57	2.42	2.16	2.12	
	2	3.53	3.15	2.42	2.16	2.12	
	3	11%	11%	11%	12%	11%	
Litton	1	1.57	1.69	1.53	1.49		
	2	4.93	4.39	5.19	5.21		
	3	8%	8%	8%	9%		
Raytheon	1	1.34	1.39	1.33	1.32	1.31	1.35
	2	9.15	8.22	9.6	10.09	9.53	8.31
	3	9%	9%	10%	10%	9%	8%
Tektronix	1	2.48	2.67	2.67	1.79	2.8	
	2	2.92	3.08	2.96	2.80	2.85	
	3	9.5%	8%	8%	10%	12%	
Westinghouse**	1	1.14	.97	1.03	1.26	1.29	
	2	33.85	0	84.01	9.99	7.56	
	3	4%	5%	5%	6%	1%	

Source: 1982, 10-K Reports.

*Firm's average for each of the three ratios is based on values over the 2 to 5 years as displayed in the table. Ratio code is as follows:

1 = Current Ratio (Current Assets to Current Liabilities).
2 = Net Sales to Net Working Capital.
3 = Return on Total Assets in Percent.

**These firms also produce luminescent coatings.

years and compared to Dun and Bradstreet industry medians and high and low quartiles shown in Table 5-3, it appears that most TV picture tube and other CRT manufacturers have experienced a number of financially lean years despite the growth of these two market sectors. Several reasons can be identified which explain these circumstances. First, and most importantly, each of these firms is large and diversified, producing many products, some of which have been severely affected by nationwide economic conditions. Second, these industries are under heavy pressure from international competition. Also, the performance of the dollar in relation to other currencies has made their task more difficult as have high interest and inflation rates.

Table 5-3

Comparative 1981 Dun and Bradstreet Industry Ratios (SIC 3671-79)
Electronic Components and Accessories (108 Firms)**

	Current Assets / Current Liabilities	Net Sales / Net Working Capital	Net Profit / Total Assets
Upper Quartile	3.8	9.0	18.2
Median	2.5	4.9	10.6
Lower Quartile	1.7	3.2	6.5

Source: Key Financial Ratios in 125 Lines of Business, Dun and Bradstreet Inc. 1981.

**The Dun and Bradstreet industry (SIC) ratios are arranged in order of "quality" with the best at the top and the weakest at the bottom. The figure in the middle becomes the median for that ratio in that line of business. The upper and lower figures typify the experience of firms in the top and bottom halves of the sample. Though not relevant to the data shown in this table, it is important to note that upper quartile figures are not always the highest, nor are lowest quartile figures always the lowest numerically. The upper quartile listings represent judgmental ranking, thus the upper quartile represents the best condition in any given ratio and is not necessarily the highest numerical value.

Analysis of each of the three ratios shown in Table 5-2 based on the firm's multi-year averages, results in the following observations.

Current Ratio (Current Assets to Current Liabilities): Only two firms (Tektronix and N.A. Philips) exceeded the median. Since the rule of thumb for healthy solvency is 2, it is obvious that money is tight for this industry sector. However, solvency is not necessarily the main issue because other ratios indicate relative strength in other areas.

Net Sales to Net Working Capital: This ratio indicates that four corporations are below the median (Zenith, Tektronix, Hewlett Packard and N.A. Philips). According to the current ratio analysis, N.A. Philips and Tektronix are among the most solvent firms in the sample. Furthermore, Hewlett Packard has one of the highest reputations among the nation's corporations. In these three cases, it is unlikely that inefficient management of assets is the cause of the relatively low ratios.

Return on Total Assets: Returns have been low for several years for almost all firms included in the analysis. Only Hewlett Packard's corporate three-year average reached the 1981 Dun and Bradstreet median.

In summary, when these firms' performance is evaluated with respect to all three ratios, the following observations can be made. Several firms have a relatively low solvency rating but show no marked weakness in the ratios that highlight management efficiency and profitability. Hewlett Packard, N.A. Philips, Tektronix and Zenith have relatively low net sales to working capital ratios but all of these except Zenith are at the top of the industry in other ratios. Return on assets has been low for several years for all firms except Hewlett Packard which indicates that these are difficult

economic times but none of the publicly held corporations in this study are judged to be in serious financial difficulty.

I.3 Baseline Projections

As discussed in Section 2, annual growth in color TV picture tubes between 1982-86 is anticipated to be 6.9 percent (in current dollar value) by industry observers. Allowing for a 5.5 percent annual rate of inflation over that period, the real increase (1.75 percent annually) would result in a 1984 value of production that is 3.5 percent greater than in 1982. The 1984 U.S. production value is projected to be $1.08 billion, in constant 1982 dollars. (This projection assumes no major changes in U.S. market penetration by imported tubes nor large reduction in import share of the U.S. market due to protectionist measures adopted by the U.S. government.)

Military and industrial uses of other CRTs will create additional demand over the next several years. An 18.4 percent annual growth over the 1982-86 period is anticipated by industry experts. Allowing for a 5.5 percent annual rate of inflation suggests that the 1984 production value will be 30.6 percent (in real terms) greater than the 1982 value. Therefore, the 1984 value of production is projected to be $146 million, in constant 1982 dollars.

II. Impact Analysis (Existing Producers)

II.1 Industry-Wide Impacts by Product Sector

II.1.1 Color TV Picture Tubes. Table 5-4 shows the impact of Options 2 and 3 on the TV picture tube industry subcategory. In Option 2, total annual cost is $2.308 million. With treatment costs fully absorbed by manufacturers, baseline profit is reduced by this amount which is 0.62 percent of the

Table 5-4. 1984 Impact Estimate (1982$)

Industry Segment	1984 Baseline: Value of Production (Million $)	1984 Baseline: Industry Profit (Million $)	Treatment Costs (Million $): Option 2	Treatment Costs (Million $): Option 3	Industry Profit After Treatment Costs (Million $)[1]: Option 2	Industry Profit After Treatment Costs (Million $)[1]: Option 3
Color TV Picture Tubes	1,076.65	374.7	2.3083	2.7414	372.4 (-.62%)	372.0 (-.73%)
Other CRTs	147.48	67.55	1.21775	1.27825	66.33 (-1.80%)	66.27 (-1.89%)
Luminescent Coatings	379.8	145.5	.11004	NA	145.4 (-.08%)	NA

[1] Percent changes from baseline are noted in parentheses.

baseline profit for the industry subcategory. For Option 3 the total annual cost is $2.7414 million when treatment costs are fully absorbed and baseline profit is reduced by 0.73 percent.

II.1.2 Other CRTs. Table 5-4 shows the impact of Options 2 and 3 on the other CRT industry subcategory. For Option 2, total annual cost is $1.218 million. When treatment costs are fully absorbed by manufacturers, baseline profit is reduced by an amount equal to the treatment cost; this is 1.80 percent of the baseline profit for the industry subcategory. For Option 3, total annual cost is $1.278 million and when fully absorbed by manufacturers, baseline profit is reduced by this amount which is 1.89 percent of the baseline profit for the industry subcategory.

II.1.3 Luminescent Coatings. Table 5-4 shows the impact of Option 2 on the luminescent coatings industry. For Option 2, total annual cost is $110.0 thousand. With fully absorbed treatment costs, baseline profit is reduced by this amount which is 0.08 percent of the estimated baseline profit.

II.2 Impacts on Financial Ratios of Firms

The publicly owned companies are large and the impacts measured by the financial ratios are small. Table 5-5 compares total assets with the treatment cost for Option 3; for example, the annualized treatment costs of three RCA plants combined ($995,100) has no measurable affect on the financial ratios given that RCA's total assets are $7.9 billion. Thus, the firm-level financial ratios are insensitive to the relatively very small changes in value of assets associated with additional treatment equipment or facilities.

Table 5-5

Comparison of Firms' Assets
with Treatment Costs
($000)

	Total Assets	Treatment Cost (Option 3) Capital Investment	Annual
Color TV Tubes			
General Electric*	20,942,000	114.3	47.3
N.A. Philips*	1,854,100	1,542.0	782.0
RCA*	7,856,700	1,988.5	995.1
Sony	5,287,400	140.0	56.0
Zenith	743,200	1,698.0	861.0
Other CRT's			
Hewlett Packard	2,758,000	5.83	2.4
Litton	3,687,600	129.43	71.8
Raytheon	3,363,800	760.4	375.9
Tektronix	953,735	0.0	0.0
Westinghouse*	8,316,200	305.4	168.7

*These firms also produce luminescent coatings.

Note: This table includes only publicly owned firms for which asset information is available.

As discussed later in the plant-level impact analysis, one firm (Thomas Electronics) has three plants with relatively higher impacts than other plants. However, the firm is privately owned and therefore not required to publish financial data that would allow analysis of the financial ratios.

II.3 Plant Level Impacts (Existing Plants)

The impact measures developed in Section 3 for individual plants are shown in Tables 5-6, 5-7 and 5-8 for the three industry product sectors, color TV picture tubes, other CRTs and luminescent coatings, respectively. The tables also display the plant sales and annual treatment costs for Option 2 and Option 3, by plant. These impacts are discussed below. Sensitivity analyses have been conducted on these impact measures and are presented in Appendices A and B.

II.3.1 TV Picture Tube Plants. Three existing plants incur treatment costs under Option 2 and six under Option 3. Tables 5-6A and 5-6B reveal that all the impact measures based on annual costs are relatively small, less than two percent, except for two plants (Zenith, IL, and Philips, OH).

