EPA-230/3-76-016
MAY 1976

ECONOMIC ASSESSMENT OF PROPOSED TOXIC POLLUTANT EFFLUENT STANDARDS FOR MANUFACTURERS AND FORMULATORS OF ALDRIN/DIELDRIN, DDT, ENDRIN AND TOXAPHENE

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

ERRATA

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Page 33- last paragraph

2nd line - change "carbon" to "resin"

6th line - change " activated carbon" to "resin adsorption"

Page 34 - 4th paragraph

1st line - change "reductive degradation or carbon" to "resin"

2nd line - change "$0.0090/kg" to "$0.0178/kg"

3rd line - change " 1.1%" to "1.6-2.1%"

Page 43

Under title insert "Cotton"

EPA-230/3-76-016

ECONOMIC ASSESSMENT OF PROPOSED TOXIC POLLUTANT STANDARDS FOR MANUFACTURERS AND FORMULATORS OF ALDRIN/DIELDRIN, DDT, ENDRIN AND TOXAPHENE

Contract No. 68-01-1902

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

May 1976

PREFACE

The attached document is a contractor's study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency (EPA). The purpose of the study is to assess the economic impact which could result from the application of effluent standards to be established under Section 307(a) of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study prepared by Midwest Research Institute supporting the issuance of proposed regulations under Section 307(a). The technical study surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposal of certain effluent standards based upon an assessment of the feasibility of these standards. Presented in the technical study are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this assessment by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68-01-1902 by Arthur D. Little, Inc. Work was completed in May 1976.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under Section 307(a) of the Act for the subject toxic pollutants and categories of sources. The study is not an official EPA publication. It will be considered along with the information contained in the technical study and any comments received by EPA on either document before or during proposed rule making proceedings necessary to establish final regulations. Prior to final promulgation of regulations, the accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION AND CONCLUSIONS

The purpose of this report is to assess the potential costs and economic impact of toxic pollutant effluent standards for the manufacturers and formulators of aldrin/dieldrin, DDT, endrin, and toxaphene. Effluent standards for these pesticides are being proposed by the U.S. Environmental Protection Agency (EPA) under the authority of Section 307(a) of the Federal Water Pollution Control Act Amendments of 1972. The proposed standards for manufacturers are limitations on the discharge of the respective pesticides to the navigable waters expressed in terms of concentrations (g/l) and mass emissions (g/kg of production) in the effluent stream. For formulators, the standards specify a prohibition on the discharge of pollutants. Controls or restrictions upon the production, marketing, or application of these pesticides are beyond the statutory scope of these regulations; therefore, compliance with any such regulations (under FIFRA or other authority) will not be considered here.

Compliance with the proposed effluent standards may require manufacturers or formulators to install pollution abatement equipment, to modify current technical operations, or to incorporate specialized facilities in new installations. The EPA contracted the services of Midwest Research Institute (MRI) to examine alternative abatement technologies capable of meeting the proposed effluent standards and to assess the costs of these treatment systems. Detailed information on technologies and costs may be found in the series of MRI reports entitled, "*Wastewater Treatment Technology for (specific pesticide) Manufacture and Formulation,*" dated February 1976. The MRI cost data were developed on the assumption that none of the required treatment had as yet been installed; however, in utilizing these data as the basis for economic impact assessment, Arthur D. Little, Inc. (ADL), made appropriate adjustments for treatment already installed to determine the additional costs attributable to the 307(a) regulations. The general conclusion of this economic assessment is that there will be no significant economic impact upon the manufacturers and formulators of these four pesticides resulting from compliance with the proposed 307(a) standards.

For the manufacturers, this conclusion was reached following an examination of the additional cost of complying with these standards, together with a general assessment of the supply, demand, and pricing for the products and the business condition of the respective firms. On the basis of this information, ADL concluded that the unit compliance costs were sufficiently low that a detailed financial analysis was not necessary to determine that there would be no adverse impact on sales, profitability, employment, or the end-use markets for these pesticides. The basis for this conclusion is presented in the economic impact sections for each product; the general cost information is summarized in Table 1.1.

For the formulators of these pesticides, ADL concluded that most plants would face little or no additional cost in meeting the proposed standards. This conclusion was based on a telephone survey of 16 companies operating 32 plants of the approximately 145 plants

TABLE 1.1

307(a) COMPLIANCE COSTS FOR PESTICIDE MANUFACTURERS

Pesticide/ Manufacturer	Selling Price $/kg	Annual Production in Met. Tons (million lb)	Compliance Technology[1]	Proposed Effluent Limitations (ppb)	Additional Cost[2]			Additional Cost as Percent of Selling Price[3]
					Investment ($000)	Annual ($000)	Unit ($/kg)	
DDT/no direct discharge	—	—	—	0	—	—	—	—
Ald-Dield/no direct discharge	—	—	—	0	—	—	—	—
Endrin/ Velsicol	6.60	2,730(6)	Reductive degradation	1.5	242- 362	109-161	0.040-0.059	0.6-0.9
Toxaphene/ Hercules	0.84	22,700(50)	Resin adsorption	1.5	543- 716	295-400	0.013-0.018	1.6-2.1
Toxaphene/ Riverside	0.84	6,820(15)	Contract disposal	1.5	20	81	0.011	1.3
Toxaphene/ Vicksburg	0.84	4,545(10)	Evaporation & incineration	1.5	40	40	0.009	1.1
Total					845-1138	525-682		

1. Treatment technology which meets the proposed limit. See Section 3 of this report for basis.
2. Additional cost of compliance, computed as total cost of compliance less technology in place. Range indicates flow assumptions used in cost computations by Midwest Research Institute.
3. Does not include cost of monitoring and analysis. Inclusion of these costs at $40,000/year (per suggestion of the Department of Commerce) for the two continuous dischargers raises the cost-sales ratios to 0.8-1.1% for Velsicol and 1.8-2.3% for Hercules. Compliance technology for Riverside and Vicksburg is based upon no discharge of effluents; thus monitoring is not required.

which currently formulate these pesticides. The sample surveyed included plants with a wide range in size and geographic distribution. All formulators surveyed indicated that they believed their present operations already complied with the proposed standards. ADL believes that the findings of the telephone survey are representative of the practices of the pesticide formulation industry, and that none of the formulators will incur a significant capital cost in meeting the proposed standards. If, however, some plants do have to install facilities to avoid contaminated runoff and/or require disposal of contaminated material, the unit cost would not be large, except possibly for those firms which formulate very small volumes of these four pesticides. The EPA estimated that, if a company were not presently meeting the standards, it would have to install roofing and curbing, and incur an annual cost ranging from about $1000 to $4000. EPA, assuming that no formulators presently meet the standards, estimated that the preceding costs would have an adverse economic impact on approximately 20 plants. Based on its telephone survey, ADL believes that substantially all formulators now meet the standards. ADL thus concludes that the potential impact estimated by EPA is very unlikely.

While the basic conclusion is that there will be no significant economic impact from compliance with these regulations, we have presented some of the data collected during the study for the use of the interested reader and to support our assumptions and conclusions.

1.2 CHARACTERIZATION OF THE GENERAL PESTICIDE INDUSTRY

The pesticide manufacturing industry is a major sector of the U.S. chemical industry with the 1975 value of synthetic organic chemical active ingredients produced exceeding $2160 million at the manufacturer's level. The major market for pesticides in the United States is agriculture which we estimate consumes more than 90% of the pesticides used.

Pesticides are usually classified as herbicides, fungicides, or insecticides. Virtually all domestic production of pesticides falls within these three classes, although small amounts of rodent, bird, and other types of control materials are also produced.

Between 1960 and 1974 the quantity of pesticides produced more than doubled and the manufacturers' value of pesticide production increased by more than fourfold. The largest single component of U.S. pesticide production is herbicides which account for about 50% of the total pesticide value. During the 1960's herbicide production experienced considerable growth. However, since 1968 pesticides and fungicides have had higher growth rates.

There are a relatively small number of firms manufacturing pesticides, but they manufacture a wide variety of products. We estimate that the 10 largest firms account for about 75% of total U.S. pesticide sales.

The companies which dominate the pesticide industry, for the most part, achieved their position through the sale of proprietary products. Industry observers estimate that the relative profitability (per sales dollar) of proprietary products is normally at least double that for products which do not have patent protection.

The pesticide formulation industry is more difficult to characterize than the pesticide manufacturing industry. There are a large number of small formulators for whom statistics are not readily available. The Midwest Research Institute indicated in 1975 that there are presently 5300 plants manufacturing some pesticide formulations. A large number of these plants are primarily involved in other businesses. However, the 1972 Census of Manufactures showed only 388 establishments whose primary business is the making of pesticide formulations. The Census also showed that the 388 establishments employed 12,200 people, had payrolls of $116.5 million, and made a product valued at $1196.2 million.

1.3 CHARACTERIZATION OF THE PORTION OF THE PESTICIDE INDUSTRY COVERED BY THE PROPOSED TOXIC POLLUTANT STANDARDS

1.3.1 Toxaphene

Toxaphene is the most widely used insecticide in the United States in terms of total poundage. At present there are four manufacturers of toxaphene in the United States, viz., Hercules, Tenneco, Vicksburg, and Riverside. Only Hercules, Vicksburg, and Riverside are direct dischargers. In 1974, approximately 90 million pounds of toxaphene were produced. Reportedly toxaphene production dropped significantly in 1975 due at least partially to a 30% decrease in cotton acreage, the primary target crop for this product.

In 1975, there were 99 plants formulating products containing toxaphene. The median toxaphene formulation plant had an annual production of 255,000 pounds of formulated product. The average selling price is $0.50/lb of formulated product.

1.3.2 DDT

The Montrose Chemical Company facility in Torrance, California, is the only plant manufacturing DDT in the United States. It is also the major formulator of DDT. All the DDT manufactured at this plant is exported. Montrose produces between 18,100 and 27,200 metric tons of DDT per year, depending on market conditions, and supplies about 50% of the world market for DDT. Most of the market is comprised of various international health organizations. Montrose will not be affected by the proposed toxic standards because it is not a direct discharger.

1.3.3 Endrin

The Velsicol Chemical Corporation plant in Memphis, Tennessee, is the only facility within the United States manufacturing endrin. It produces approximately 2700 metric tons of endrin per year. Of the 1975 production, only approximately 16% was applied within the United States. Approximately two-thirds of this volume was used on cotton with the other major application being on corn. Velsicol manufactures about 25 to 30% of the world market for endrin. In 1975, Velsicol Chemical also produced about 50% of all endrin formulations. The remaining endrin formulations were produced by 38 other plants. The median endrin formulator produced 13.6 metric tons of product valued at $7.26/kg. Other pesticides can be used to control the same pests controlled by endrin although these pesticides may not be as efficient or as economical.

1.3.4 Aldrin/Dieldrin

In 1974 the EPA banned the agricultural use of aldrin/dieldrin. The use of aldrin/dieldrin for the protection of shelters was not banned.