Excluding the Philips, OH, plant, the total annual treatment cost to plant sales (ATC/Sp) ratio is less than 0.54 percent for Option 3 and the ratio of annual treatment cost to manufacturing conversion cost (ATC/MCC), is less than 0.91 percent. The ratio of annual treatment cost to unadjusted profit at the plant level is less than 1.5 percent for Option 2 and less than 1.6 percent for Option 3, again for all plants except the Philips, OH plant. These ratios (ATC/Sp, ATC/MCC, ATC/UP) are higher for the Philips, OH plant. The largest of the three is the annual treatment cost to unadjusted profit at 4.59 for Option 3. However, the ATC/NI ratio is very small for both Options

Table 5-6A

Impact Measures: Color TV Picture Tube Plants
Option 2 (Level 1)

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
RCA, PA	0	0	114.8	0	0	0	0	0
Zenith, IL	1.5	.78	160.1	.487	0.816	1.4	4.83	28.7
GE, NY	0	0	77.0	0	0	0	0	0
RCA,IN	1.578	.8263	264.6	0.312	0.524	0.897	1.48	18.2
Philips, OH	1.3488	.702	49.0	1.43	2.41	4.11	0.653	84.2
Philips, NY	0	0	36.7	0	0	0	0	0
Sony, CA	0	0	131.7	0	0	0	0	0
Total, Option 2	4.4268	2.3083	833.9					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table 5-6B

Impact Measures: Color TV Picture Tube Plants
Option 3 (Level 2)

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, PA	.182	.074	114.8	.0644	.108	.185	.133	4.85
Zenith, IL	1.698	.861	160.1	.538	.901	1.55	5.33	32.4
GE, NY	.1143	.0473	77.0	.0614	.102	.177	.003	8.28
RCA, IN	1.8065	.9211	264.6	.348	.583	1.0	1.56	20.9
(ECG) Philips, OH	1.542	.782	49.0	1.59	2.68	4.59	.926	96.3
(ECG) Philips, NY	0	0	36.7	0	0	0	0	0
Sony, CA	.14	.056	131.7	.043	.072	.123	.189	3.26
Total, Option 3	5.4828	2.7414	833.9					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table 5-7A

Impact Measures: Other CRT Plants
Option 2 (Level 1)

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
Raytheon, MA	.7013	.3514	124.1	.283	.438	.619	.083	15.7
Clinton Elec.,IL	.2896	.1621	53.8	.301	.466	.658	NA	14.9
Thomas Elec., NY	.1236	.06935	3.1	2.21	3.42	4.83	NA	109.3
Thomas Electronics, NJ 1/	.1236	.06935	12.0	.577	.896	1.26	NA	28.5
Thomas Electronics, CA 1/	.1236	.06935	2.2	3.12	4.83	6.82	NA	154.2
Hewlett Packard, CO 1/	0	0	122.1	0	0	0	0	0
General Atronics, PA 2/	0	.00165	5.9	.028	.044	.061	NA	0
Litton Ind., AZ	.1236	.06935	3.9	1.78	2.75	3.88	.022	87.8

(Table 5-7A continues).

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment cost assumed to be the same as for Thomas Electronics in Clyde, NY

2/ Owned by N.A. Philips.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table 5-7A (continued)

Impact Measures: Other CRT Plants
Option 2 (Level 1)

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/OP	ATC/NI	TCC/CAP
Dumont Electronics, NJ	.2896	.1621	17.6	.919	1.42	2.01	NA	45.5
B-Scan Inc., PA	0	.00165	2.0	.084	.13	.184	NA	0
Video Display Corp., GA	0	.00165	2.7	.0602	.093	.132	NA	0
Westinghouse, NY	.2896	.1621	94	.172	.266	.377	.0273	8.53
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	712.4	0	0	0	0	0
Tex-Video Man., TX	0	.00165	NA	NA	NA	NA	NA	NA
Datagraphix, CA	0	.00165	96.2	.002	.002	.004	NA	0
Total, Option 2	2.0645	1.125	1252.0					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment cost assumed to be the same as for Thomas Electronics in Clyde, NY

2/ Owned by N.A. Philips.

*All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table 5-7B

Impact Measures: Other CRT Plants
Option 3 (Level 2)

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
Raytheon, MA	.7604	.3759	124.1	.303	.469	.662	.089	17.0
Clinton Elec, IL	.3054	.1687	53.8	.313	.485	.685	NA	15.7
Thomas Elec, NY	.12943	.07175	3.1	2.29	3.54	5.0	NA	114.4
Thomas Elec. NJ 1/	.12943	.07175	12.0	.597	.927	1.3	NA	29.8
Thomas Elec.,CA 1/	.12943	.07175	2.2	3.23	4.99	7.06	NA	161.5
Hewlett Packard, CO 1/	.00583	.0024	122.1	.002	.0031	.0043	.001	.13
Gen. Atronics, PA 2/	0	.00165	5.9	.028	.044	.061	NA	0
Litton Ind. AZ	.12943	.07175	3.9	1.84	2.84	4.02	.023	91.9
Dumont Electronics, NJ	.3054	.1687	17.6	.957	1.48	2.09	NA	48.0
B-Scan Inc, PA	0	.00165	2.0	.083	.13	.184	NA	0
Video Display, GA	0	.00165	2.7	.0602	.093	.132	NA	0
Westinghouse, NY	.3054	.1687	94	.179	.277	.392	.029	9.0
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	712.4	0	0	0	0	0
Tex-Video Man, TX	0	.00165	NA	NA	NA	NA	NA	NA
Datagraphix,	0	.00165	96.2	.002	.002	.004	NA	0
Total, Option 3	2.20015	1.1813	1252.0					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment cost assumed to be the same as for Thomas Electronics in Clyde, NY

2/ Owned by N.A. Philips.

*All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table 5-8

Impact Estimates: Luminescent Coatings
Option 2

Plant	Treatment Cost (Mill. 1982 $) Invest-ment	Treatment Cost (Mill. 1982 $) Annual	1984 Annual Sales (Mill. 1982 $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
RCA, Lancaster, PA	.0025	.0137	129.0	.011	.017	.037	.023	.035
GTE, Towanda, PA	.0025	.0137	238.6	.005	.009	.020	.015	.019
GE, Cleveland, OH	.0025	.0137	14.4	.095	.151	.336	.001	.321
U.S. Radium, Morristown, NJ	0	0	4.0	0	0	0	0	0
Westinghouse, Bloomfield, NJ	.1156	.06894	115.2	.06	.094	.156	.014	1.85
Total, Option 2	.1231	.11004	501.2					

Notes: Annual Sales are from EIS data file; except one plant where sales are derived from employment; 1982 $, adjusted to 1984.

*All the impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

2 and 3 for this plant which suggests that a decline in one plant's profit will not significantly affect the parent firm's income.

The annual cost of treatment to the firm's net income (ATC/NI) ranges up to 4.83 percent for Option 2 and up to 5.33 percent for Option 3. These values are associated with one plant (the Zenith plant in Melrose Park, Illinois) and if it is excluded, the ratio is less than 1.60 for Options 2 and 3. It should be noted that this Zenith plant is closing and its production will move to Taiwan according to a recent announcement in Electronic News.

The capital investment portion of treatment cost (TCC/CAP), is less than 21.0 percent of annual plant investment if the Zenith and Philips plants are excluded; if they are included, the ratio is as high as 96.3 percent for Option 3.

II.3.2 Other CRT Plants. Fourteen existing plants incur treatment costs under Option 2 and fifteen incur costs for Option 3 as shown in Tables 5-7A and 5-7B.

The ratio of annual treatment cost to plant sales (ATC/Sp), ranges up to 3.12 percent for Option 2 and up to 3.23 percent for Option 3. For annual treatment cost relative to manufacturing conversion cost (ATC/MCC), the ratio is as high as 4.83 percent for Option 2 and 4.99 percent for Option 3. For annual treatment cost to unadjusted plant level profit (ATC/UP) the ratio is as high as 6.82 percent for Option 2 and 7.06 percent for Option 3.

For all three of the impact ratios discussed above, the high values are associated with one plant owned by Thomas Electronics of California. The plant showing the second highest impact in terms of these three impact

measures is owned by same parent company, the Clyde, New York plant. The third highest values are associated with the Litton Industries, Arizona plant.

To consider the total annual treatment cost burden to the Thomas Electronics Company, aggregate costs were compared to aggregate sales for the three plants. The ratio of aggregate annual treatment costs to aggregate plant sales is 1.20 percent for Option 2 and 1.24 percent for Option 3. Because Thomas Electronics is privately owned and not required to publish financial data, estimates of annual treatment costs to net income cannot be carried out.

The ratio of plant annual treatment cost to the firm's net income (ATC/NI) is less than 0.09 percent for any of the publicly owned plants for either Option 2 or 3. However, it should be noted that net income data are fragmentary for this industry subcategory. The ratio of capital investment for treatment to annual plant investment (TCC/CAP) is less than 30 percent for all plants, except for the Thomas Electronics, CA and NY plants, Litton, CA plant and Dumont, NY plant. For the most severely impacted plant (Thomas Electronics, CA plant), the ratio is 154 percent for Option 2 and 162 percent for Option 3.

Returning to the first mentioned impact measure of annual treatment costs to sales (ATC/Sp), this ratio has sometimes been used in other EPA impact studies to identify plants that potentially might experience severe impacts. If a value of this ratio equal to, or greater than, one percent is used as a screening criterion, three plants are severely impacted under Option 2 and Option 3; two are owned by Thomas Electronics and one by Litton Industries. The Dumont Electronics plant comes very close to being impacted under this criterion. If a value equal to, or greater than, two percent is used, only

the two Thomas Electronics plants are noted as potentially severely impacted. With three percent as a screening criterion, only one plant (Thomas Electronics of California) is severely impacted. With a criterion of four percent, no plants are severely impacted under either Option 2 or Option 3.

II.3.3 Luminescent Coatings Plants. Four of the five existing plants would incur treatment costs under Option 2 as shown in Table 5-8. The U.S. Radium, Morriston, N.J. plant has no discharge and therefore has no treatment costs. (Option 3 does not apply to this subcategory.)

All the impacts based on annual treatment costs are relatively small. None of the impact measures based on annual costs exceed 0.34 percent. The highest ratio of the capital investment impact measure is less than 1.9 percent.

III. Closure Analysis

III.1 High-Impact Plant Identification

III.1.1 Color TV Picture Tube Plants. As discussed above, the Philips plant in Ottawa, OH shows the highest impacts under both Options 2 and 3. Annual treatment costs to sales ratios are greater than one percent but less than two percent for both options. The ratios of annual treatment costs to manufacturing conversion costs and to unadjusted plant profit are also high, above two and four percent, respectively, for both options. The impact measure comparing treatment capital investment to annual firm capital investment is also quite high, 84 percent for Option 2 and 96 percent for Option 3. Thus, these impact measures indicate that this plant would have significant profitability impacts. Even the "best case" sensitivity analysis results do not contradict this conclusion (see Appendix A). However, based on

the financial ratio trend analysis conducted in Section I.2, Philips is a financially strong firm. In addition, as shown in Table 5-5 total annual treatment costs are very small when compared to the firm's total assets. Therefore, it is probable that the firm will not close the plant, but will carry the treatment costs given the growing market, its overall strong position and the fact that the plant is a large integrated facility.

For the other plants in this industry segment, the first mentioned impact measure indicates annual treatment costs to plant sales will be less than 0.6 percent. A plant may have multiple product lines with treatment facilities dedicated to one or more particular product lines. If so, the treatment costs should be allocated to the selected product line (or lines) which incur the additional treatment costs. In such cases, the ratio of annual treatment cost to product line sales could be higher than the values estimated in the above impact analysis; if higher than the ratios calculated for the plant, a product line shutdown may be implied. However, sales data on a product line basis are not available.

Two other impact measures--annual treatment cost to manufacturing conversion cost and to unadjusted plant profit--support the above conclusion that impacts are slight on all except the Philips plant, because the ratios are less than two percent (Option 2 or Option 3).

The next impact measure of annual treatment cost to firm net income is as high as 5.63 percent for one plant (Zenith, Melrose IL). However this plant is closing as noted earlier, for reasons other than treatment cost impacts.

Some of the larger firms engaged in TV picture tube manufacturing show relatively low net incomes, for example, Zenith with $15 million in 1981. However, Zenith and the other firms manufacture complete color TV sets and

therefore it does not seem reasonable to consider a possible TV tube plant or product line shutdown without considering the plant's relationship as a supplier to one of the firms' major product lines. Firms such as RCA are large and highly diversified (for example, broadcasting, major appliances, and defense hardware) and capital investment for treatment at the plant level is not exorbitant compared to annual investments routinely contemplated by large, diversified firms. (The Zenith plant has the highest ratio but capital investment for Option 3 is less than 35 percent of the annual investments at the plant level).

Based on the observations discussed above, no closures are anticipated among the color TV picture tube manufacturing plants under either Option 2 or Option 3.

III.1.2 Other CRT Plants. Two plants owned by Thomas Electronics and one owned by Litton Industries show the highest impacts as pointed out earlier. In particular, annual treatment costs for the Thomas Electronics, Los Angeles plant are somewhat more than three percent of sales under either Option 2 or Option 3, and the capital investment component of treatment cost is 154 to 162 percent of the average annual plant investment for the two options, respectively. This plant, with annual sales of $2.2 million, is small relative to total company sales (over $17 million). The Clyde, NY, Thomas Electronics plant is also small (sales of $3.1 million) and shows significant impacts, though not as great as the Los Angeles plant. It is conceivable that Thomas Electronics might consider closing either the California plant or the New York plant or both, and consolidate all CRT manufacturing at the Wayne, NJ plant if (1) the Wayne, NJ plant (with CRT sales greater than the aggregate sales of the other two Thomas CRT plants) has slack capacity and (2) the company's major market opportunities are compatible with expanding their

operations on the East Coast. However, such a decision is more likely to be driven by other factors such as labor costs, marketing prospects, raw material acquisitions, and transportation costs. Since Thomas Electronics is a privately-held firm, it was not possible to analyze its financial base.

The analysis for the Litton Industries, Tempe, AZ plant also shows moderately high impacts, as indicated above. The annual treatment costs to sales ratios are between one and two percent for both options, and treatment capital costs are 88 percent and 92 percent of the firm's annual capital investment for Options 2 and 3, respectively. The worst case sensitivity analysis supports the conclusion that there may be plant profitability impacts (see Appendix A). Although Litton Industries has a low current ratio, as discussed in the Financial Ratio Analysis of Firms, Section I.2, it shows no weakness in the ratios that are indicators of management efficiency and profitability. In addition, total annual treatment costs are very small when compared to the firm's total assets, as shown in Table 5-5. Thus, Litton has an adequate financial base to afford the wastewater treatment expenditures and given the rapidly growing CRT market, will probably choose not to close the plant.

Dumont Electronics, located in Clifton, NJ, is a borderline plant according to the impact measures discussed previously. This plant has annual treatment cost to sales ratios which are near one percent for both options and fairly high percentages (46 and 48 percent) of treatment capital costs to annual firm investment. When the worst case sensitivity analysis is considered (i.e., if the sales estimates have been underestimated by 10 percent) it supports the conclusion that this plant may be adversely impacted (see Appendix A). Since Dumont Electronics is a privately-owned firm, no analysis can be made of its financial strength.

Based on the observations discussed above, it is anticipated that the Thomas Electronics firm will be severely impacted by Option 2 or Option 3 and that its Los Angeles, CA and Clyde, NY plants are candidates for closure. Closure is also possible at the Dumont Electronics, Clifton, NJ plant.

III.1.3 Luminescent Coatings Plants. None of the coatings plants are closure candidates. As noted earlier, all of the impact measures are relatively small.

III.2 Reliability of the Impact Ratios

The ratios used to estimate the plant level impacts of additional treatment costs were derived from the 1977 Census of Manufactures. These ratios might not typify the current relationships for each of the industry subcategories. In order to test the reliability of these ratios, they have been recalculated for the years 1979, 1980 and 1981 and are shown in Table 5-9.

Table 5-9.

Comparison of the Unadjusted Profit to Sales Ratio (f_{up}) and the Plant Investment to Sales Ratio (f_{cap}) for Several Years

	1977	1979	1980	1981	average
Color TV					
f_{up}	.348	.328	.341	.328	.336
f_{cap}	.0327	.0316	.0278	.0371	.0323
Other CRT					
f_{up}	.458	.468	.456	.471	.463
f_{cap}	.0361	.0413	.04	.0415	.0397
Luminescent Coatings					
f_{up}	.383	.42	.44	.425	.417
f_{cap}	.0541	.0562	.0495	.0514	.0528

Source: U.S. Department of Commerce, Annual Survey of Manufactures.

As this table illustrates, the 1977 values are very close to the four-year averages. The 1977 f_{cap} ratio for other CRT plants differs the most from the average. Using the Thomas plant in California under Option 3 as an example, this difference in ratios results in only an 8.7 percent change in the impact measures (147 percent vs. 161 percent). Thus, using the 1977 ratios gives us reasonably accurate measures.

III.3 Solvency Analysis

This solvency analysis is applied to three plants which have high impact measures and are judged to be possible candidates for closure. All three of these plants are privately owned, so it was not possible to conduct a financial analysis of the firms. As discussed in Section 3, Methodology, a proxy for cash flow minus annual treatment costs for Option 3 is compared with the estimated salvage value of each plant. The results of this analysis are shown in Table 5-10 below.

Table 5-10.

Comparison of Salvage Value to the PV of Cash Flow

Plant	S_e (Mill.$)	PV_8 (Mill.$)	PV_{10} Mill.$)	$\frac{S_e}{PV_8}$	$\frac{S_e}{PV_{10}}$
Thomas Elec., NY	0.685	5.77	5.13	.119	.127
Thomas Elec., CA	0.486	4.01	3.56	.121	.137
Dumont Elec., NJ	3.89	33.78	30.02	.115	.13

S_e = Salvage value of equity.
PV_8 = Present value of cash flow at 8 percent.
PV_{10} = Present value of cash flow at 10 percent.

From this table, it is obvious that for all three plants the salvage value is much less than the present value of cash flow after treatment cost. In all instances, the ratio of salvage value to PV of cash flow is less than fourteen percent. Thus, the plants are worth more to the owners if they remain open. Even if the actual cash flow of the plants is only one-half or one-third of the estimates made here (due to other costs such as maintenance not accounted for by the unadjusted profit estimates used as proxies for cash flow) the cash flow of the plants is still sufficiently high that the plants would remain open. On the basis of this analysis, no plant closures are foreseen as a result of the treatment costs.

IV. Production and Employment Impacts

As discussed in Section 3, Methodology, this impact study assumes that treatment costs are absorbed by the manufacturers and therefore prices of plant output remain unchanged because costs are not passed through, so that total production and employment will not be changed due to price-related demand changes. However, the impact measures indicate that several plants will have significant profitability impacts, and, while the solvency analysis shows that these plants will not close, it is possible that production and employment reductions could take place. Whether these reductions would remain over the long-term or whether they would merely be temporary adjustments as production is picked up by expansion at other sites, is subject to many uncertainties.

The three small CRT plants discussed in III.1.2, above, are not expected to close, but even assuming that some or all of them did, does not necessarily imply an overall loss of production. If Thomas Electronics closed its plants, their decision might be based on increasing production at the Thomas

Electronics, NJ plant. Or, if they did not choose to maintain their share of total industry CRT output and if Dumont Electronics decided to reduce its share, then other firms might increase their production to replace that which would be lost. Thus, while the industry-wide geographical distribution of production (and employment) might change, given the rapidly growing CRT market, no significant reductions in total output are anticipated as a result of any of the options.

V. Foreign Trade Impacts

Foreign trade projections are always difficult to make because there are so many international factors involved, such as government restrictions, interest rates and changes in the strength of the dollar, which are hard to predict. Historical data on imports, exports and balance of trade are presented in Tables 2-8, 2-9 and 2-10. No balance of trade estimates for the industry subcategories for 1982 or 1984 are readily available and therefore foreign trade impacts have to be evaluated using the historical data from Section 2. However, because of factors such as those just mentioned, what actually happens may be very different from what is estimated.

As explained in Section 3, the foreign trade assessment presented here is a worst case analysis based on the closure analysis discussed earlier. That analysis, in III.1.2, above, concludes that three small CRT plants are expected to incur adverse profitability impacts due to the additional treatment costs but are unlikely to close. If production were reduced at these sites, then foreign trade in the other CRT subcategory could be affected. However, the balance of trade for other CRTs appears to be steadily improving (see Table 2-9). The 1981 balance of trade was $37.9 million. Given this favorable outlook, it is probable that even if these plants did

reduce output, production would be increased elsewhere in the U.S. and therefore, foreign trade would not be seriously impacted.

The decision of some U.S. firms to relocate their production in foreign countries and the decision of some foreign owned firms to open manufacturing plants in the U.S. are based on much more fundamental reasons than can be associated with the relatively small effects of treatment costs. These reasons include labor cost differentials and overall cost of operations, corporate strategy for increasing market share and existence (or threat) of import quotas and/or other measures undertaken at the national level.

VI. New Sources

VI.1 New TV Tube Plants

As discussed in Section 3, Methodology, two cases are considered for new TV tube and other CRT plants, representing costs for indirect dischargers (Case A) and direct dischargers (Case B).