At the time use of aldrin/dieldrin for agricultural purposes was banned, Shell was the only producer in the United States. Shell formally announced the closing of its plant following the ban on agricultural use. At present aldrin/dieldrin is being produced overseas by Shell; however, there appear to be no plans to resume production in the United States. We have been unable to locate any aldrin/dieldrin manufacturing operations which are direct dischargers or any formulators of aldrin/dieldrin.

2.0 INDUSTRY CHARACTERIZATION

2.1 GENERAL DESCRIPTION OF PESTICIDE INDUSTRY

2.1.1 The Manufacturers

The pesticide manufacturers represent a major sector of the U.S. chemical industry. The value of synthetic organic chemical active ingredients produced by this industry in 1975 exceeded $2160 million at the manufacturer's level. The major market for pesticides in the United States is agriculture. We estimate that more than 90% of all pesticides consumed domestically is used for the protection of agricultural products.

The most common categorization of pesticides is by type of pest controlled, e.g., weeds, insects, fungal diseases, and the like. Three classes of products – herbicides, fungicides, and insecticides (including nematocides and acaracides) – compose virtually all domestic pesticide production, although small amounts of rodent- and bird-control materials are also produced.

The physical volume of pesticide production more than doubled between 1960 and 1974. During the same period, the manufacturers' value of this production increased by more than 400%. Historical information on U.S. pesticide production value, and average price are presented in Table 2.1.1A.

The largest single component of U.S. pesticide production in terms of value is herbicides. With an average manufacturer's price of $4.80/kg ($2.18/lb), herbicides accounted for about 60% of total pesticide value, while providing less than 40% of pesticide poundage. The relative importance of the three product classes is given in Table 2.1.1B.

The proportionate value of these components has changed considerably since 1960 with herbicide production exhibiting dramatic growth during the 1960's. Since 1968, however, both insecticides and fungicides have exhibited a greater annual growth rate in sales than herbicides. Historical production and value data for herbicides, insecticides, and fungicides are presented in Tables 2.1.1C, 2.1.1D, and 2.1.1E.

The pesticide industry is composed of a relatively small number of firms producing a wide variety of products. There is considerable concentration in the industry with the 10 largest firms estimated to account for about 75% of total U.S. pesticide sales. The industry is further stratified by the fact that less than 10% of the products (45) are estimated to be responsible for nearly 70% of the total pesticide sales value. In fact, industry experts estimate that as few as 12 products comprise over 40% of the total value of pesticide sales.

Companies which dominate the pesticide industry, for the most part, achieved their position through sales of proprietary products, i.e., products for which they hold a patent

TABLE 2.1.1A

TOTAL U.S. SYNTHETIC ORGANIC PESTICIDE PRODUCTION[1]
(1960-1974)
(active ingredients at the manufacturer's level)

	Volume			Average Price	
Year	in Metric Tons	in Millions of Pounds	Value ($ millions)	$/kg	$/lb
1960	295,000	648	306	1.03	0.47
1961	318,000	700	366	1.14	0.52
1962	332,000	730	458	1.39	0.63
1963	347,000	764	453	1.30	0.59
1964	356,000	783	513	1.45	0.66
1965	399,000	877	607	1.52	0.69
1966	460,000	1,013	761	1.65	0.75
1967	477,000	1,050	988	2.07	0.94
1968	542,000	1,192	1,138	2.09	0.95
1969	502,000	1,104	1,113	2.22	1.01
1970	470,000	1,034	1,087	2.31	1.05
1971	516,000	1,135	1,276	2.46	1.12
1972	526,000	1,157	1,313	2.49	1.13
1973	585,000	1,289	1,453	2.49	1.13
1974	642,000	1,415	1,950	3.04	1.38
Annual Growth (Percent)					
1960-1968		8	18	9	
1968-1974		2	6	3	

1. Herbicides, insecticides, and fungicides

Source: United States International Trade Commission.

position. Industry observers estimate that the relative profitability (per sales dollar) is normally at least doubled for proprietary products versus commodity products (no patent protection). This profit relationship will, of course, vary with manufacturing costs, value of crop protected, potential pest damage, and the like.

In the pesticide industry the relative profitability of a product is affected by the competitiveness of the market for control of the specific pests. For instance, some industry

TABLE 2.1.1B

ESTIMATED COMPOSITION OF U.S. PESTICIDE SALES
(1974)

	Volume			Manufacturers' Value		Average Price	
Class	**Metric Tons**	**Millions of Pounds**	**Percent**	**Million $**	**Percent**	**$/kg**	**$/lb**
Herbicides	275,000	604	43	1,211	62	4.40	2.00
Insecticides	295,000	650	46	605	31	2.05	0.93
Fungicides	74,000	163	11	138	7	1.86	0.85
	644,000	1,417	100	1,954	100		

Source: Arthur D. Little, Inc., calculations based on United States International Trade Commission data.

TABLE 2.1.1C

U.S. SYNTHETIC ORGANIC HERBICIDE PRODUCTION
(1960-1974)
(active ingredients at the manufacturer's level)

	Volume			Average Price	
Year	**in Metric Tons**	**in Millions of Pounds**	**Value in $ Millions**	**$/kg**	**$/lb**
1960	47,000	103	79	1.69	0.77
1961	55,000	121	113	2.05	0.93
1962	69,000	151	147	2.13	0.97
1963	80,000	175	166	2.09	0.95
1964	103,000	226	243	2.38	1.08
1965	120,000	263	302	2.53	1.15
1966	147,000	324	386	2.62	1.19
1967	136,000	409	617	3.32	1.51
1968	213,000	469	718	3.37	1.53
1969	179,000	393	662	3.70	1.68
1970	184,000	404	663	3.61	1.64
1971	195,000	429	800	4.08	1.86
1972	205,000	451	816	3.98	1.81
1973	225,000	496	844	3.74	1.70
1974	239,000	525	925	3.87	1.76
Annual Growth (Percent)					
1960-1968		21	32	9	
1968-1974		2	4	2	

Source: United States International Trade Commission

TABLE 2.1.1D

U.S. SYNTHETIC ORGANIC INSECTICIDE PRODUCTION
(1960-1974)
(active ingredients at the manufacturer's level)

	Volume			Average Price	
Year	in Metric Tons	in Millions of Pounds	Value in $ Millions	$/kg	$/lb
1960	166,000	366	157	0.95	0.43
1961	187,000	411	193	1.03	0.47
1962	210,000	461	258	1.23	0.56
1963	217,000	478	234	1.08	0.49
1964	202,000	444	219	1.08	0.49
1965	223,000	490	248	1.12	0.51
1966	251,000	552	317	1.25	0.57
1967	225,000	496	304	1.34	0.61
1968	259,000	569	347	1.34	0.61
1969	260,000	571	383	1.47	0.67
1970	223,000	490	340	1.52	0.69
1971	254,000	558	393	1.54	0.70
1972	256,000	564	406	1.58	0.72
1973	290,000	639	495	1.69	0.77
1974	302,000	650	605	2.05	0.93
Annual Growth (Percent)					
1960-1968		6	10	4	
1968-1974		3	8	5	

Source: United States International Trade Commission

personnel believe that profitability per sales dollar is generally higher for herbicides than for insecticides because of the high degree of competition in the insecticide market.

The willingness and the ability of the pesticide user to tolerate price increases will vary for different crops, according to the pest to be controlled and the crop value at risk. Once a crop is planted, it is only a question of how much pesticide costs versus the value of the crop yield to be saved. Growers of a high-value crop would normally be more willing to absorb price increases than growers of low-value crops such as grain.

The only portion of the pesticide industry covered by the proposed standards for toxic pollutants is the manufacture and formulation of toxaphene, DDT, endrin, and aldrin/

TABLE 2.1.1E

U.S. SYNTHETIC ORGANIC FUNGICIDE PRODUCTION
(1960-1974)
(active ingredients at the manufacturer's level)

Year	Volume in Metric Tons	Volume in Millions of Pounds	Value in $ Millions	Average Price $/kg	Average Price $/lb
1960	82,000	180	70	0.86	0.39
1961	76,000	168	60	0.79	0.36
1962	54,000	118	53	0.99	0.45
1963	50,000	111	53	1.06	0.48
1964	51,000	113	51	0.99	0.45
1965	56,000	124	58	1.03	0.47
1966	62,000	137	60	0.97	0.44
1967	65,000	144	66	1.01	0.46
1968	70,000	154	72	1.03	0.47
1969	64,000	141	68	1.06	0.48
1970	64,000	140	71	1.12	0.51
1971	68,000	149	82	1.21	0.55
1972	65,000	143	92	1.41	0.64
1973	70,000	154	114	1.63	0.74
1974	73,000	163	138	1.86	0.85
Annual Growth (Percent)					
1960-1968		-2	<1	2	
1968-1974		1	10	9	

Source: United States International Trade Commission

dieldrin. All of these pesticides are chlorinated organic compounds. At present, there are no producers who are direct dischargers of DDT and aldrin/dieldrin in the United States.

2.1.2 The Formulators

The pesticide formulation industry is difficult to characterize accurately. There are a large number of small formulators for whom statistics are not readily available. According to Midwest Research Institute's formulation technology documentation,* there are presently 5300 plants manufacturing pesticide formulations. However, the 1972 Census of Manufactures shows only 388 establishments whose primary business is in SIC 2879, the

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*Wastewater Treatment Technology Documentation for aldrin/dieldrin, toxaphene, DDT, endrin, formulators, May 1976.

SIC category covering pesticide formulators. The Census shows that the 388 establishments employed 12,200 people, had payrolls of $116.5 million, and made products valued at $1196.2 million.

Companies owning pesticide formulation plants range in size from those having only one or two registrations to those having hundreds. Plants in the formulation industry fall into one of the following three categories: (1) the pesticide producer and formulator, (2) the independent formulator, and (3) the small packager. Only categories (2) and (3) are of concern in this section of the report. Those formulators affected by the proposed toxic standards and falling in category (1) are covered with the manufacturers of the respective pesticide.

The independent formulator typically formulates a number of products which he markets under his own brand, although he may also formulate products on a contractual arrangement with a manufacturer. He often manufactures the contracted products under the manufacturer's brand. The reason for contract formulation is that a number of large pesticide manufacturers do not formulate any of their own products.

The small packager typically manufactures one to five formulations which he markets under his own brand. Pesticide formulation is often only a small portion of his business and sometimes small packagers will contract an independent formulator to do their formulation work.

A formulator takes technical-grade pesticide active ingredients, dilutes them, and transforms them into a usable form. The dilution is carried out by combining the technical-grade pesticides with an inert material. Often, for efficacy reasons, a pesticide formulation will contain more than one type of active ingredient. For example, many formulations often combine methyl parathion with toxaphene. In its final physical form, a formulation can be an emulsifiable concentrate, a powder, a dust, or granules.