VI.1.1 Case A. Treatment costs relative to wastewater flow are presented in Table 4-4, Section 4. Sizes of color TV picture tube plants are likely to be over 100,000 gpd wastewater flow based on existing plants (none of which are smaller than 200,000 gpd). For new source indirect dischargers, the incremental costs are between Option 3 and Option 2. The incremental capital costs range from $59,100 to $228,500 and the incremental annual costs, from $24,500 to $94,800 for the three plant sizes above 100,000 gpd.

The annual production of TV tubes for the three model plants is shown in Table 5-11 for the low, average and high values of 10, 20 and 30 tubes per thousand gallons per day. The annual treatment costs per TV tube range from

Table 5-11. Case A

Impact of Treatment Cost on New TV Tube Plants

Indirect Dischargers

Plant Size (gpd)	CRTs Produced per 1000 gpd	Annual Plant Production of CRTs (000)	Annual Treatment Cost * ($000)	1986 Annual Plant Sales** (Mill. 1982$)	Annual Treatment Cost to Sales %	Annual Treatment Cost per Tube $
100,000	10	250	24.5	17.6	.139	.10
	20	500	24.5	35.2	.070	.05
	30	750	24.5	52.8	.046	.03
200,000	10	500	47.3	35.2	.134	.09
	20	1,000	47.3	70.4	.067	.05
	30	1,500	47.3	105.7	.045	.03
500,000	10	1,250	94.8	88.1	.108	.08
	20	2,500	94.8	176.1	.054	.04
	30	3,750	94.8	264.2	.036	.03

Note: Annual production is based on 250 days per year of plant operation.

* Treatment cost is the increment from Option 2 to Option 3 and is calculated as the difference between the annual treatment costs for these Options shown in Table 4-4.

** Based on an average unit price of $70.44 per TV Tube (1982 $).

$0.03 to $0.10. Annual treatment costs to plant sales are also presented and are less than 0.2 percent.

A new plant would take advantage of more up-to-date, efficient production processes than used in existing plants; thus overall costs of manufacturing (including the additional cost for Option 3) are likely to result in a lower cost per TV tube than can be met in existing plants.

The incremental capital investment costs for Option 3 are modest and the per-unit cost increases that might stem from Option 3 are very small. Thus, in our judgment there are no significant barriers to new indirect discharger sources entering the TV tube industry that are attributable to treatment costs.

VI.1.2 Case B. The total cost for TV tube plants to achieve new source standards equivalent to Option 3 for direct dischargers are presented in Section 4, Table 4-4. Assuming that new color TV picture tube plants are going to be over 100,000 gpd wastewater flow, treatment costs would range from $760.4 thousand to $1,807.0 thousand for capital investment and from $375.9 to $921.1 thousand for annual costs for the three larger model plants. Table 5-12 shows the impacts of treatment costs. The costs per TV tube range from $1.50 for a 100,000 gpd plant with a low output (i.e., 10 TV tubes produced per 1,000 gpd) to $0.25 for a 500,000 gpd plant with high output (i.e., 30 TV tubes produced per 1,000 gpd).

The average unit value of color TV picture tubes is projected to be $70.44 in 1986. The annual treatment cost per tube ranges from $1.50 to $0.50 per tube or from 2.1 percent to 0.71 percent of the unit value.

Table 5-12. Case B

Impact of Treatment Cost on New TV Tube Plants

Direct Dischargers

Plant Size (gpd)	CRTs Produced per 1000 gpd	Annual Plant Production of CRTs (000)	Annual Treatment Cost * ($000)	1986 Annual Plant Sales** (Mill. 1982$)	Annual Treatment Cost to Sales %	Annual Treatment Cost per Tube $
100,000	10	250	375.9	17.6	2.14	1.50
	20	500	375.9	35.2	1.07	0.75
	30	750	375.9	52.8	0.71	0.50
200,000	10	500	618.4	35.2	1.76	1.24
	20	1,000	618.4	70.4	0.88	0.62
	30	1,500	618.4	105.7	0.59	0.41
500,000	10	1,250	921.1	88.1	1.05	0.74
	20	2,500	921.1	176.1	0.52	0.37
	30	3,750	921.1	264.2	0.35	0.25

Note: Annual production is based on 250 days per year of plant operation.

* Treatment cost is total for Option 3 (i.e., not the increment between Option 3 and Option 2).

** Based on an average unit price of $70.44 per TV Tube (1982 $).

For the color TV tube industry segment the ratio of cost to sales value is less than 2.2 percent. However, this value is associated with the 100,000 gpd plant and, as mentioned above, no existing plant has a flow less than 200,000 gpd. Thus, for new plants of the same sizes as existing ones (i.e. 200,000 gpd or greater), the cost to sales ratio would be 1.76 percent or less. The value of production per tube includes plant profits and, therefore, the ratio of treatment cost to production cost would be somewhat higher than this. Even so, both annual and capital investment cost increases are modest and, therefore, it appears that there are no significant barriers for new direct discharger sources to enter the color TV tube industry.

VI.2 New Other CRT Plants

VI.2.1 Case A. Existing plants producing other CRTs range widely in size; many are smaller than the typical TV tube plant. Thus, for this industry segment all five model plant sizes will be considered. For indirect dischargers, the incremental cost is between Option 3 and Option 2. Incremental treatment capital costs range from $5,830 to $228,500 and incremental annual costs from $16,100 to $108,500 based on model plant costs presented in Table 4-4.

The annual production of other CRT tubes for the five model plants is shown in Table 5-13 for the low, average and high values of 10, 20, and 30 tubes per thousand gallons per day. Annual treatment costs range from $0.02 to $0.10 per CRT. Annual treatment costs to plant sales are less than 0.1 percent. As discussed above for TV tube plants, a new CRT plant is likely to be more efficient and therefore have lower costs per CRT than can be met in existing plants.

Table 5-13. Case A

Impact of Treatment Cost on Other CRT Plants

Indirect Dischargers

Plant Size (gpd)	CRTs Produced per 1000 gpd	Annual Plant Production of CRTs (000)	Annual Treatment Cost * ($000)	1986 Annual Plant Sales** (Mill. 1982$)	Annual Treatment Cost to Sales %	Annual Treatment Cost per Tube $
10,000	10	25	2.4	5.55	.043	.10
	20	50	2.4	11.1	.022	.05
	30	75	2.4	16.7	.014	.03
50,000	10	125	6.6	27.8	.024	.05
	20	250	6.6	55.5	.012	.03
	30	375	6.6	83.3	.008	.02
100,000	10	250	24.5	55.5	.044	.10
	20	500	24.5	111.0	.022	.05
	30	750	24.5	166.5	.015	.03
200,000	10	500	47.3	111.0	.043	.09
	20	1,000	47.3	222.0	.021	.05
	30	1,500	47.3	333.0	.014	.03
500,000	10	1,250	94.8	277.5	.034	.08
	20	2,500	94.8	555.0	.017	.04
	30	3,750	94.8	832.5	.011	.03

Note: Annual production is based on 250 days per year of plant operation.

* Treatment cost is the increment from Option 2 to Option 3 and is calculated as the difference between the annual treatment costs for these Options shown in Table 4-4.

** Based on an average unit price of $222 per CRT (1982 $).

Assuming that even a small plant will require capital expenditures of at least one million dollars, the incremental capital investment costs for Option 3 are modest. Thus, as cost increases are small, in our judgment there are no significant barriers to new indirect discharger sources entering the CRT industry that are attributable to treatment costs.

VI.2.2 Case B. The total cost for CRT plants to achieve new source standards equivalent to Option 3 for direct dischargers range from $129.43 thousand to $1,807.0 thousand for capital investment and the annual costs range from $71.75 to $921.1 thousand as presented in Table 4-4. Table 5-14 shows the impacts of treatment costs which for other CRTs range from $2.87 for a small plant (10,000 gpd) with a low output (i.e., 10 CRTs produced per 1,000 gpd) to $0.25 for a large plant (500,000 gpd) with high output (i.e., 30 CRTs produced per 1,000 gpd).

Using existing plants as a guide, the small plants are likely to be associated exclusively with CRTs other than TV picture tubes and the average unit value of these tubes in 1986 is forecast as $222.00 (1982$). The $2.87 cost per tube is about 1.3 percent of the average unit value which is the maximum impact on the other CRT industry segment. Using an average output (20 CRTs per 1,000 gpd) the small plants would experience an impact of $1.44 per tube which is 0.65 percent of the unit value. If a new facility has an average tube value below $222, the impacts will be proportionately higher, but are not expected to be significant.

For the other CRT industry segment the ratio of cost to sales value is less than two percent. The value of production per tube includes plant profits and therefore, the ratio of treatment cost to production cost would be higher than two percent.

Table 5-14. Case B

Impact of Treatment Cost on Other CRT Plants

Direct Dischargers

Plant Size (gpd)	CRTs Produced per 1000 gpd	Annual Plant Production of CRTs (000)	Annual Treatment Cost * ($000)	1986 Annual Plant Sales** (Mill. 1982$)	Annual Treatment Cost to Sales %	Annual Treatment Cost per Tube $
10,000	10	25	71.75	5.55	1.29	2.87
	20	50	71.75	11.1	0.65	1.44
	30	75	71.75	16.7	0.43	0.96
50,000	10	125	168.7	27.8	0.61	1.35
	20	250	168.7	55.5	0.30	0.67
	30	375	168.7	83.3	0.20	0.45
100,000	10	250	375.9	55.5	0.68	1.50
	20	500	375.9	111.0	0.34	0.75
	30	750	375.9	166.5	0.23	0.50
200,000	10	500	618.4	111.0	0.56	1.24
	20	1,000	618.4	222.0	0.28	0.62
	30	1,500	618.4	333.0	0.19	0.41
500,000	10	1,250	921.1	277.5	0.33	0.74
	20	2,500	921.1	555.0	0.17	0.37
	30	3,750	921.1	832.5	0.11	0.25

Note: Annual production is based on 250 days per year of plant operation.

* Treatment cost is total for Option 3 (i.e., not the increment between Option 3 and Option 2).