Emulsifiable concentrates are combinations of technical-grade pesticides and emulsifiers in a solvent. The emulsifiable concentrate formulations are always diluted by water or oil before application. Emulsifiable concentrates usually contain 15% to 50% concentrations of the technical-grade pesticide, although they can contain 80% or more pesticide materials when combinations of different pesticides are used. The concentration of emulsifiers is usually 5% or less. Typical solvents used to make emulsifiable concentrates include xylenes, methyl isobutyl ketone, and deodorized kerosene.

Powders are a mixture of pesticide, inert carriers, and adjuvants that are mixed with water by the user before application. The powders usually contain a concentration of 15% to 95% of the technical-grade pesticide and a concentration of 1% to 5% surfactant to improve wettability and suspendability.

Dusts are formulations which contain a relatively low concentration of the technical-grade pesticide absorbed onto an inert powder. While the potency of dusts is low, they are relatively inexpensive and simple to apply. However, their use is becoming less common because of problems caused by the ease with which they can be blown away by the wind.

Granules are similar to dusts and are formed by impregnating the technical-grade material onto granular carriers. Common carriers include clay, vermiculite, sand, carbon, and diatomaceous earth. The content of fine particles is minimized to prevent the problems that occur with the use of dust.

2.2 CHARACTERIZATION OF PRODUCERS AND FORMULATORS OF PESTICIDES SUBJECT TO THE PROPOSED TOXIC STANDARDS

Four pesticides are subject to the 307(a) toxic standards. These are toxaphene, DDT, endrin, and aldrin/dieldrin. The EPA supplied ADL with a profile of the pesticide formulator industry subject to the proposed standards. A copy of this profile is presented as Appendix I.

2.2.1 Toxaphene

Toxaphene is the most widely used insecticide* in the United States in terms of total poundage. A 1974 study** sponsored by the Office of Pesticide Programs, U.S. Environmental Protection Agency (EPA), estimated 1972 domestic consumption at 26,300 metric tons (58 million lb). Our recent assessment of the toxaphene market indicates that domestic consumption probably did not change through 1974 with consumption in the range of 25,000 to 28,000 metric tons (55 to 62 million lb). Reportedly toxaphene usage dropped significantly in the United States in 1975. The drop was due, at least partially, to the 30% decrease in cotton acreage planted, the primary target crop of this product.

Four companies (Hercules, Tenneco, Riverside, and Vicksburg) manufacture toxaphene in the United States. The production of these companies (delineated in Table 2.2.1A) is sufficient to supply U.S. toxaphene needs and about 60% of non-U.S. toxaphene demand which is estimated at something less than 23,000 metric tons (50 million lb) annually.

In 1975, 133 plants were registered to formulate products containing toxaphene. The mean output of 99 plants for which production data were available was 594,000 pounds of formulated product per year, and the median output was 255,000 pounds of formulated product per year. Table 2.2.1B shows the size distribution of toxaphene formulators for 1975.

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*Chemical and Engineering News, July 28, 1975.

**Production, Distribution, Use and Environmental Impact Potential of Selected Pesticides, OPP, U.S. EPA, 1974.

TABLE 2.2.1A

ESTIMATED U.S. TOXAPHENE PRODUCTION (1974)

	Toxaphene Sales					
	United States		Exports		Total	
Company	**Thousands of Metric Tons**	**Millions of Pounds**	**Thousands of Metric Tons**	**Millions of Pounds**	**Thousands of Metric Tons**	**Millions of Pounds**
Hercules	14.5-15.9	32-35	8.6-10	19-22	24.5	54
Tenneco	4.5- 5.5	10-12	2.7- 3.6	6- 8	8.2	18
Vicksburg	2.3	5	1.8	4	4.1	9
Riverside	3.6- 4.5	8-10	0	0	3.6-4.5	8-10
Total	24.9-28.2	55-62	13.1-15.4	29-34	≃41	≃90

Source: Arthur D. Little, Inc., estimates.

TABLE 2.2.1B

SIZE DISTRIBUTION OF TOXAPHENE FORMULATORS (1975)

Projected Output of Toxaphene in 1975 (thousands of pounds)	Number of Plants
1- 10	6
11- 25	10
26- 50	9
51- 100	9
101- 200	11
201- 300	9
301- 400	6
401- 500	5
501- 750	12
751-1000	4
1001-1500	7
1501-2000	6
2001-3000	2
3001-4000	1
4001-5000	1
5001+	1
	99

Source: Environmental Protection Agency

The most important use of toxaphene has traditionally been in the control of cotton insects, usually in combination with other insecticides (DDT until 1973, methyl parathion, and others). Toxaphene can easily be formulated or mixed with other insecticides, and it is often desirable to do so. Toxaphene appears to act as a solubilizer for insecticides that have low solubility by themselves. Additionally, some combinations of toxaphene with other insecticides are reported to have synergistic properties. Although less significant than cotton, other important uses for toxaphene are on livestock and various field crops (including soybeans and peanuts). Somewhat marginal uses (in the context of the total market) are on vegetable crops and ornamentals.

Typical toxaphene use during the 1970's is given in Table 2.2.1C. However, usage can vary considerably on an annual basis depending on the level of cotton acreage planted in any given year.

Resistance of some target pests is a problem with crops in certain regions. Often combining toxaphene with other insecticides has been sufficient to overcome the resistance problem. Some non-target species (fish) in areas of heavy toxaphene use can have also developed resistance.

TABLE 2.2.1C

BREAKDOWN OF TYPICAL U.S. TOXAPHENE USE IN THE 1970's

Use	Percent of Use	
Crops		87.7
Cotton	75.0	
Soybeans	4.1	
Peanuts	3.6	
Other Field Crops	2.6	
Vegetables	2.1	
Fruits and Nuts	0.2	
Nursery and Greenhouse	0.1	
Livestock		12.1
Beef	9.3	
Swine	2.3	
Others	0.6	
Other		0.1
Total		100.0

Source: Arthur D. Little, Inc., estimates are based on U.S. Department of Agriculture and industry information.

There are other chemical insecticides which control some or most of the insects controlled by toxaphene. However, the possible alternates for toxaphene may not be as efficacious or economical. Appendix II discusses possible alternates for toxaphene.

Each manufacturer of toxaphene uses camphene as a raw material. The camphene is produced from α-pinene, a product of the gum and wood chemicals industry (SIC 2861).

The following is a description of the toxaphene manufacturers who discharge directly to the navigable waters:

Hercules

Hercules is the largest producer of toxaphene in the United States. In 1974, it produced an estimated 24,000 metric tons (54 million lb), or approximately 60% of the U.S. toxaphene production volume; it was valued at an estimated $15.7 million at the manufacturer level. This represented slightly more than 1% of total Hercules' sales for that year.

Hercules produces its own camphene, the major input for the production of toxaphene. Approximately 80 persons are employed in the production of toxaphene and another 50 are employed in sales and sales-related work for toxaphene.

Hercules is not forward-integrated. However, the firm does contract in the United States for small amounts of formulation to meet market needs in certain countries with no formulators. Some 15 to 20 formulators in the United States (out of approximately 80 who formulate toxaphene) handle the bulk of Hercules' production for the domestic market.

Hercules exported an estimated 8,600 to 10,000 metric tons (19 to 22 million lb) of toxaphene in 1974 – valued at $7 to $9 million (1974 prices). This represents approximately 40 to 50% of the non-U.S. world market. Hercules deals primarily with formulators and governments for all its overseas sales. Hercules is involved in a joint venture in Nicaragua. In addition, it began to construct a plant in Brazil with an annual capacity of 11,300 metric tons (25 million lb). However, construction has been halted because the Brazilian government wants to change the plant location to a site in northern Brazil. As of December 1975, we believe that the problem had not been resolved. At the present time, we believe Hercules has no other expansion plans.

The Hercules plant at Brunswick, Georgia (which produces toxaphene as well as other chemicals), is an old plant which should be fully depreciated. Although maintenance and repair costs for this plant are probably greater than those of a new plant, they ought to be lower than interest and depreciation costs on a new plant. This lower cost may give Hercules greater pricing flexibility than, say, Riverside with its new Texas plant and Vicksburg Chemical with its Mississippi plant. Hercules' ownership of camphene production facilities and the economies of scale inherent in large-scale production further contribute to its favorable market position. Should toxaphene pricing become more competitive in the future, Hercules would probably have an advantage over its competitors.

Riverside

Riverside Chemical produced an estimated 3,600 to 4,500 metric tons (8 to 10 million lb) of toxaphene in 1975 with an estimated manufacturer's value of $3 to $4 million. In 1974, toxaphene products represented 2 to 3% of Riverside's total sales. It supplies approximately 12 to 20% of U.S. production. Some of its production was exported in 1975.

Sonford Chemical was the original owner of the Groves, Texas, toxaphene facility now owned by Riverside. Bison bought the site from Sonford, tore down the original plant, and constructed a new one. This new plant was then purchased by Riverside. Riverside recently finished (August 1975) doubling the size of this plant to its present capacity of 15 million lb. This plant employs 29 persons. We believe Riverside has no present plans for further production expansion, since the expanded plant is presently operating at less than full capacity.

Riverside plans to increase exports in 1976 so that the plant will be operating closer to capacity. Since Riverside has no market structure or experience in the foreign marketing of pesticides, it is probably contracting with brokers to do the marketing for them.

Riverside's toxaphene operations are not back-integrated. Riverside's forward-integration consists of ownership of 15 formulators who formulate all toxaphene produced by Riverside as well as other chemicals. (Toxaphene-based products represent 50% of their formulation business.) Riverside acts as a distributor for all its toxaphene products. Fifty percent of these products are sold through its own dealers. Unformulated toxaphene materials "sold" represent only 2 to 3% of Riverside's total sales. However, when distributor and retail prices of toxaphene-based products sold by Riverside are also included, the value to Riverside of toxaphene sales become significant. (No estimate of this value is presently available.)

Vicksburg

Vicksburg Chemical produced an estimated 4100 metric tons (9 million lb) of toxaphene in 1974 which was 10% of the U.S. production. The estimated value of production was $3.4 million (1975 manufacturers' price), or 8 to 10% of total Vicksburg sales.

Vicksburg marketed approximately 2300 metric tons (5 million lb) domestically, or 8 to 10% of the U.S. market. Vicksburg neither formulates, distributes, nor retails toxaphene products.

Vicksburg Chemical's plant in Vicksburg, Mississippi, has a toxaphene capacity of 5900 to 6800 metric tons (13 to 15 million lb) and employs 12 to 15 persons in toxaphene production. Vicksburg does produce chlorine, an important input for toxaphene, but not camphene, the most important input. Vicksburg's toxaphene plant is only two years old (December 1975).

Vicksburg exports an estimated 1800 metric tons (4 million lb) of toxaphene annually which represents 8 to 10% of the world market. The value of these exports would be $1.5 million using 1975 manufacturers' prices. They market almost exclusively in South America through formulators.

2.2.2 DDT

The Montrose Chemical Company facility in Torrance, California, is the only plant manufacturing DDT in the United States. This plant is not a direct discharger. The Montrose plant and one other facility are the only formulators of DDT. All DDT from these plants is exported, since DDT is not used in the United States.

The major users of DDT are the various international health agencies, such as the Pan American Health Organization, WHO, and the UN. These organizations distribute DDT to the health ministries of various governments. The primary health application of DDT is in the control of malaria-carrying mosquitoes. Many industry observers believe that no other pesticide is as effective in mosquito control.

Agricultural use of DDT is primarily on cotton, although some is used on the soybean crop. Throughout the world the system of distribution for agricultural application varies from government purchase and control to systems similar to that found in the United States. The agricultural market for DDT is slowly declining because of increased competition from other products, decreased acreage of crops on which DDT is used, and bans on its use by some countries.

2.2.3 Endrin

The Velsicol Chemical Company facility in Memphis, Tennessee, is the only plant manufacturing endrin within the United States. Velsicol is included in the economic impact assessment because it discharges directly as well as to a municipal system. Approximately two-thirds of the endrin produced is used on cotton. The other major use of endrin is on corn. It is also used as a rodenticide and for emergency use on small grains. There are other pesticides which are used to control some or most of the pests controlled by endrin. However, the possible alternate for endrin may not be so efficacious or economical. Appendix II discusses possible alternates for endrin.

Besides Velsicol, some 38 other plants prepare endrin formulations. The mean size of all plants formulating endrin is 410 metric tons (84,000 lb) of formulated product per year and the median size is 13.6 metric tons (30,000 lb) of formulated product per year. Table 2.2.3 shows the 1975 size distribution of plants producing endrin formulations.

TABLE 2.2.3

SIZE DISTRIBUTION OF ENDRIN FORMULATORS (1975)

Projected Output of Endrin in 1975 (thousands of pounds)	Number of Plants
1- 10	7
11- 25	11
26- 50	3
51-100	8
101-200	6
201-300	2
301-400	1
401-500	0
501-750	1
	39

Source: U.S. Environmental Protection Agency

Velsicol

Velsicol produces several products at its facility in Memphis, Tennessee. Endrin, however, is produced in a separate unit within the facility. An estimated 20 to 25 people are employed in the endrin operation. Production is approximately 2700 metric tons (6 million lb) per year. The estimated value of the production for 1976 was approximately $17 million. Of the 1975 production only approximately 16% was applied within the United States.

Velsicol buys most of the raw materials it uses to manufacture endrin. However, it does have a captive source of chlorine and cyclopentadiene which are reacted to make hexachlorocyclopentadiene, one of the inputs to the endrin manufacturing process.

Velsicol itself makes more than 50% of all endrin formulations at its Memphis plant. The remaining formulation is done by 10 to 12 major insecticide formulators. However, there are 63 companies which have endrin labels registered.

The world market for endrin is 9,100 to 11,300 metric tons (20 to 25 million lb) per year. Velsicol has about 25 to 30% of this market, with Dutch Shell being the major supplier. Most endrin exports are typically in the technical form with only a small amount already formulated. In Latin America the majority of the endrin produced by Velsicol is formulated by firms controlled by or contracted to Velsicol. Velsicol then acts as the distributor of these formulated materials, acting in the capacity of a dealer. The remainder of the endrin shipped to Latin America is formulated and distributed by non-affiliated firms. There is minimal government purchasing of endrin in Latin America. Veliscol is apparently gaining volume and market share in Latin America.

In Africa and the Near East, most of the marketing of endrin is done through governments. Loss of a single contract could significantly affect Velsicol's annual sales.

2.2.4 Aldrin/Dieldrin

In 1974, the Environmental Protection Agency banned the agricultural use of aldrin/dieldrin. At the time, the major uses of aldrin/dieldrin were on corn and for the protection of structures from termites. Minor uses were on sugarcane, tobacco, and other field, vegetable, and fruit crops. The use of aldrin/dieldrin for the protection of structures was not banned by the EPA.

Shell was the only producer of aldrin/dieldrin at the time its agricultural use was banned. It was producing it at its facility in Denver, Colorado, which still produces numerous other products. In 1975, Shell formally announced the closing of the aldrin/dieldrin plant. The plant had employed approximately 80 people. At the time it was shut down, it is believed to have been operating at approximately 50% of capacity.

In 1971, the Shell plant produced approximately 4100 metric tons (9 million lb) of aldrin/dieldrin. At today's prices, this production would have been worth $12.15 million. The current price is based on production by Shell (London). Shell appears to have no plans to resume aldrin/dieldrin production in the United States

There are some formulators who have aldrin/dieldrin registrations. As far as we have been able to determine,however, none of the formulators having aldrin/dieldrin registrations are making aldrin/dieldrin formulations.

2.3 SELLING PRICES

2.3.1 Selling Prices of Pesticides Covered by the Proposed Toxic Standards

Table 2.3.1 shows the 1975 selling price of the pesticides covered by the proposed standards for toxic pollutants. Average prices for all pesticides rose at an annual rate of 8 percent from 1960 to 1975. Toxaphene prices rose 50 percent from 1972 to 1975, but prices of endrin and DDT have not risen so rapidly.

TABLE 2.3.1

SELLING PRICES FOR PESTICIDES
(1975)

	Selling Price	
Pesticide	**$/kg**	**$/lb**
Toxaphene	0.84	0.38
Endrin	6.60	3.00
DDT	0.88-1.10	0.40-0.50
Aldrin/dieldrin	2.97*	1.35*

*Based on Shell (London) prices.

Source: Arthur D. Little, Inc., estimates based on a telephone survey of industry representatives.

2.3.2 Selling Prices of Formulated Products Containing Pesticides Covered by the Proposed Toxic Standards

Table 2.3.2 shows the average prices charged by the formulator for products containing DDT, endrin, and toxaphene.

TABLE 2.3.2

AVERAGE CURRENT SELLING PRICE OF THE FORMULATED PRODUCT

	Price of Formulated Product	
Pesticide	**$/lb**	**$/kg**
DDT	0.36	0.79
Endrin	3.30	7.26
Toxaphene	0.50	1.10

Source: Arthur D. Little, Inc., estimates based on a telephone survey of industry.

3.0 TREATMENT TECHNOLOGIES AND ASSOCIATED COSTS

3.1 TREATMENT TECHNOLOGIES AND ASSOCIATED COSTS FOR PESTICIDE MANUFACTURERS AS REPORTED BY MIDWEST RESEARCH INSTITUTE

Midwest Research Institute (MRI) was retained by EPA to determine what technologies are available for treating effluents from the manufacture of pesticides which will be subject to the proposed standards for toxic pollutants. For each technology identified they were to estimate the costs associated with its implementation. In developing these costs, they were not to take into consideration whether any other steps of the proposed technology had already been installed.

The proposed standards for toxaphene, DDT, endrin, and aldrin/dieldrin set the following effluent limitations on manufacturers:

Toxaphene – 1.5 ppb
DDT – 0 ppb
Endrin – 1.5 ppb
Aldrin/dieldrin -- 0 ppb

This section presents the technologies and associated costs developed by MRI*. Although there are no direct discharges of DDT and aldrin/dieldrin, we have included the MRI data for these pesticides since that information is applicable to new sources. In Section 3.2, we present estimates of the additional cost each manufacturer who is a point-source discharger will incur if the proposed standards are implemented.

3.1.1 Toxaphene

In its report dated February 6, 1976, MRI proposes four treatment technologies for treating effluents containing toxaphene:

1) adsorption on activated carbon;
2) adsorption on XAD-4 resin;
3) reductive degradation; and
4) adsorption on XAD-4 resin followed by reductive degradation.

Cost estimates for adsorption on activated carbon were based on an effluent flow rate of 1136 ℓ/min. Since the required adsorption contact time has not been determined, cost estimates were prepared for two different contact times, viz., 30 minutes and 60 minutes. The costs of resin adsorption, reductive degradation, and resin adsorption followed by reductive degradation were each estimated at two effluent flow rates, viz., 757 and 1136 ℓ/min. Table 3.1.1 summarizes the cost information developed by MRI.

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*MRI, *Wastewater Treatment Technology Document for Aldrin/Dieldrin, Toxaphene, Endrin, DDT,* (February 6, 1976).

TABLE 3.1.1

INVESTMENT AND OPERATING COSTS ASSOCIATED WITH THE PROPOSED TECHNOLOGIES FOR TREATING TOXAPHENE-CONTAINING EFFLUENTS

Technology	**Carbon Adsorption (30 min. Contact Time)**	**Carbon Adsorption (60 min. Contact Time)**	**Resin Adsorption**		**Reductive Degradation**		**Two Systems in Series**	
Effluent Flow Rate	1136 ℓ/min	1136 ℓ/min	757 ℓ/min	1136 ℓ/min	757 ℓ/min	1136 ℓ/min	757 ℓ/min	1136 ℓ/min
Toxaphene in Treated Effluent	< 5 ppb	< 5 ppb	1.4 ppb	1.4 ppb	< 3 ppb	< 3 ppb	0.1 ppb	0.1 ppb
Total Installed Capital Equipment Cost (1975$)	$617,000	$794,000	$586,200	$770,400	$350,700	$433,700	$731,600	$955,900
Annual Operating Costs (1975$)								
Direct Costs								
Materials	9,800	9,800	93,400	140,100	4,400	6,600	97,800	146,700
Labor	19,000	19,000	30,400	32,500	30,400	32,500	49,900	54,100
Supervision	3,800	3,800	6,100	6,500	6,100	6,500	10,000	10,800
Payroll Charges	6,800	6,800	11,000	11,700	11,000	11,700	18,000	19,500
Maintenance	30,000	36,800	18,900	23,400	16,100	19,900	24,500	30,500
Operating Supplies	1,100	1,100	1,800	2,000	1,800	2,000	3,000	3,200
Utilities	6,200	6,200	1,500	2,300	2,900	4,400	4,200	6,400
Laboratory	3,800	3,800	6,100	6,500	6,100	6,500	10,000	10,800
Indirect Costs								
Depreciation	39,600	53,300	66,800	91,600	29,900	33,400	81,400	110,200
Property Taxes }	18,500	23,800	11,700	15,400	7,000	8,700	14,600	19,100
Insurance }			5,900	7,700	3,500	4,300	7,300	9,600
Capital Cost (interest)	38,800	50,000	36,900	48,500	22,100	27,300	46,100	60,200
Plant Overhead	16,100	17,500	33,800	45,000	15,800	18,000	43,500	56,400
Total Operating Costs	$194,000	$232,000	$324,300	$433,200	$154,100	$181,800	$410,300	$537,500
Unit Operating Costs $/kg of Toxaphene Product	0.0086	0.010	0.014	0.019	0.0068	0.0079	0.018	0.024

3.1.2 DDT

The only DDT plant now in operation does not discharge into a navigable stream so proposed effluent treatments may apply only to new DDT plants that might be constructed. In its report dated February 6, 1976, MRI proposed solvent extraction followed by a Friedel Crafts reaction, adsorption on XAD-4 resin, adsorption on activated carbon, or two-stage extraction with monochlorobenzene as possible technologies for treating effluents containing DDT. Cost estimates for solvent extraction followed by the Friedel Crafts reactions are developed for two effluent flow rates, viz., 113,550 and 170,325 ℓ/day. The cost estimates for the other treatment technologies are based on an effluent flow rate of 113,550 ℓ/day. Table 3.1.2 summarizes the cost information developed by MRI.