** Based on an average unit price of $222 per CRT (1982 $).

More efficient production processes are likely to be introduced in new plants, as mentioned earlier, which would minimize treatment cost impacts. In addition, the high product value ($222.00) associated with other CRTs means that even the highest treatment cost per tube in Table 5-14 ($2.87) is only 1.3 percent of the average unit value. These factors indicate that, except for very small plants, treatment costs would not be barriers to entry for new direct discharger CRT plants. These very small plants can rely on contract hauling rather than capital investment in treatment technology and therefore new source standards are unlikely to be entry barriers for them, as well.

VI.3 New Luminescent Coatings Plants

As discussed in the Methodology, Section 3, the additional treatment costs for new luminescent coatings plants, both direct and indirect dischargers, are the total treatment costs of Option 2. The costs are shown in Section 4, Table 4-4 for the three plant sizes (10,000, 100,000 and 250,000 gpd); incremental capital investment costs range from $100,500 to $1,180,100, and incremental annual costs from $58,990 to $583,850.

Total annual treatment cost as a percent of plant sales is displayed in Table 5-15. For the small model plants (10,000 gpd) the total annual treatment cost is as high as 7.8 percent of plant sales and ranges down to 1.4 percent depending on the value selected for the sales-flow relationship. Information concerning one existing small plant (U.S. Radium in Morristown, NJ) suggests that a new small plant in the 10,000 gpd range would experience an impact of treatment cost to sales of 1.0 to 1.5 percent. (This existing plant with sales of $4.2 million according to the EIS data file, and 10,000 gpd wastewater flow, establishes the high end of the sales to flow

Table 5-15.

Impact of Treatment Cost on New Luminescent Coatings Plants

Plant Size (gpd)	Sales per 1000 gal of flow ($)	1986 Annual Plant Sales (1982 $000)	Annual Treatment Cost ($000)	Annual Treatment Cost to Sales (%)
10,000	304	759	58.99	7.8
	993	2,482	58.99	2.4
	1,682	4,204	58.99	1.4
100,000	304	7,592	318.75	4.2
	993	24,820	318.75	1.3
	1,682	42,048	318.75	0.8
500,000	304	18.980	583.85	3.1
	993	62,050	583.85	0.9
	1,682	105,120	583.85	0.6

Note: Annual sales are based on 250 days per year of plant operation.

relationship of $1,682 sales per 1,000 gallons.) This magnitude of treatment cost impact is small enough so that manufacturing improvements incorporated in a new plant design might well remove the apparent cost disadvantage calculated above (however, the degree to which the existing U.S. Radium plant utilizes up-to-date process technology and plant design is not known).

This simplified analysis does not consider the relationship of coatings plants to downstream users of the product. At least four of the existing five plants are owned by large firms (RCA, GE, Westinghouse, GTE) that utilize the coatings in their CRT and lamp production; the amount of the new coatings production used captively is unknown. It seems reasonable that if new plants were built by one of these firms, or another large corporation, the plants would be large (e.g., 100,000 gpd) and vertically integrated with other plants owned by the firm. Thus treatment costs would be in the range of 0.8 to 4.2 percent of the value of coatings output.

The conclusion is that large integrated firms seeking new sources of luminescent coatings will not face a cost burden from treatment requirements sufficient to dissuade them from building new plants. For new, small coatings plants that are not vertically integrated with CRT or lamp manufacturing, treatment costs may possibly pose a barrier to entering the industry. However, even though the difference in costs to meet the regulatory requirements between existing and new plants appears great, it should be noted that most existing plants already have invested in some type of treatment which is in place and are currently incurring annual costs. Thus, the incremental differential between existing and new plants is not as large as it might first appear.

VII. Small Business Analysis

Under the Regulatory Flexibility Act of 1980, the EPA and other regulatory agencies are required to consider the effects of proposed regulations on small companies. This section reviews the potential small business impacts of the promulgated regulations for the color TV picture tubes, other CRTs and luminescent coatings industries.

The Act relies on the Small Business Administration (SBA) for guidance in defining a small firm. The Small Business Act, section three, defines a small business as:

> "...a small business concern shall be deemed to be one which is independently owned and operated and which is not dominant in its field or operation. In addition to the foregoing criteria, the Administration (of the SBA), in making a detailed definition may use these criteria, among others: Number of employees and dollar volume of business."

In addition, the SBA published specific employee based guidelines for various business activities including manufacturing. Companies classified in

SICs 2831 and 2833 with not more than 250 employees are considered small; this is the criterion used in this analysis. It should be noted that even 250 employees may be large, given that the Regulatory Flexibility Act is concerned with firms with limited resources and is aimed at avoiding regulatory barriers to entry into an industry.

This analysis is conducted to determine whether small firms bear disproportionate impacts under the promulgated effluent guidelines. The firms in the study are described in terms of their sales and employment. The distribution of treatment costs incurred by plants belonging to the firms is analyzed.

Six firms out of nineteen (one-third of the total) may be candidates for the small business category based on employment of 250 or less as shown in Table 5-16. (This determination cannot be made with certainty because firm-level sales and employment figures are lacking for five of the smallest companies.)

Table 5-17 compares annual treatment costs born by large and small firms which have been grouped using the 250 employee criterion. As shown in this table the thirteen firms designated as large incur 95.2 percent of the Option 2 annual treatment costs of $3,543,340. For Option 3, these thirteen large firms incur 95.5 percent of the $3,922,700 annual treatment costs. All of these firms have more than 250 employees.

Of the large firms, Clinton Electronics and Thomas Electronics are the smallest (ranked twelfth and fourteenth based on sales in Table 5-16). Clinton Electronics incurs costs of $162.1 thousand for Option 2 and $168.7 thousand for Option 3. These costs represent 4.57 and 4.30 percent of the total industry costs for these options. Thomas Electronics is too large to

Table 5-16.

Firm Ranking by 1982 Sales

1982 Sales Rank	Firm	Millions $	1981 Employment***	Annual Treatment Cost** ($000) Option 2	Option 3
1	General Electric	27,240.0	404,000	13.7 (2)	47.3 (1)
2	Westinghouse	9,367.5	147,841	231.04 (2)	168.7 (1)
3	RCA	8,004.8	119,000	840.0 (3)	995.1 (2)
4	Raytheon	5,636.2	79,500	351.4 (1)	375.9 (1)
5	Litton	4,942.8	76,500	69.35 (1)	71.75 (1)
6	Sony	3,864.1	38,550	0 (1)	56.0 (1)
7	Hewlett Packard	3,578.0	64,000	0 (1)	2.4 (1)
8	N.A. Philips	3,030.0	49,400	717.35 (4)	783.65 (3)
9	Zenith	1,275.2	28,000	780.0 (1)	861.0 (1)
10	Tektronix	1,061.8	24,028	0 (1)	0 (0)
11	Datagraphix	73.7	1,000	1.65 (1)	1.65 (1)
12	Clinton Electronics	41.2	500 ++	162.1 (1)	168.7 (1)
13	+*Dumont Electronics	13.5	230	162.1 (1)	168.7 (1)
14	Thomas Electronics	13.3	400	208.05 (3)	215.25 (3)
15	+U.S. Radium	12.0	190	0 (1)	0 (0)
16	+*Video Display Corp.	2.1	36	1.65 (1)	1.65 (1)
17	+*B-Scan Inc.	1.5	25	1.65 (1)	1.65 (1)
18	+Special Purpose Tech.	NA	NA	1.65 (1)	1.65 (1)
19	+Tex-Video Man.	NA	NA	1.65 (1)	1.65 (1)
				3,543.34 (28)	3,922.70 (22)

* Plant Sales and Employment are used as if they are firm-level data.

** Number of plants included in the study are shown in parentheses. Fewer plants are counted under Option 3 than Option 2 because Option 3 does not apply to lumninescent coatings plants.

*** Employment data are from EIS.

\+ These firms have been selected as small businesses for the purposes of this analysis.

++ Information provided by Clinton Electronics. 1982 employment level.

qualify as a small business but is of concern because it is impacted by treatment costs to a greater degree than other firms in this study. The three Thomas Electronics plants incur 5.87 and 5.49 percent of the total industry annual treatment costs under Options 2 and 3, respectively.

Table 5-17.
Comparison of Small and Large Firms

	Total Annual Treatment Costs			
	Option 2		Option 3	
	$000	Percent	$000	Percent
13 largest firms	3,374.64	95.2	3,747.4	95.5
6 small firms	168.7	4.8	175.3	4.5

As shown in Table 5-17 the six firms designated as small businesses incur 4.8 percent ($168,700) of the Option 2 annual treatment costs and 4.5 percent ($175,300) of the Option 3 annual treatment costs. Dumont Electronics is the largest firm in this category (ranked thirteenth according to sales) and incurs most of the small business annual treatment costs. Its costs are $162.1 thousand for Option 2 and $168.7 thousand for Option 3, representing 4.57 and 4.30 percent, respectively, of the total industry costs for each option.

U.S. Radium (ranked fifteenth in sales) is a small publicly held firm with sales of $12 million and employment of 190 in 1981. As Table 5-16 shows, U.S. Radium does not incur treatment costs. All other small firms incur annual treatment costs of $1,650 each for Options 2 and 3.

As this comparison of large and small businesses shows, small firms do not bear a disproportionate level of the total annual treatment costs for the industry and, therefore, the selected options for promulgation are not expected to have a significant impact on small facilities in this industry.

Section 5

Selected References

1. Electronic Industries Assoc. (EIA), 1982 Edition Electronic Market Data Book, Washington, D.C. 1982.

2. U.S. Bureau of the Census, Current Industrial Reports, M36D (1982)-6 and M36D (1983)-1.

3. Data Resources, Inc., U.S. Long-Term Review, Winter 1982-1983, 1983.

4. U.S. Department of Commerce, 1982 U.S. Industrial Outlook for 200 Industries with Projections for 1986, January 1982 and January 1983.

5. Electronics, January 13, 1982, (p.126 as reported in Predicasts, Forecast Abstracts, p. B-242) and January 13, 1983.

6. U.S. Department of Commerce, Current Industrial Reports, Selected Electronic and Associated Products, Including Telephone and Telegraph Apparatus, MA-36N(80)-1, October 1981.

Section 6
Limits of the Analyses

The results of the impact analysis depend on several major assumptions underlying the methodology and on the accuracy of data used to carry out the impact calculations.