3.1.3 Endrin

In the same report, MRI proposed adsorption on XAD-4 resin, reductive degradation, adsorption on XAD-4 resin followed by reductive degradation, or adsorption on activated carbon as technologies for treating effluents containing endrin. Cost estimates for all the treatment technologies, except adsorption on activated carbon, are prepared for two different effluent flow rates, viz., 1136 and 2271 ℓ/min. Cost estimates for adsorption or activated carbon were developed for two different contact times (30 and 60 minutes), since MRI had insufficient data for determining the proper contact time. The cost estimates for adsorption on activated carbon were based on an effluent flow rate of 1136 ℓ/min. Table 3.1.3 summarizes the cost information developed by MRI.

3.1.4 Aldrin/Dieldrin

In the same report, MRI estimated the cost associated with evaporating the effluent stream from an aldrin/dieldrin manufacturing plant, indicating no other costs for handling effluents containing aldrin/dieldrin. The cost estimate for the evaporation pond is based on an effluent flow rate of 7570 ℓ/day. Table 3.1.4 summarizes the cost information developed by MRI.

3.2 ESTIMATED ADDITIONAL TREATMENT COSTS

Many of the pesticide manufacturers covered in this study currently practice some form of wastewater treatment and are already incurring the costs thereof. In these instances, the cost of the existing wastewater treatment is already exerting its influence on the price of the product. If the treatment measures presented by MRI are implemented, they will either replace or be added (in whole or in part) to the existing treatment steps. Therefore, if such treatment measures are implemented as the result of the proposed standards for toxic pollutants, the cost directly attributable to the standards would be the cost of the resultant treatment system less that of the cost of the existing treatment. In the following sections we explain the rationale we used in estimating the actual additional costs, which are presented in Table 3.2. These costs are only for toxaphene and endrin, since there are no point-source dischargers of DDT and aldrin/dieldrin.

TABLE 3.1.2

INVESTMENT AND OPERATING COSTS ASSOCIATED WITH THE PROPOSED TECHNOLOGIES FOR TREATING EFFLUENTS CONTAINING DDT

Technology	**Solvent Extraction/ Friedel Crafts**		**Resin Adsorption**	**Carbon Adsorption**	**Two Stage Extraction With Monochlorobenzene**
Effluent Flow Rate	113,550 ℓ/day	170,325 ℓ/day	113,550 ℓ/day	113,550 ℓ/day	113,500 ℓ/day
DDT in Treated Effluent	~ 590 ppb	~ 590 ppb	< 25 ppb	< 25 ppb	~ 32 ppb
Total Installed Capital Equipment Cost (1975$)	$381,000	$485,000	$209,000	$230,000	$101,000
Annual Operating Costs (1975$)					
Direct Costs					
Raw Materials	108,778	163,170	9,700	24,200	82,800
Operating Labor	56,538	62,546	17,200		
Supervision of Labor	11,308	12,510			
Maintenance	38,099	48,499	5,500		
Operating Supplies	3,391	3,751			
Utilities	145,163	217,746	2,300		
Laboratory Charges	11,308	12,510			
Indirect Costs					
Depreciation	38,099	48,499	12,100		
Property Taxes	7,621	9,698	2,900		
Insurance	3,809	4,849			
Capital Cost	24,005	30,557	6,000		
Plant Overhead	74,952	104,112	5,500		
Cost for Landfill of Treatment Solid Wastes ($/day)	7,920	12,240	5,800	5,800	
Coagulation, Sedimentation and Filtration	NONE	NONE	5,000	5,000	
Total Operating Costs	$531,000	$730,000	$ 72,000	$ 35,000	
Unit Operating Cost $/kg of DDT Product	0.0196	0.0189	0.0026	0.0013	0.0031

TABLE 3.1.3

INVESTMENT AND OPERATING COSTS ASSOCIATED WITH THE PROPOSED TECHNOLOGIES FOR TREATING EFFLUENTS CONTAINING ENDRIN

Technology	**Resin Adsorption**		**Reductive Degradation**		**Resin Adsorption and Reductive Degradation**		**Activated Carbon (30-min Contact Time)**	**Activated Carbon (60-min Contact Time)**
Effluent Flow Rate	1136 ℓ/min	2271 ℓ/min	1136 ℓ/min	2271 ℓ/min	1136 ℓ/min	2271 ℓ/min	1136 ℓ/min	1136 ℓ/min
Endrin in Treated Effluent	1.4 ppb	1.4 ppb	1 ppb	1 ppb	0.1 ppb	0.1 ppb	< 2 ppb	< 2 ppb
Total Installed Capital Equipment Cost (1975$)	$770,000	$1,260,000	$433,000	$631,000	$954,000	$1,541,000	$692,000	$870,000
Annual Operating Costs (1975$)								
Direct Costs								
Raw Materials	140,100	280,200	6,600	13,200	146,700	293,400	7,600	7,600
Operating Labor	32,500	36,400	32,500	36,400	54,100	61,900	19,000	19,000
Supervisor of Labor	6,500	7,300	6,500	7,300	10,800	12,400	3,800	3,800
Payroll Charges	11,700	13,100	11,700	13,100	19,500	22,300	6,800	6,800
Maintenance	23,500	35,500	20,000	30,200	30,600	46,300	30,000	36,800
Operating Supplies	2,000	2,200	2,000	2,200	3,200	3,700	1,100	1,100
Utilities	2,300	4,500	4,400	8,700	6,400	12,600	6,200	6,200
Laboratory	6,500	7,300	6,500	7,300	10,800	12,400	3,800	3,800
Indirect Costs								
Depreciation	91,500	160,300	33,300	48,200	110,000	188,400	45,400	59,100
Property Taxes	15,400	25,200	8,700	12,600	19,100	30,800	20,700	26,100
Insurance	7,700	12,600	4,300	6,300	9,500	15,400		
Capital Cost	48,500	79,400	27,300	39,800	60,100	97,100	43,600	54,800
Plant Overhead	45,000	77,300	18,000	23,700	56,400	93,000	15,700	17,000
Total Operating Cost	$433,200	$ 741,300	$181,800	$249,000	$537,200	$ 889,700	$203,700	$242,100
Unit Operating Cost $/kg Endrin Produced	0.158	0.273	0.066	0.092	0.198	0.326	0.0748	0.0880

TABLE 3.1.4

INVESTMENT AND OPERATING COSTS ASSOCIATED WITH THE PROPOSED EVAPORATION TECHNOLOGY FOR TREATING EFFLUENTS CONTAINING ALDRIN/DIELDRIN

Effluent Flow Rate	7,570 ℓ/day
Total Installed Capital Cost (1975$)	24,100
Annual Operating Costs (1975$)	
Direct Costs	
Labor	830
Supervision	170
Payroll Charges	300
Maintenance	800
Operating Supplies	50
Laboratory	170
Indirect Cost	
Depreciation	590
Property Taxes	480
Insurance	240
Capital Cost	1,520
Plant Overhead	460
Total Operating Costs	5,610
Unit Operating Cost $/kg aldrin/dieldrin Produced	0.0132

TABLE 3.2

PESTICIDE TREATMENT COST TO SELLING PRICE RATIOS*

Product	Effluent Level Achievable (ppb)	Selling Price ($/kg)	A. Cost of Proposed Treatment (from 3.1.1 and 3.1.2)				B. Cost of Existing Treatment				C. Cost of Additional Treatment			
			Treatment Cost		Percent of Selling Price		Treatment Cost		Percent of Selling Price		Treatment Cost		Percent of Selling Price	
			High ($/kg)	Low ($/kg)	High (%)	Low (%)	High ($/kg)	Low ($/kg)	High (%)	Low (%)	High ($/kg)	Low ($/kg)	High (%)	Low (%)
Endrin[1]	1.4	6.60	0.273	0.158	4.1	2.4	0.033	0.026	0.5	0.4	0.240	0.132	3.6	2.0
Endrin[2]	1.0	6.60	0.092	0.066	1.4	1.0	0.033	0.026	0.5	0.4	0.059	0.040	0.9	0.6
Endrin[3]	0.1	6.60	0.326	0.198	4.9	3.0	0.033	0.026	0.5	0.4	0.293	0.172	4.4	2.6
Endrin[4]	<2	6.60	0.088	0.075	1.3	1.1	0.033	0.026	0.5	0.4	0.055	0.049	0.8	0.7
Toxaphene														
Hercules[5]	1.4	0.84	0.0191	0.0143	2.3	1.7	(approx. 0.00128)		0.15		0.0178	0.0130	2.1	1.6
Hercules[6]	<3	0.84	0.0079	0.0068	0.9	0.8	(approx. 0.00128)		0.15		0.0066	0.0055	0.79	0.66
Hercules[7]	0.1	0.84	0.0238	0.0180	2.8	2.2	(approx. 0.00128)		0.15		0.0225	0.0167	2.7	2.0
Hercules[8]	<5	0.84	0.0103	0.0086	1.2	1.0	(approx. 0.00128)		0.15		0.0090	0.0073	1.1	0.87
Riverside[9]	–	0.84	0.0110		1.3		NIL		NIL		0.0110		1.3	
Vicksburgh[9]	–	0.84	0.0088		1.0		NIL		NIL		0.0088		1.1	

*Monitoring costs are not included above. These costs, EPA reports, could be as high as $40,000 per year if done by an outside laboratory. However, the manufacturers will probably do the testing themselves for much less.

(1) Treatment via resin adsorption
(2) Treatment via reductive degradation model technology for meeting standards
(3) Treatment via resin adsorption plus reductive degradation
(4) Treatment via activated carbon adsorption
(5) Treatment via resin adsorption model technology for meeting standards
(6) Treatment via reductive degradation
(7) Treatment via resin adsorption plus reductive degradation
(8) Treatment via activated carbon adsorption
(9) Treatment costs supplied by EPA

3.2.1 Toxaphene

Hercules, Inc. – Hercules' existing facility currently treats toxaphene-containing wastewater by means of neutralization and sedimentation. The proposed treatment schemes include neutralization and sedimentation as pretreatment steps to be used ahead of the more operationally sensitive resin adsorption, carbon adsorption, and the like. Thus, a portion of the cost of the proposed treatment is already being incurred. By subtracting those cost components associated with the neutralization and sedimentation steps, we were able to estimate the incremental treatment cost for the Hercules plant.

Riverside Chemical Co., and Vicksburg Chemical Co. – Since, at this time, the levels of toxaphene in wastewater from these operations has not been firmly determined, there is no treatment in place that is specifically intended for toxaphene removal. Therefore, we have assumed that the treatment costs supplied by EPA are total costs and will be fully incurred by these plants (should treatment be required).

3.2.2 Endrin

The existing wastewater treatment at the Velsicol Chemical Corp. plant consists of sedimentation and filtration, both of which are included in the costs for the four treatment alternatives presented by MRI. As in the case of toxaphene, we estimated the incremental costs by subtracting the appropriate cost components from the total cost.

3.3 COST TO THE FORMULATORS OF MEETING THE PROPOSED STANDARDS

The proposed standards prohibit any discharge from any formulators of toxaphene, DDT, endrin or aldrin/dieldrin. These standards apply to all discharges into navigable waters, including stormwater and other runoff, from formulating areas, loading and unloading areas, storage areas, and other areas which are subject to direct contamination by any of these four pesticides as a result of the formulating process. This includes all discharges of process wastewaters and all discharges of water used for routine cleanup or cleanup of spills, but excludes fallout from fugitive air emissions.

The Environmental Protection Agency prepared a worst case estimate of the costs that formulators would incur in meeting the proposed standards. The EPA cost estimate assumed that a formulator would have to do the following in order to meet the proposed standards:

1. Place the entire formulation operation onto a concrete slab.
2. Cover the entire formulation operation with a metal roof.
3. Put curbing around the entire plant to prevent runoff.

Although the ADL survey results indicate that these costs will not generally be incurred by formulators, it can be assumed that such costs, if necessary, would fall most heavily on those formulators whose output of the specified pesticides is small in absolute terms (i.e., the cost is large compared to sales volume) but large relative to total output of all pesticides (i.e., the product line could not be dropped without potentially serious profit impact). In order to roughly determine the number of plants who might fit this set of conditions, EPA selected a cost-to-price ratio of 5% or greater and a 307(a) pesticide-to-total output ratio of 5% or greater. The application of these conditions by EPA indicated that less than 20 plants fit the specified conditions for worst case costs.

Because of uncertainty as to the increment of the estimated costs that formulators might incur, a telephone survey was made of pesticide formulators in order to establish what formulators would actually have to do to meet the proposed standards. ADL selected for survey by telephone those formulators affected by the proposed standards for whom information was available based on previous ADL contacts. It is the results of this telephone survey which form the basis of ADL's appraisal of the economic impact of the proposed standards as reported in Section 4.0 of this report.

4.0 ECONOMIC IMPACT ASSESSMENT

4.1 MANUFACTURERS

4.1.1 Aldrin/Dieldrin

There are no aldrin/dieldrin manufacturers who are point-source dischargers. Thus, the proposed toxic standards will have no economic impact upon any current aldrin/dieldrin manufacturers.

When the EPA removed the registration for the agricultural uses of aldrin/dieldrin, Shell Chemical Company was the only manufacturer. The Shell plant was shut down when the aldrin/dieldrin registration was cancelled. The effluent treating facilities at the Shell plant prevented any discharge of effluents containing aldrin/dieldrin. Thus, if Shell resumed manufacturing aldrin/dieldrin, it would not be impacted by the proposed toxic standards.

Any new manufacturers would be able to install treatment facilities similar to Shell's. The treatment costs they would incur would, therefore, be no greater than the costs Shell incurred before it shut down its aldrin/dieldrin plant and those costs have been reflected in market prices.

4.1.2 DDT

There are no DDT manufacturing operations which are point-source dischargers of effluents containing DDT. Thus, no manufacturing operations will incur an economic impact attributable to the proposed toxic standards.

Montrose Chemical Company is currently the only manufacturer of DDT in the United States. Any new DDT manufacturing operation would be able to meet the proposed toxic standards using a treatment technology which is less expensive than the technology now used by Montrose to handle its effluents. Thus, the proposed toxic standards will have no economic impact on new manufacturers.

4.1.3 Endrin

The only manufacturer of endrin within the United States is the Velsicol Chemical Corporation. The proposed standards could be met using reductive degradation or carbon adsorption treatment of effluents. Using reductive degradation, Velsicol would incur a maximum incremental treatment cost of $0.059/kg (treatment cost to selling price ratio equals 0.9%). This cost increase would not have an economic impact on either the company or the community. If activated carbon is used to meet the proposed toxic standards, the higher treatment cost might cause an economic impact.

The nature of the specific economic impacts of a treatment cost higher than the cost of reductive degradation is dependent upon the competitive market for endrin and for the company itself. The demand for endrin is generally regarded as inelastic. Endrin can be characterized as an extremely efficacious, broad-spectrum insecticide which faces competition only in certain pest control markets.

The impact of treatment costs will be determined more by price competition within the industry than by price competition from other pesticides. Velsicol faces substantial competition in the world endrin market. Royal Dutch Shell produces endrin in Europe in substantial quantities (reportedly about 14-18 million pounds annually or about 2.8-3.6 times Velsicol's annual export sales). Shell is believed to be marketing substantial quantities of endrin in the United States. Most of this product is presumably from inventory, but substantial imports were reported to have been made by Shell as recently as 1973. Shell is recognized as the "price leader" for the endrin market.

4.1.4 Toxaphene

There are four manufacturers of toxaphene: Hercules, Tenneco, Riverside, and Vicksburg. Only Hercules, Riverside, and Vicksburg are direct dischargers covered by the proposed standards. Vicksburg and Riverside would incur an incremental treatment cost no greater than $0.0110/kg (treatment cost to selling price ratio equals 1.3%). The level of cost increase these two companies would actually incur would not be judged as being economically impactive to either the companies or the community under our criteria.

Since Hercules can meet the proposed standards using reductive degradation or carbon adsorption, the additional cost it would incur is less than $0.0090/kg (treatment cost to selling price ratio equals 1.1%). This additional cost would not be judged as being economically impactive to either the company or the community. A higher treatment cost might result in an economic impact. Precise estimation of the impact would be uncertain because of the following:

- The diversity of the crop/pest markets in which toxaphene is consumed;
- Differing competitive situations in these markets; and
- A complex production structure.

The market for toxaphene is generally characterized by an inelastic demand. The cost/benefit ratio for toxaphene users is favorable with respect to competing products, so that modest price increases for toxaphene are unlikely to induce a switch by consumers to competing products. Historic sales data show a market insensitivity to price increases. Toxaphene prices have increased an estimated 50% since 1972, from about $0.55/kg ($0.25/lb) to about $0.77/kg ($0.35/lb), while U.S. sales are believed to have increased during the period. A sales drop in 1975 is commonly attributed to decreases in cotton acreage, not price resistance.

As in the case with endrin, the impact of treatment costs on producers depends on the competitive structure within the industry rather than on competition from other products.

4.2 FORMULATORS

ADL conducted a telephone survey of 16 companies which manufacture formulations containing pesticides subject to the proposed toxic standards. The 16 companies operate 32 plants of various sizes; the largest operation has around 60 employees and the smallest operation has only three employees. The plants surveyed are scattered throughout the United States. Appendix III contains data indicating the representativeness of the ADL survey.

Table 4.2 shows the size and location of the plants contacted and the results of the telephone survey. The substance of the proposed regulations was described to an appropriate person at each plant contacted. None of the plants contacted indicated that it had any process or cooling water discharges containing pesticides subject to the proposed standards. Also, all plants surveyed indicated that their present practices virtually precluded any accidental discharge of the pesticides subject to the proposed standards. Thus, none of the plants surveyed would be expected to incur any significant capital costs in meeting the proposed toxic standards. Some of the small formulators, however, indicated concern about the administrative and monitoring costs that they might incur, and they indicated that these costs might cause them to cease formulating the affected pesticides.

ADL believes that the findings of the telephone survey are representative of the practices in the pesticide formulation industry, and that it is very unlikely that any formulators will incur significant costs in implementing treatment to meet the proposed standards.

TABLE 4.2

RESULTS OF THE TELEPHONE SURVEY

Company Contact No.	States in Which Formulation Plants are Located	Number of Plants	Number of Employees	
1	GA	1	45	All formulation is done indoors. Raw materials, including technical grade toxaphene, are stored in tanks, while formulated product is stored outdoors on a concrete slab. The loading dock is covered but not enclosed. In the event of a spill, soda ash is applied to neutralize the toxaphene and then an absorbent is applied. The absorbent is then picked up and sent to an EPA-approved landfill.
2	SC	1	45	Formulate mainly toxaphene products. They used to formulate a lot of endrin, but do very little endrin formulation now. Formulation is carried out under a roof; the formulation area has no walls. Any spills go to a sump tank, the contents of which will be disposed of at an EPA-approved landfill. Raw materials are stored in a warehouse which has a concrete floor. The loading area is uncovered. Any spills on it would be picked up with absorbents.
3	KS	1	60	Storage is in tanks which are surrounded by dikes. The formulation area is indoors. Liquid spills either go down a drain to a sump and are evaporated, or are picked up with absorbent which is taken to an EPA-approved landfill. The loading dock which is 12' x 60' is not covered. Any spills on it are immediately picked up with an absorbent.
4	NC	1	12	Formulation is done under a roof; the structure has no sides. Formulated product is stored in a shed. The loading dock is covered. All toxaphene spills are immediately neutralized with soda ash and then picked up.
5	NC	1	6	Formulation and storage are all within buildings. The loading dock is covered by an awning. They formulate only toxaphene dust. Any spills are immediately vacuumed up.
6	AR, MO, MS TN, TX, NC SC, AL, FL GA, CA	17	1000 total for company. Some plants have as few as 3 employees.	All the toxaphene formulations are emulsifiable concentrates. The formulations typically contain toxaphene combined with methyl parathion, an emulsifier, and a solvent such as xylene or mineral spirits. All tank farms are diked and pumps are located in the diked areas. Toxaphene arrives by tank truck. Endrin formulation is also done. The endrin arrives at the plant in drums. Four plants use a slab height loading station with the truck located in a depressed loading pit. The concrete floor of the pit ends in a sump which can be pumped to an evaporation tank. All the other plants have a canopy-covered loading dock which is at truck height.
7	FL	1	8	The whole operation – storage, formulation, and loading – is carried out within one building.
8	CA	1	50	Formulation is in a steel-roofed shed building. The plant has a cement curb around it, so spills cannot be washed off the plant site. The loading dock is wide open. Any spills are immediately covered with absorbent which is shipped away for disposal.