I. Plants With Multiple Product Lines

There is a lack of information on product lines for individual plants, particularly the sales value of product lines affected by additional wastewater treatment. This data deficiency has resulted in the allocation of treatment cost to total plant sales and therefore may underestimate impacts on the specific product lines of color TV tubes, other CRTs, and luminescent coatings which are the subjects of this study. For example, the Tektronix Company makes various kinds of scientific instruments and many of these incorporate cathode ray tubes which the firm produces for captive consumption. If additional wastewater treatment is needed just for the CRT production line, the impact of treatment costs estimated are low because the costs are measured against total plant sales of the Beaverton, Oregon plant as reported in the EIS data file. This problem of potential underestimation of impacts seems particularly important for the CRT plants with relatively large sales (such as Tektronix, Raytheon, and Hewlett Packard) because we suspect that the CRT is only one of the product lines. However, these plants are also generally those with the strongest financial positions, and are certainly those with greatest cash flow. Also, three color TV picture tube plants and two luminescent coatings plants may each have several major

product lines; this judgement is based on the wastewater flow associated with the products addressed in this study compared to the flow reported for the entire plant. During the public comment period firms did not clarify the matter or submit additional data on product lines for individual plants.

II. Impact Measure Derivation

To develop plant level impact measures in addition to the treatment cost/sales ratio, we have estimated manufacturing conversion costs, unadjusted profit and annual plant investment. The derivations rest on aggregate rather than plant-specific information and use data that are not up-to-date. The aggregate data are at the 4-digit SIC level. Therefore, the method implicitly assumes each plant operates with the same average ratio of sales (a) to conversion costs, (b) to profit, and (c) to annual investment as the 4-digit SIC group. In addition, the data used are from the 1977 Census of Manufacturers. However, averages calculated for several later years showed no significant differences when compared with the 1977 factors.

III. Discount Factors

The capital recovery factor used to annualize the investment portion of the treatment cost is based on a 13 percent discount rate and a five-year equipment life. The appropriateness of any particular discount rate is debatable. Therefore, we have examined the sensitivity of plant-level impacts to two alternative rates; 10 percent and 16 percent. Annual costs using these rates were calculated for tube manufacturers under Option 3. (There are six existing color TV picture tube plants and 15 other CRT plants that incur capital investment expenditures under this option.)

For color TV picture tubes the 10 percent discount rate reduces the annual treatment cost by five percent or less, and the 16 percent rate increases the annual costs by five percent or less. The highest impact ratio of treatment cost to sales was computed to be 1.59 percent. With the alternative discount rates this value becomes 1.53 percent (for the 10 percent rate) and 1.66 percent (for the 16 percent rate). Or, in absolute terms the treatment cost to sales ratio is only altered by, at most, 0.07 percentage points.

For other CRT plants, the 10 percent rate reduces annual treatment costs by four percent or less, and at the 16 percent rate, the annual costs increase by five percent or less. The highest ratio of treatment cost to sales using a 13 percent discount rate was computed to be 3.23 percent. With the alternative discount rates, the ratio becomes 3.14 percent and 3.39 percent for 10 and 16 percent, respectively. In absolute terms the ratio changes by no more than 0.16 percentage points.

The changes in the treatment cost to sales ratio for the alternative discount rates are small. None of the conclusions would change if the alternative discount rates had been used in annualizing the investment portion of treatment cost.

IV. Small Companies

Small firms are likely to be privately owned and not required to provide 10-K information. Therefore, financial ratios cannot be examined to help determine whether or not the financial condition of small firms makes them more vulnerable to adverse impacts of treatment costs.

V. Import Policies

If the production level of U.S. cathode ray tubes declines, the existing plants may be more adversely affected than anticipated because treatment costs will be spread over a smaller production base. If U.S. production grows over the next few years as anticipated, estimated impacts should be less severe. There are, however, uncertainties. The anti-dumping regulations imposed by the U.S. on Japanese-made TV receivers may or may not continue. Also, other protectionist policies could be adopted that apply to the foreign-made TV picture tubes that are imported and used in TV sets manufactured in the U.S.

Appendix A

Sensitivity Analysis

A.1 Sensitivity to Sales Estimates

In this section, the impact measures for the individual plants have been recalculated to test the strength of the conclusions drawn from the ratios discussed in Section 5. This sensitivity analysis allows us to check the results of the impact analysis by making allowances for error in our sales projections. We will determine if a 10 percent change in our sales estimates alters the impact measures enough to change our conclusions. Each of the three tables (5-6, 5-7 and 5-8) have been recalculated twice. The first set assumes a 10 percent increase in plant sales. The second set assumes a 10 percent decrease in plant sales.

A.1.1 TV Picture Tube Plants

The adjusted ratios for color television tube plants are shown in Tables A-1 and A-2. As these tables illustrate, none of these plants are significantly affected by the changes in sales estimates. The ratios are essentially of the same magnitude and no different conclusions could be made about any one of the plants.

A.1.2 Other CRT Plants

The impact measures for the other CRT plants are shown in Tables A-3 and A-4. As these tables reveal, the ratios for several plants change enough so that the impacts for those plants must be reconsidered.

The very worst case occurs under Option 3 with the assumption of a 10 percent decrease in plant sales. This case is shown in Table A-4B. Two

Table A-1A.

Color TV, Option 2, Assuming a 10 Percent Increase in Sales

Plant	Treatment Cost: Investment	Treatment Cost: Annual	Annual Sales (Mill. $)	Impact Measures (Percent)*: ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, PA	0	0	126.3	0	0	0	0	0
Zenith, IL	1.5	.78	176.1	.443	.742	1.27	4.39	26.1
GE, NY	0	0	84.7	0	0	0	0	0
RCA, IN	1.578	.8263	291.1	.284	.476	.815	1.35	16.5
ECG Philips, OH	1.3488	.702	53.9	1.30	2.19	3.74	.594	76.5
ECG Philips, NY	0	0	40.4	0	0	0	0	0
Sony, CA	0	0	144.9	0	0	0	0	0
Total	4.4268	2.3083	917.3					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-1B.

Color TV, Option 2, Assuming a 10 Percent Decrease in Sales

Plant	Treatment Cost: Investment	Treatment Cost: Annual	Annual Sales (Mill. $)	Impact Measures (Percent)*: ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, PA	0	0	103.3	0	0	0	0	0
Zenith, IL	1.5	.78	144.1	.54	.907	1.56	5.37	31.9
GE, NY	0	0	69.3	0	0	0	0	0
RCA, IN	1.578	.8263	238.1	.347	.581	.995	1.64	20.27
ECG Philips, OH	1.3488	.702	44.1	1.58	2.68	4.57	.725	93.6
ECG Philips, NY	0	0	33.0	0	0	0	0	0
Sony, CA	0	0	118.5	0	0	0	0	0
Total	4.4268	2.3083	652.4					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-2A.

Color TV, Option 3, Assuming a 10 Percent Increase in Sales

Plant	Treatment Cost: Investment	Treatment Cost: Annual	Annual Sales (Mill. $)	Impact Measures (Percent)*: ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
RCA, PA	.182	.074	126.3	.059	.099	.169	.121	4.4
Zenith, IL	1.698	.861	176.1	.489	.819	1.4	4.85	29.5
GE, NY	.1143	.0473	84.7	.057	.093	.16	.003	7.52
RCA, IN	1.8065	.9211	291.1	.319	.53	.91	1.42	18.9
ECG Philips, OH	1.542	.782	53.9	1.45	2.43	4.17	.842	87.5
ECG Philips, NY	0	0	40.4	0	0	0	0	0
Sony, CA	.14	.056	144.9	.039	.065	.111	.172	2.96
Total	5.4828	2.7414	917.3					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-2B.

Color TV, Option 3, Assuming a 10 Percent Decrease in Sales

Plant	Treatment Cost: Investment	Treatment Cost: Annual	Annual Sales (Mill. $)	Impact Measures (Percent)*: ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
RCA, PA	.182	.074	103.3	.072	.12	.206	.148	5.39
Zenith, IL	1.698	.861	144.1	.598	1.0	1.72	5.92	36.0
GE, NY	.1143	.0473	69.3	.068	.113	.197	.003	9.2
RCA, IN	1.8065	.9211	238.1	.387	.648	1.11	1.73	23.2
ECG Philips, OH	1.542	.782	44.1	1.77	2.98	5.1	1.03	107.0
ECG Philips, NY	0	0	33.0	0	0	0	0	0
Sony, CA	.14	.056	118.5	.048	.08	.137	.21	3.62
Total	5.4828	2.7414	652.4					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-3A.

Other CRT Plants, Option 2, Assuming a 10 Percent Increase in Sales

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
Raytheon, MA	.7013	.3514	136.5	.257	.398	.563	.075	14.3
Clinton Elec., IL	.2896	.1621	59.2	.274	.424	.598	NA	13.5
Thomas Elec., NY	.1236	.06935	3.4	2.01	3.11	4.39	NA	99.4
Thomas Elec., NJ 1/	.1236	.06935	13.2	.525	.815	1.15	NA	25.9
Thomas Elect., CA 1/	.1236	.06935	2.4	2.84	4.39	6.20	NA	140.2
Hewlett Packard, CO	0	0	134.3	0	0	0	0	0
General Atronics, PA 2/	0	.00165	6.5	.025	.04	.055	NA	0
Litton Ind., AZ	.1236	.06935	4.3	1.62	2.5	3.53	.02	79.8
Dumont Elect., NJ	.2896	.1621	19.4	.835	1.29	1.83	NA	41.4
B-Scan Inc., PA	0	.00165	2.2	.076	.118	.167	NA	0
Video Display Corp., GA	0	.00165	3.0	.055	.085	.120	NA	0
Westinghouse, NY	.2896	.1621	103.4	.156	.242	.343	.025	7.8
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	783.6	0	0	0	0	0
Tex-Video Man., TX	0	.00165	NA	NA	NA	NA	NA	NA
Datagraphix, CA	0	.00165	105.8	.002	.002	.004	NA	0
Total	2.0645	1.125	1377.2					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment costs assumed to be the same as for Thomas Electronics in Clyde, NY.

2/ Owned by N.A. Philips.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-3B.