TABLE 4.2 (Continued)

Company Contact No.	States in Which Formulation Plants are Located	Number of Plants	Number of Empoyees	
9	CA	1	10	They formulate relatively dilute formulations for use by homeowners. The entire operation is carried out indoors. The loading area is covered with a roof. The loading dock also slopes toward the plant so any spills would drain into the building. The packing material they use would absorb any spills resulting from broken containers.
10	CA	1	20	The firm believes toxaphene will be cancelled by the EPA in the near future and therefore it would be unwilling to spend any money to meet new toxaphene standards. The contour of their land combined with the large acreage of their plant site precludes any runoff. Their present operations meet local regulations which do not permit any discharge by them to sewage, rivers, etc., no matter how indirect. Presently their entire operation is conducted outdoors. To roof their formulation area, they would have to cover an area 50 feet by 40 feet.
11	OR	1	45	All formulation work is done indoors. Storage tanks are surrounded by dikes and the loading dock is covered.
12	MS	1	15	Manufacture only about 1000 pounds of toxaphene formulation per year. The firm is located next to a cotton field where toxaphene is applied by airplane. All their operations are indoors. Trucks back to the edge of the building for loading. The open space between the building and the truck is not greater than six inches.
13	IL	1	50	Have ceased formulating pesticides subject to the proposed toxic standards. They used up their last supplies of aldrin/dieldrin two years ago. They said they contacted Shell for more, but Shell indicated that there was no more available anywhere. Toxaphene has not been formulated in the plant for over five years.
14	GA	1		Formulation is done indoors. The loading dock is covered.
15	SC	1	23	The formulations are done outdoors. The plant has catch basins so that all runoff is collected. If a catch basin should exceeds a critical level, it is drained into drums which are disposed of at an approved landfill.
16	IL	1	17	Purchase formulated material and mix it into only one product. Storage and formulation are indoors. Loading is direct from the building into vehicles which drive up against it.

APPENDIX I

PROFILE OF THE PESTICIDE FORMULATOR INDUSTRY†

A. NUMBER/SIZE OF PLANTS*

	Total Plant Formulations (million lb/yr)***								
	Endrin				Toxaphene				
Number of Formulations	<1	1-10	>10	Total	<0.1	0.1-1	1-10	>10	Total
1-10	2	4	–	6	5	9	10	–	24
10-20	5	12	1	18	–	5	15	–	20
20-30	–	3	–	3	–	2	8	3	13
30-40	–	1	–	1	–	1	2	–	3
40-65	–	3	1	4	–	4	10	5	19
65-100	–	–	1	1	–	–	4	6	10
100	–	2	4	6	–	–	4	6	10
Total**	7	25	7	39	5	21	53	20	99
Output for Specific Pesticide									
(thousands of pounds – Range)	–	1-70	2-640	1-204	–	1-24	11-576	3-6400	2-3254
Mean)	–	30	102	72	–	9	168	735	815

†Prepared by the Office of Planning and Evaluation, EPA, April 1976, from data provided by the Office of Enforcement, EPA.

*Plants with registration for pesticide indicating intent to formulate in 1975.

**Endrin and Toxaphene totals do not add, due to double counting.

***Size obtained by rough total adjusting of liquid formulations to pounds at 8 lb/gal.

* * * * * * *

B. GENERAL STATISTICS

- Formulation per plant ranged from 1000 to 6,400,000 pounds and 1000 to 640,000 pounds for toxaphene and endrin, respectively.

- Range, mean, and median output per plant for toxaphene and endrin show no strong correlations with total output for all formulations or number of formulations. It is assumed that this reflects the fact that the particular combinations of formulations for a given plant are relatively random events.

- For the pesticides other than endrin and toxaphene, there are too few formulators for any general observations. The breakout is as follows:

Pesticide	No. of Active Formulators	Total Formulation (this pesticide) ($lbx10^3$)
Aldrin	3	D*
Dieldrin	6	246
DDT	1	D

*Disguised – three or fewer plants

* * * * * * *

C. REGIONAL PROFILE (ACTIVE FORMULATORS)

EPA Region	Pesticide	No. Plants	Output (million lb)
I	Endrin	0	0
	Toxaphene	0	0
II	Endrin	1	D*
	Toxaphene	2	D
III	Endrin	0	0
	Toxaphene	0	0
IV	Endrin	21	1.6
	Toxaphene	65	45.2
V	Endrin	0	0
	Toxaphene	9	0.9
VI	Endrin	9	0.8
	Toxaphene	24	11.0
VII	Endrin	3	D
	Toxaphene	13	8.6
VIII	Endrin	1	D
	Toxaphene	3	D
IX	Endrin	2	D
	Toxaphene	10	1.7
X	Endrin	2	D
	Toxaphene	7	0.8
TOTAL	Endrin	39	2.4+
	Toxaphene	133	68.2+

*Disguised – three or fewer plants

APPENDIX II

POSSIBLE ALTERNATES FOR THE PESTICIDES COVERED BY THE PROPOSED TOXIC POLLUTANT STANDARDS

A. INTRODUCTION

This appendix presents possible alternates for toxaphene and endrin. Whether the use of these alternates has been approved by the EPA was not considered in preparing the information on possible alternates. DDT is not discussed in this section since it is no longer used in the United States, but it is still widely used in developing countries. Aldrin/dieldrin is also not covered because its current use is extremely limited in the United States. The information on alternates was developed for use in assessing the impact of the proposed standards on the users of toxaphene and endrin. As work progressed, it became evident that effluent treatment costs at the manufacturing plants may be low enough so that no significant changes in bulk prices would be encountered. Therefore, the information is presented as general background information and for possible later use in considering potential options available to independent formulators.

There are certain aspects of the availability of substitutes that are beyond the scope of this report. These are:

- Relative efficacy – Efficacy is a function of crop, region, weather, pest to be controlled, and the like. Alternates indicated in this section may not be so efficacious as toxaphene or endrin.

- Spectrum of control – In many instances, toxaphene and endrin are used to control a large number of pests. Alternates may not have this characteristic. The spectrum of control required by users varies considerably.

- Relative costs – The raw price of the alternates is not the only factor which might make alternates more expensive. The substitute might require more applications, be more expensive to handle, and so forth.

- Supply – Alternates may not be produced in sufficient quantities. The increased demand for the alternates could cause its price to increase.

The alternates that are described in this section are registered in the United States, although not necessarily for use as endrin or toxaphene alternates. Some of them may not be readily available for export to foreign customers who are major users of endrin or toxaphene.

B. TOXAPHENE

Table II-1 presents a breakdown of the major uses of toxaphene. Tables II-2 through II-7 show on which pests toxaphene was used for all except the pests of vegetable crops. For each pest, the possible alternates for toxaphene are indicated. Table II-8 shows the same information for vegetable crops.

TABLE II-1

BREAKDOWN OF TOXAPHENE USAGE

Usage	Percent
Cotton	75.0
Soybeans	4.1
Peanuts	3.6
Beef Cattle	9.3
Swine	2.3
	94.3
Other Field Crops	2.6
Vegetable Crops	2.1
	99.0

Source: Arthur D. Little, Inc., calculations based on 1971 U.S. Department of Agriculture data.

TABLE II-2

TOXAPHENE ALTERNATES

Insect Pesticide	Beet Armyworms	Boll Weevil	Bollworm	Cotton Fleahopper	Cotton Leaf Perforator	Cutworms	Flea Beetle	Garden Webworm	Grasshopper	Lygus Bugs	Thrips
Toxaphene				*		*	*	*	*	*	*
Toxaphene and Methyl Parathion		*	*	*	*	*					*
Toxaphene and Trichlorfon	*										
Toxaphene and MP and Chlordimeform			*								
Aldicarb				*							*
Azinphosmethyl		*		*						*	*
Carbaryl		*	*	*	*	*		*	*	*	*
Chlordimeform			*		*						
Dicrotophos				*						*	*
Dimethoate				*						*	*
Disulfoton											*
Endrin			*								
EPN		*	*								
EPN and Methyl Parathion		*	*								
Malathion		*		*				*	*	*	*
Methomyl					*						
Methyl Parathion	*	*	*	*	*			*	*	*	*
Methyl Parathion and Chlordimeform			*								
Methyl Parathion and Parathion					*						
Monocrotophos		*	*	*						*	
Monocrotophos and Chlordimeform		*	*	*	*					*	
Naled									*		
Parathion				*						*	
Phorate											*
Phosphamadin				*						*	*
Strobane						*					
Trichlorfon	*			*	*	*		*		*	

Note: This table should in no way be considered complete. These data are based on information contained in the USDA "Guidelines for the Use of Insecticides," and in the State insect control regulations for cotton in Texas, California, Alabama, and Louisiana. It is in no way complete. No doubt other compounds are recommended elsewhere.

TABLE II-3

TOXAPHENE ALTERNATES

Soybeans (4.1%)

Pesticide Pest	Toxaphene	Azinohosmethyl	Carbaryl	Carbophenthion	Chlordane	Disulfoton	Malathion	Methyl Parathion	Methomyl	Methoxychlor
Bean Leaf Beetle	•	•	•				•			
Corn Earworm	•		•					•	•	
Fall Armyworm	•		•					•		
Flea Beetle	•									
Garden Webworm	•		•				•			
Grasshopper	•		•		•		•			
Green Cloverworm	•	•	•				•		•	
Mexican Bean Beetle	•	•	•	•		•	•		•	•
Soybean Looper	•								•	
Thistle Caterpillar	•									
Thrips	•		•			•	•			

Note: This figure should in no way be considered complete. It is based on the USDA "Guidelines for the Use of Insecticides" and on State extension regulations in Iowa, Kansas, and Virginia.

TABLE II-4

TOXAPHENE ALTERNATES

Peanuts (3.6%)[1]

Pesticide Pest	Toxaphene	Carbaryl	Diazinon	Disulfoton	Malathion	Methomyl	Phorate	Trichlorfon
Corn Earworm	*	*				*		
Cutworm	*		*					*
Fall Armyworm	*	*				*		
Green Cloverworm	*	*				*		
Potato Leafhopper	*	*	*	*	*		*	
Thrips	*	*		*	*			

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1. There were no recommendations for using toxaphene on peanuts in Virginia, South Carolina, and in the USDA "Guidelines for the Use of Insecticides." This table was constructed using the insects found on cotton which are treated with toxaphene. The competing chemicals are those actually recommended for peanuts in either Virginia, South Carolina, or in the USDA guidelines.

TABLE II-5

TOXAPHENE ALTERNATES

Beef Cattle (9.3%)

Pesticide Pest	Toxaphene	Ciodrin and DDUP	Coumaphos	Crotoxphos	Crufomate	Delnav	Dioxathion	Imidan	Lindane	Malathion	Methoxychlor	Phenathiazine	Pyrethrins and Piperonyl Butoxide	Ronnel
Horn Fly	*		*	*	*		*	*		*	*	*		*
Lice	*	*	*	*	*	*	*	*		*	*		*	*
Mites	*								*					
Ticks	*	*	*	*	*	*	*	*	*	*				*

Note: This table should not be considered complete. It is based on the USDA "Guidelines for the Use of Insecticides," and the Texas Extension Services brochure, "Suggestions for Controlling External Parasites of Livestock and Poultry," and the "Summary of Iowa Insect Pest Control Recommendations for 1974."

TABLE II-6

TOXAPHENE ALTERNATES

Swine (2.3%)

Pesticide Pest	Toxaphene	Ciodrin and DDUP	Coumaphos	Crotoxphos	Crufomate	Delnav	Dioxathion	Imidan	Lindane	Malathion	Methoxychlor	Phenathiazine	Pyrethrins and Piperonyl Butoxide	Ronnel
Lice	*		*	*			*		*	*	*			*
Mites	*								*	*				

Note: This table should not be considered complete. It is based on the USDA "Guidelines for the Use of Insecticides," and the Texas Extension Services brochure, "Suggestions for Controlling External Parasites of Livestock and Poultry," and the "Summary of Iowa Insect Pest Control Recommendations for 1974."

TABLE II-7

TOXAPHENE ALTERNATES

Other Field Crops (2.6%)

Corn

Pesticide / Pest	Toxaphene	Carbaryl	Carbofuran (Furadan)	Diazinon	EPN	Malathion	Naled (Dibrom)	Parathion	Thimet	Trichlorfon
Armyworm	*	*		*		*		*		*
Chinch Bug	*									
Corn Earworm	*									
Cutworms	*	*								
European Corn Borer	*	*	*	*	*				*	*
Fall Armyworm	*	*						*		
Grasshoppers	*	*		*		*	*			
Mormon Cricket	*									

Note: This table should in no way be considered complete. It is based on the USDA "Guidelines for the Use of Insecticides," and on the "Summary of Iowa Insect Pest Control Recommendations for 1974."

TABLE II-8

TOXAPHENE ALTERNATES

Crop	Pest	Pesticides for Controlling
1. Beans	Lygus Bugs	Toxaphene and Malathion
2. Brussel Sprouts	Cabbage Looper and Cabbageworm	Toxaphene and Parathion Toxaphene Malathion Naled Parathion
	Cutworms	Toxaphene
3. Cabbage	Cutworms	Toxaphene
4. Cauliflower	Cutworms	Toxaphene
5. Collards	Cutworms	Toxaphene
6. Eggplant	Cutworms	Toxaphene
7. Kale	Cabbage Looper and Cabbageworm	*Bacillus Thuringiensis* Toxaphene Methomyl Mevinphos (Phosdrin)* Parathion
8. Peppers	Pepper Weevil	Toxaphene
9. Rutabaga	Cutworm	Toxaphene
10. Tomatoes	Blister Beetle	Toxaphene Endosulfan Methoxychlor Naled

*Kentucky State Cooperative Extension Service recommendations.

Source: USDA "Guidelines for the Use of Insecticides."

C. ENDRIN

Table II-9 presents a breakdown of the major uses of endrin. Tables II-10 through II-13 show on which pests endrin is used and the endrin substitutes that are available.

TABLE II-9

ENDRIN USAGE, 1971

	1000 lbs	Metric Tons
Corn	30	13.6
Cotton	1065	483.0
Wheat	5	2.27
Other Grains	25	11.34
Soy Beans	23	10.43
Other Field Crops	226	102.49
Irish Potatoes	5	2.27
Other Vegetables	1	0.45
Apples	2	0.91
Other Fruits and Nuts	33	14.97
	1418	641.73

Note: Current usage in the United States is probably only 1 million pounds.

Source: Arthur D. Little, Inc., calculations based on 1971 U.S. Department of Agriculture data.

TABLE II-10

ENDRIN ALTERNATES

Cotton 80% Pesticide Pest	Endrin	Aldicarb	Azinphosmethyl	Bacillus Thuringiensis	Carbaryl	Chlordimeform	Diazinon	Dicrotophos	Dimethoate	Disulfoton	Endosulfan	EPN	EPN and Methyl Parathion	Malathion	Methomyl	Methyl Parathion	Ethyl Parathion and Parathion	Monocrotophos	Monocrotophos and Chlordimeform	Naled	Parathion	Phorate	Phosphamidon	Strobane	Toxaphene	Toxaphene and Methyl Parathion	Toxaphene and Methyl Parathion and Chlordimeform	Trichlorfon
Boll Weevil	*		*		*							*	*	*		*		*								*		
Bollworm	*				*	*						*	*			*		*	*							*	*	
Brown Cotton Leafworm	*		*											*							*							
Cabbage Looper	*			*		*					*									*								
Celery Leaftier	*																											
Cotton Leafworm	*		*		*									*		*					*							
Cutworms	*				*																			*	*	*		*
Flea Hopper	*	*	*		*			*	*					*		*					*		*		*	*		*
Garden Webworm	*				*									*		*									*			*
Grasshoppers	*				*									*		*				*					*			
Greenhouse Leaftier	*																											
Leaf Perforator	*				*	*									*	*	*									*		*
Lygus Bugs	*				*			*	*					*		*		*			*		*		*			*
Rapid Plant Bug	*				*			*	*					*		*		*							*			*
Salt Marsh Caterpillar	*						*									*												*
Tarnished Plant Bug	*		*		*			*	*					*		*		*							*			*
Thrips	*	*	*		*			*	*	*				*		*		*				*	*		*	*		

Note: This table should not be considered all-inclusive. It is based on data obtained from Velsicol, the USDA "Guidelines for the use of Insecticides," and State Extension Services recommendations in Alabama, California, Mississippi, Louisiana, and Texas. Typical endrin usage indicated here is probably exaggerated. By the five states and USDA, endrin was recommended only for use on bollworms and the greenhouse.

TABLE II-11

ENDRIN ALTERNATES

Apples	Endrin	Chlorophacinone	Sodium Fluoroacetate	Strychnine	Zinc Phosphide
Meadow Mice	*	*		*	*
Pine Mice	*[1]		*	*	

1. Endrin acts as a repellent for use against the pine mouse.

Source: USDA

TABLE II-12

ENDRIN ALTERNATES

	Endrin	Chlordane
Sugarcane Beetle*	*	*

*Presently treatment of the sugarcane beetle is recommended in neither Florida, Louisiana, nor the USDA "Guidelines for the Use of Insecticides." In the past, chlordane rather than endrin was recommended for use on sugarcane beetles in Louisiana.

TABLE II-13

ENDRIN ALTERNATES

Pesticide Pest	Endrin	Endosulfan	Parathion	Toxaphene	Trichlorfon[2]
Armyworm	*		*[1]	*	*
Army Cutworm	*	*			*
Cutworms	*				
Fall Armyworms	*		*[1]	*	*
Pale Western Cutworms	*				

1. Except on rye.
2. Recommended on wheat in Kansas.

Note: This table should not be considered all-inclusive. It is based on data from Velsicol, the USDA "Guidelines for the Use of Insecticides," and State Extension Services recommendations in Kansas and Oregon.

APPENDIX III

REPRESENTATIVENESS OF THE ADL TELEPHONE SURVEY

Table III-1 shows the distribution of formulators who make endrin and toxaphene formulations by total volume of all formulations and number of label registrations. Shown in parentheses is the distribution of firms contacted by ADL in the telephone survey.

TABLE III-1

DISTRIBUTION OF FORMULATOR PLANTS IN ADL'S TELEPHONE SURVEY COMPARED TO DISTRIBUTION OF PLANTS ACCORDING TO PRODUCTION LEVEL AND LABEL REGISTRATION

	Total Production of All Formulators (million lb/yr)						
	Endrin Formulators			Toxaphene Formulators			
Label Registrations	<1	1-10	>10	<0.1	0.1-1	1-10	>10
1-10	2	4	–	5	9(1)	10(1)	–
10-20	5(3)	12(4)	1	–	5(2)	15(4)	–
20-30	–	3	–	–	2	8(1)	3(1)
30-40	–	1(1)	–	–	1	2(1)	–
40-65	–	3	1(1)	–	4(1)	10(1)	5(1)
65-100	–	–	1	–	–	4	6
>100	–	2(2)	4(1)	–	–	4(4)	6(2)

Note 1: Plain numbers indicate plants with registration for pesticide indicating intent to formulate in 1975.

Note 2: Numbers in parentheses indicate plants in ADL's telephone survey.

Source: Distribution information supplied by EPA.

Tables III-2 and III-3 show the distribution of endrin and toxaphene production by formulators related to the number of plants surveyed.

TABLE III-2

DISTRIBUTION OF ENDRIN PRODUCTION BY FORMULATORS RELATED TO THE NUMBER OF PLANTS SURVEYED (1975)

Endrin Projected Output, 1975 (million lb)	Number of Plants	Surveyed
1- 10	7	4
11- 25	11	3
26- 50	3	1
51-100	8	1
101-200	6	2
201-300	2	1
301-400	1	0
401-500	0	0
501-750	1	0
	39	12

Source: Distribution information supplied by U.S. Environmental Protection Agency.

TABLE III-3

SIZE DISTRIBUTION OF TOXAPHENE PRODUCTION BY FORMULATORS RELATED TO THE NUMBER OF PLANTS SURVEYED (1975)

Toxaphene Projected Output, 1975 (million lb)	Number of Plants	Surveyed
1- 10	6	1
11- 25	10	3
26- 50	9	1
51- 100	9	2
101- 200	11	2
201- 300	9	2
301- 400	6	1
401- 500	5	0
501- 750	12	3
751-1000	4	1
1001-1500	7	2
1501-2000	6	1
2001-3000	2	1
3001-4000	1	0
4001-5000	1	0
5001+	1	0
	99	20

Source: Distribution information supplied by U.S. Environmental Protection Agency.

BIBLIOGRAPHIC DATA SHEET

1. Report No.
EPA-230/3-76-016

2.

3. Recipient's Accession No.

4. Title and Subtitle
Economic Impact Assessment of Proposed Toxic Pollutant Effluent Standards for Manufacturers and Formulators of Aldrin-Dieldrin, DDT, Endrin, and Toxaphene

5. Report Date
May 1976

6.

7. Author(s)
Anon.

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Arthur D. Little, Inc.
Acorn Park
Cambridge Mass. 02140

10. Project/Task/Work Unit No.

11. Contract/Grant No.
68-01-1902

12. Sponsoring Organization Name and Address
Office of Planning and Evaluation
U.S. Environmental Protection Agency
Washington, D. C. 20460

13. Type of Report & Period Covered
Proposal

14.

15. Supplementary Notes

16. Abstracts

An assessment of the economic impact of proposed toxic pollutant effluent standards for the manufacturers and formulators of Aldrin-Dieldrin,DDT, Endrin, and Toxaphene (Section 307(a) of the Fed. Water Poll. Cont. Act) was performed, based on abatement cost data supplied by EPA. It was concluded that there will be no significant adverse economic impact upon prices, sales, profitability, employment, or the end use markets for these pesticides. In aggregate, compliance will require additional investment in treatment facilities of $0.8 - 1.1 million with annualized total costs of $0.5 -0.7 million. The impact on prices will be potential increases of no greater than 2.3%.

The assessment includes descriptions of firms, plants, and markets for these pesticides; investments and operating costs for the abatement technologies; evaluation of pricing for these products and potential adverse impacts.

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

Economic Analysis
Water Pollution
Pesticides

17b. Identifiers/Open-Ended Terms

Toxic Pollutant Effluent Standards
Federal Water Pollution Control Act

17c. COSATI Field/Group

18. Availability Statement
Release Unlimited

19. Security Class (This Report)
UNCLASSIFIED

20. Security Class (This Page
UNCLASSIFIED

21. No. of Pages
62

22. Price