Other CRT Plants, Option 2, Assuming a 10 Percent Decrease in Sales

Plant	Treatment Cost: Investment	Treatment Cost: Annual	Annual Sales (Mill. $)	Impact Measures (Percent)*: ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
Raytheon, MA	.7013	.3514	111.7	.314	.487	.688	.092	17.4
Clinton Elec., IL	.2896	.1621	48.4	.334	.518	.731	NA	16.6
Thomas Elec., NY	.1236	.06935	2.8	2.46	3.8	5.37	NA	121.4
Thomas Elec., NJ 1/	.1236	.06935	10.8	.641	.996	1.40	NA	31.7
Thomas Elect., CA 1/	.1236	.06935	2.0	3.47	5.37	7.58	NA	171.3
Hewlett Packard, CO	0	0	109.9	0	0	0	0	0
General Atronics, PA 2/	0	.00165	5.3	.031	.049	.068	NA	0
Litton Ind., AZ	.1236	.06935	3.5	1.98	3.06	4.31	.024	97.6
Dumont Elect., NJ	.2896	.1621	15.8	1.02	1.58	2.23	NA	50.6
B-Scan Inc., PA	0	.00165	1.8	.093	.144	.204	NA	0
Video Display Corp., GA	0	.00165	2.4	.067	.103	.147	NA	0
Westinghouse, NY	.2896	.1621	84.6	.191	.296	.419	.03	9.5
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	641.2	0	0	0	0	0
Tex-Video Man., TX	0	.00165	NA	NA	NA	NA	NA	NA
Datagraphix, CA	0	.00165	86.6	.002	.003	.004	NA	0
Total	2.0645	1.125	1126.8					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment costs assumed to be the same as for Thomas Electronics in Clyde, NY.

2/ Owned by N.A. Philips.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-4A.

Other CRT Plants, Option 3, Assuming a 10 Percent Increase in Sales

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
Raytheon, MA	.7604	.3759	136.5	.275	.426	.602	.081	15.5
Clinton Elec., IL	.3054	.1687	59.2	.285	.441	.623	NA	14.3
Thomas Elec., NY	.12943	.07175	3.4	2.08	3.22	4.55	NA	104.0
Thomas Elec., NJ 1/	.12943	.07175	13.2	.543	.843	1.18	NA	27.1
Thomas Elect., CA 1/	.12943	.07175	2.4	2.94	4.54	6.42	NA	146.8
Hewlett Packard, CO	.00583	.0024	134.3	.002	.004	.005	.001	.12
General Atronics, PA 2/	0	.00165	6.5	.025	.04	.055	NA	0
Litton Ind., AZ	.3054	.07171	4.3	1.67	2.58	3.65	.021	83.5
Dumont Elect., NJ	.3054	.1687	19.4	.87	1.35	1.9	NA	43.6
B-Scan Inc., PA	0	.00165	2.2	.075	.118	.167	NA	0
Video Display Corp., GA	0	.00165	3.0	.055	.085	.12	NA	0
Westinghouse, NY	.3054	.1687	103.4	.163	.252	.356	.026	8.2
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	783.6	0	0	0	0	0
Tex-Video Man., TX	0	.00165	NA	NA	NA	NA	NA	NA
Datagraphix, CA	0	.00165	105.8	.002	.002	.003	NA	0
Total	2.20015	1.1813	1377.2					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment costs assumed to be the same as for Thomas Electronics in Clyde, NY.

2/ Owned by N.A. Philips.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-4B.

Other CRT Plants, Option 3, Assuming a 10 Percent Decrease in Sales

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
Raytheon, MA	.7604	.3759	111.7	.337	.521	.736	.099	18.9
Clinton Elec., IL	.3054	.1687	48.4	.348	.539	.761	NA	17.4
Thomas Elec., NY	.12943	.07175	2.8	2.54	3.93	5.56	NA	127.1
Thomas Elec., NJ 1/	.12943	.07175	10.8	.663	1.03	1.44	NA	33.1
Thomas Elect., CA 1/	.12943	.07175	2.0	3.59	5.54	7.84	NA	179.4
Hewlett Packard, CO	.00583	.0024	109.9	.002	.003	.005	.001	.14
General Atronics, PA 2/	0	.00165	5.3	.031	.049	.068	NA	0
Litton Ind., AZ	.12943	.07175	3.5	2.04	3.16	4.47	.026	102.1
Dumont Elect., NJ	.3054	.1687	15.8	1.06	1.64	2.32	NA	53.3
B-Scan Inc., PA	0	.00165	1.8	.092	.144	.204	NA	0
Video Display Corp., GA	0	.00165	2.4	.067	.103	.147	NA	0
Westinghouse, NY	.3054	.1687	84.6	.199	.308	.436	.032	10.0
Special Purpose Technologies, CA	0	.00165	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	0	641.2	0	0	0	0	0
Tex-Video Man., TX	0	.00165	NA	NA	NA	NA	NA	NA
Dataqraphix, CA	0	.00165	86.6	.002	.003	.004	NA	0
Total	2.20015	1.1813	1126.8					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment costs assumed to be the same as for Thomas Electronics in Clyde, NY.

2/ Owned by N.A. Philips.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

plants have significantly different ratios. They are Litton and Dumont. For the Litton plant, the annual treatment cost to sales ratio is over 2 percent and the measure of investment treatment cost to total plant investment is over 100 percent. However, the ATC/NI ratio is still much less than one percent. Thus while it appears that the firm can easily absorb the treatment costs, the plant would potentially suffer a severe impact.

The Dumont plant in this case has an annual treatment cost to sales ratio of just over one percent and a TCC/CAP ratio of over 50 percent. Since this plant is privately owned, no information about company net income is available. Thus, the impact on this small plant could be severe.

The "best" case occurs with Option 2 and a 10 percent increase in plant sales. For this case, one plant's status might change. This is the Thomas Electronics plant in New York. Its annual treatment cost to sales ratio is about 2 percent and the TCC/CAP ratio is under 100 percent. While these ratios appear high, the impact would be lessened if production from the California plant were moved to the New York location. Also, the New Jersey plant has relatively small ratios, easing the burden of the treatment costs to the firm as a whole.

A.1.3 Luminescent Coatings

The sensitivity analysis of the impact measures for the luminescent coatings plants is shown in Tables A-5A and A-5B. It is obvious that no plants are significantly affected by either a 10% increase or decrease in sales. All but one of the ratios are less than one percent.

Table A-5A.

Impact Estimates: Luminescent Coatings Assuming a 10 Percent Increase in Sales
Option 2

Plant	Treatment Cost (Mill. 1982 $) Investment	Treatment Cost (Mill. 1982 $) Annual	1984 Annual Sales (Mill. 1982 $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, Lancaster, PA	.0025	.0137	129.0	.010	.015	.033	.021	.032
GTE, Towanda, PA	.0025	.0137	238.6	.005	.008	.018	.014	.017
GE, Cleveland, OH	.0025	.0137	14.4	.086	.136	.302	.001	.289
U.S. Radium, Morristown, NJ	0	0	4.0	0	0	0	0	0
Westinghouse, Bloomfield, NJ	.1156	.06894	115.2	.054	.085	.140	.013	1.67
Total, Option 2	.1231	.11004	501.2					

Notes: Annual Sales are from EIS data file; except one plant where sales are derived from employment; 1982 $, adjusted to 1984.

*All the impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table A-5B.

Impact Estimates: Luminescent Coatings Assuming a 10 Percent Decrease in Sales
Option 2

Plant	Treatment Cost (Mill. 1982 $) Invest-ment	Treatment Cost (Mill. 1982 $) Annual	1984 Annual Sales (Mill. 1982 $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, Lancaster, PA	.0025	.0137	129.0	.012	.019	.041	.026	.039
GTE, Towanda, PA	.0025	.0137	238.6	.006	.01	.022	.017	.021
GE, Cleveland, OH	.0025	.0137	14.4	.106	.168	.373	.001	.357
U.S. Radium, Morristown, NJ	0	0	4.0	0	0	0	0	0
Westinghouse, Bloomfield, NJ	.1156	.06894	115.2	.067	.104	.173	.016	2.05
Total, Option 2	.1231	.11004	501.2					

Notes: Annual Sales are from EIS data file; except one plant where sales are derived from employment; 1982 $, adjusted to 1984.

* All the impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant Sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

A.2 Sensitivity to Costs

Throughout the analysis, a general inflation rate of from five to six percent is assumed. However, the costs of the raw materials for CRTs might be increasing at a rate greater than inflation. This possible increase in costs would be reflected in a decrease in profit. For this case, the ratios of annual treatment cost to unadjusted profit and annual treatment cost to net income have been recalculated assuming a 10 percent decrease in profit (caused by the increase in input costs). These measures are shown in Table A-6 for color TV tube plants and in Table A-7 for the other CRT plants.

Table A-6. Impact Measures - Assuming an Increase in Costs Resulting in a 10 Percent Decrease in Profit: Color TV Tubes

Plant	1984 Annual Sales (1982$)	Impact Measures (Percent) Option 2 ATC UP	Option 2 ATC NI	Option 3 ATC UP	Option 3 ATC NI
RCA, PA	114.8	0	0	.206	.148
Zenith, IL	160.1	1.56	5.37	1.72	5.92
GE, NY	77.0	0	0	.197	.003
RCA, IN	264.6	.997	1.64	1.11	1.73
Philips, OH	49.0	4.57	.726	5.1	1.03
Philips, NY	36.7	0	0	0	0
Sony, CA	131.7	0	0	.137	.21

Table A-7.

Impact Measures - Assuming an Increase in Costs Resulting in a 10 Percent Decrease in Profit: Other CRTs

Plant	1984 Annual Sales (1982$)	Impact Measures (Percent) Option 2 ATC UP	Option 2 ATC NI	Option 3 ATC UP	Option 3 ATC NI
Raytheon, MA	124.1	.688	.092	.736	.098
Clinton Elec.	53.8	.731	NA	.761	NA
Thomas Elec., NY	3.1	5.37	NA	5.56	NA
Thomas Elec., NJ	12.0	1.4	NA	1.44	NA
Thomas Elec., CA	2.2	7.58	NA	7.84	NA
Hewlett Packard	122.1	0	0	.005	.001
Genera Atronics	5.9	.068	NA	.068	NA
Litton Ind.	3.9	4.31	.024	4.47	.026
Dumont Elec.	17.6	2.23	NA	2.32	NA
B-Scan, Inc.	2.0	.204	NA	.204	NA
Video Display Corp.	2.7	.147	NA	.147	NA
Westinghouse	94.0	.419	.0303	.436	.032
Special Purpose Tech.	NA	NA	NA	NA	NA
Tektronix	712.4	0	0	0	0
Tex-Video Man.	NA	NA	NA	NA	NA
Datagraphix	96.2	.004	NA	.004	NA

NA = Data not available.

As these tables illustrate, a substantial increase in costs does not severely affect the impact measures, nor does it change any conclusions based on these measures. The four most affected plants are the Zenith, IL and Philip, OH color TV tube facilities and the two Thomas Electronics CRT plants. The impacts on all of these plants have been considered earlier in Section 5 II.3.1 and II.3.2.

A.3 Solvency Analysis Sensitivity

The conclusions drawn from the solvency analysis in Section 5 are unaffected by either of the sensitivity analyses discussed above, concerning decreases in sales estimates or increases in input costs. The resulting changes are small and have only a slight impact on the comparison of cash flow to salvage value for the plants included in the solvency analysis.

Appendix B

Total Toxic Organics(TTO) Compliance Costs

EPA has determined that the incremental costs associated with improved solvent management techniques tend to be offset by resale of the solvents. Consequently, EPA did not cost out those small costs for the purposes of the impact analysis. Some facilities have contended that they may have to haul away their solvents under the requirements of the Resource Conservation and Recovery Act (RCRA). Therefore, this analysis addresses these "worst case" costs for RCRA hauling for all plants not currently meeting the TTO limitation being promulgated because EPA cannot determine which plants, if any, will fall under these requirements. These costs are not considered to be ordinary or average costs of compliance for facilities in this industry.

EPA is examining the incremental cost to comply with the TTO limitation, not the total cost of a solvent management program. Information on existing plants shows that all plants currently have a solvent management program in-place, and that compliance would involve improving the current program.

The impact measures have been recalculated with treatment costs that include TTO compliance costs. The TTO compliance costs for the CRT subcategory have been estimated by EPA to be $1,200 per year for each plant not currently meeting the regulations. Because there is no data available on the actual compliance of most of the plants in the CRT subcategory with the TTO limitation, the TTO compliance costs are estimated based on a hypothetical plant which has an average discharge flow (135,500 gpd) and which exceeds the TTO limit by 1 mg/l (i.e. an effluent flow of 2.54 mg/l). The worst case compliance costs for this hypothetical facility would occur if

the incremental solvent waste were sent to a hazardous waste disposal site under the requirements of RCRA. The amount of waste for disposal would be:

$$(1 \text{ mg/l})\ (135{,}500 \text{ gpd})\ (3.78 \text{ l/gal})\ (1 \times 10^{-6} \text{ kg/mg}) = 0.51 \text{ kg/day}$$

This is approximately equivalent to 0.15 gallons per day or 13.5 gallons every 90 days. The cost for the disposal of one 55 gallon drum of hazardous waste every 90 days is about $300 (including transportation). Thus the annual TTO compliance cost for this hypothetical plant would be $1200. Since only 13.5 gallons of the drum's 55 gallon capacity is utilized in this example, the same compliance costs would be applicable for a plant with a flow four times that of the hypothetical plant or over 540,000 gpd, which is larger than any plant in the CRT subcategory. In the same way, the compliance costs would be the same for a facility of average flow with a discharge of TTO exceeding the limit by 4.0 mg/l. Obviously, these costs are significantly overstated for facilities that can dispose of partially filled 55 gallon drums at less than the disposal cost for full drums; e.g., at treatment or disposal facilities that charge on a per-gallon basis, rather than on a per-drum basis.

The $1,200 annual cost was applied to all plants that EPA did not know to be currently in compliance. EPA's data show that all plants with sampling data comply with the promulgated TTO limitation. Therefore, the plants for which EPA has no data are the ones to which the incremental costs are applied. It should be noted that TTO limitations do not apply to the Luminescent Coatings Subcategory.

B.1 TV Picture Tube Plants

The results for Color TV picture tube plants appear in Tables B-1 and B-2. Only one Color TV picture tube plant might incur TTO costs, the Philips plant in Ohio. The other plants already meet the TTO discharge limitation. The changes in the impact measures for this plant are almost imperceptible (from 0 to .01%), not enough to change any conclusions about the estimated impact on the plant.

B.2 Other CRT Plants

The impact measures of treatment costs with TTO removal for other CRT plants are shown in Tables B-3 and B-4 for Options 2 and 3. These are applied to all the Other CRT plants. The additional cost for TTO removal is so small that the changes in the impact ratios are also very small. The largest change occurs in the ATC/UP ratio for the Thomas Electronics plant in California. The ratio increases from 7.06 to 7.24 percent. This difference is not enough to change any conclusions about this plant and the differences are equally insignificant for all of the other plants.

Table B-1

Impact Measures: Color TV Picture Tube Plants
Option 2 (Level 1) Plus TTO

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
RCA, PA**	0	0	114.8	0	0	0	0	0
Zenith, IL**	1.5	.78	160.1	0.487	0.816	1.4	4.83	28.7
GE, NY**	0	0	77.0	0	0	0	0	0
RCA, IN**	1.578	.8263	264.6	0.312	0.524	0.897	1.48	18.2
(ECG) Philips, OH	1.3488	.7032	49.0	1.44	2.41	4.12	.654	84.2
(ECG) Philips, NY**	0	0	36.7	0	0	0	0	0
Sony, CA**	0	0	131.7	0	0	0	0	0
Total, Option 3	4.4268	2.3095	833.9					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

** These plants currently comply with the TTO limitation and therefore no incremental cost was included in the impact measures.

Table B-2

Impact Measures: Color TV Picture Tube Plants
Option 3 (Level 2) Plus TTO

Plant	Treatment Cost (Mill. $) Invest-ment	Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC/Sp	ATC/MCC	ATC/UP	ATC/NI	TCC/CAP
RCA, PA	.182	.074	114.8	.0644	.108	.185	.133	4.85
Zenith, IL	1.698	.861	160.1	.538	.901	.155	5.33	32.4
GE, NY	.1143	.0473	77.0	.0614	.102	.177	.003	8.28
RCA, IN	1.8065	.9211	264.6	.348	.583	1.0	1.56	20.9
(ECG) Philips, OH	1.542	.7832	49.0	1.6	2.68	4.6	.927	96.3
(ECG) Philips, NY	0	0	36.7	0	0	0	0	0
Sony, CA	.140	.056	131.7	.043	.072	.123	.189	3.26
Total, Option 3	5.4828	2.7426	833.9					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984.

* All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table B-3

Impact Measures: Other CRT Plants
Option 2 (Level 1) Plus TTO

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
Raytheon, MA	.7013	.3526	124.1	.284	.439	.62	.083	15.7
Clinton Elec, IL	.2896	.1633	53.8	.304	.469	.663	NA	14.9
Thomas Elec, NY	.1236	.07055	3.1	2.28	3.52	4.97	NA	109.3
Thomas Elec. NJ 1/	.1236	.07055	12.0	.588	.909	1.28	NA	28.5
Thomas Elec.,CA 1/	.1236	.07055	2.2	3.21	4.96	7.0	NA	154.2
Hewlett Packard, CO 1/	0	.0012	122.1	.001	.002	.002	.0004	0
Gen. Atronics, PA 2/	0	.00285	5.9	.048	.075	.105	NA	0
Litton Ind. AZ	.1236	.07055	3.9	1.81	2.8	3.95	.022	87.8
Dumont Electronics, NJ	.2896	.1633	17.6	.928	1.43	2.03	NA	45.5
B-Scan Inc, PA	0	.00285	2.0	.143	.22	.311	NA	0
Video Display, GA	0	.00285	2.7	.106	.163	.23	NA	0
Westinghouse, NY	.2896	.1633	94	.174	.269	.379	.0275	8.53
Special Purpose Technologies, CA	0	.00285	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	.0012	712.4	0	0	0	.002	0
Tex-Video Man, TX	0	.00285	NA	NA	NA	NA	NA	NA
Datagraphix,	0	.00285	96.2	.003	.005	.006	NA	0
Total, Option 3	2.0645	1.1442	1252.0					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment cost assumed to be the same as for Thomas Electronics in Clyde, NY

2/ Owned by N.A. Philips.

*All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.

Table B-4

Impact Measures: Other CRT Plants
Option 3 (Level 2) Plus TTO

Plant	Treatment Cost (Mill. $) Investment	Treatment Cost (Mill. $) Annual	Annual Sales (Mill. $)	Impact Measures (Percent)* ATC Sp	ATC MCC	ATC UP	ATC NI	TCC CAP
Raytheon, MA	.7604	.3771	124.1	.304	.47	.663	.089	17.0
Clinton Elec, IL	.3054	.1699	53.8	.316	.488	.69	NA	15.7
Thomas Elec, NY	.12943	.07295	3.1	2.35	3.64	5.14	NA	114.4
Thomas Elec. NJ 1/	.12943	.07295	12.0	.608	.94	1.33	NA	29.8
Thomas Elec.,CA 1/	.12943	.07295	2.2	3.32	5.13	7.24	NA	161.5
Hewlett Packard, CO 1/	.00583	.0036	122.1	.003	.005	.006	.001	.13
Gen. Atronics, PA 2/	0	.00285	5.9	.048	.075	.105	NA	0
Litton Ind. AZ	.12943	.07295	3.9	1.87	2.89	4.08	.023	91.9
Dumont Electronics, NJ	.3054	.1699	17.6	.965	1.49	2.11	NA	48.0
B-Scan Inc, PA	0	.00285	2.0	.143	.22	.311	NA	0
Video Display, GA	0	.00285	2.7	.106	.163	.23	NA	0
Westinghouse, NY	.3054	.1699	94	.181	.279	.395	.029	9.0
Special Purpose Technologies, CA	0	.00285	NA	NA	NA	NA	NA	NA
Tektronix, OR	0	.0012	712.4	0	0	0	.002	0
Tex-Video Man, TX	0	.00285	NA	NA	NA	NA	NA	NA
Dataqraphix,	0	.00285	96.2	.003	.005	.006	NA	0
Total, Option 3	2.20015	1.2005	1252.0					

Notes: Annual Sales are from EIS data file; 1982 $, adjusted to 1984. NA = Data not available.

1/ Treatment cost assumed to be the same as for Thomas Electronics in Clyde, NY

2/ Owned by N.A. Philips.

*All impact measures are shown as percents. ATC = Annual treatment cost, Sp = Plant sales, MCC = Manufacturing conversion cost, NI = Company net income, CAP = Annual plant investment, TCC = Capital investment portion of treatment cost.