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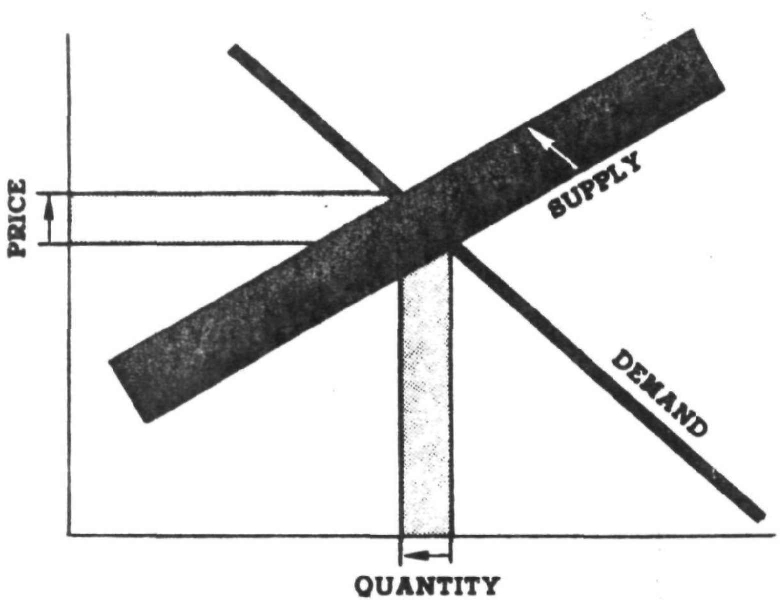
ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES

Independent Rendering Industry



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

ECONOMIC ANALYSIS OF PROPOSED EFFLUENT GUIDELINES
INDEPENDENT RENDERING INDUSTRY

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PREFACE

The attached document is a contractor's study prepared with the supervision and review of the Office of Planning and Evaluation of the U.S. Environmental Protection Agency (EPA). Its purpose is to provide a basis for evaluating the potential economic impact of effluent limitations guidelines and standards of performance established by EPA pursuant to section 304(b) and 306 of the Federal Water Pollution Control Act.

The study supplements an EPA technical Development Document issued in conjunction with the promulgation of guidelines and standards for point sources within this industry category. The Development Document surveys existing and potential waste treatment and control methods and technologies within this category and presents the investment and operating costs associated with various control technologies. This study supplements that analysis by estimating the broader economic effects (including product price increases, continued viability of affected plants, employment, industry growth and foreign trade) of the required application of certain of these control technologies.

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. 68-01-1533, Task Order No. 9 by Development Planning and Research Associates, Inc. Work was completed as of July, 1974.

This report is being released and circulated at approximately the same time as publication in the Federal Register of a notice of proposed rule making under sections 304(b) and 306 of the Act for the subject point source category.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulation, and other materials in the establishment of final effluent limitations, guidelines and standards of performance.

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PHASE I - INDUSTRY DATA AND ANALYTICAL FRAMEWORK

I. INDUSTRY SEGMENTS

The purpose of this study is to analyze the economic impact of the cost of proposed effluent control guidelines on the independent rendering industry. These requirements are being developed by EPA pursuant to the Federal Water Pollution Control Amendment of 1972.

The three levels of treatment are being considered. They are:

1. Best practicable control technology currently available (BPT) - to be met by industrial dischargers by 1977.

2. Best available technology economically achievable (BAT) - to be met by 1983.

3. New source performance standards (NSPS) - to be applied to all new facilities (that discharge directly to navigable waters) constructed after the promulgation of these guidelines (approximately January 1, 1974).

A. General Description of the Industry

The independent rendering industry falls within Industry No. 2094, Animal and Marine Fats and Oils. The 1967 Census of Manufactures describes this industry as those establishments primarily engaged in manufacturing animal oils, including fish oil and other marine animal oils, and by-product meal, and those rendering inedible grease and tallow from animal fat, bones, and meat scraps. Establishments primarily engaged in manufacturing lard and edible tallow and stearin are classified in Group 201; those refining marine oils for medicinal purposes in Industry 2833; and those manufacturing fatty acids in Industry 2899. The following products are included in 2094.

Fish liver oils, crude
Fish meal
Fish oil and fish oil meal
Grease and tallow: Inedible
Meat meal and tankage
Oil, neat's foot
Oil, animal
Oils, fish and marine animal: herring menhaden, whale (refined), sardine
Stearin, animal: Inedible

The independent rendering industry covered in this report includes only meat-meal and tankage; animal oils; and inedible grease and tallow. However, these three categories account for over 81 percent of the value of shipments for the entire industry classification.

Total value of shipments in the industry (SIC 2094) increased from $558 million in 1967 to $910 million in 1972 (Table I-1). Detailed census statistics are available only for 1967 at which time value of the primary products accounted for 94 percent of total shipments (industry specialization ratio of 94 percent). In 1967 the Animal and Marine Fats and Oils (SIC 2094) coverage ratio was 67 percent. Total value of all primary products made in all industries amounted to $709.4 million. There was no change in the specialization ratio and coverage ratio from 1963 to 1967.

In summary, the 1967 value of shipments for SIC 2094 amounted to

Item	1967 Value of Shipments	Percent
Grease and inedible tallow	201.9	36.2
Meat meal and tankage	178.2	31.9
Animal and marine products	59.3	10.6
Animal and marine fats and oils	32.7	5.9
Other secondary products	85.8	15.3
Total shipments	557.9	100.0

The rendering industry consists of off-site or independent renderers, as well as on-site or captive renderers. It should be noted that the on-site or captive renderers are not included in Industry No. 2094. The independent renderers reprocess discarded animal materials such as fats, bones, hides, feathers, blood, and offal into saleable by-products, almost all of which are inedible for human consumption, and "dead stock" (whole animals that die by accident or through natural causes).

Independent renderers operate regular daily truck routes to collect discarded fat and bone trimmings, meat scraps, bone and offal, blood, feathers, and entire animal carcasses from a variety of sources. In some cases there are independent haulers who would pick up material and sell it on a competitive basis to two or more rendering plants. These

Table I-1 . Industry and primary product shipments; specialization ratios and coverage ratios for Animal and Marine Fats and Oils (SIC 2094), 1967 and 1963

	Value of Shipments (SIC 2094)					Value of Primary Product Shipments			
Year	Total	Primary Products	Secondary Products	Misc. Receipts	Primary Product Specilization Ratio	Total Made in All Industries	Made In This Industry	Made In Other Industries	Coverage Ratio
	($ mil.)	($ mil.)	($ mil.)	($ mil.)	(%)	($ mil.)	($ mil.)	($ mil.)	(%)
	A	B	C	D	E	F	G	H	I
1972	910 1/								
1967	557.9	472.1	31.3	54.5	94	709.4	472.1	237.3	67
1963	474.0	430.4	24.5	19.1	94	642.9	430.4	212.5	66

Source: 1967 Census of Manufactures.
1/ 1972 Census of Manufactures preliminary

sources are butcher shops, supermarkets, restaurants, poultry processors, slaughterhouses, and meat packing plants, farmers and ranchers. The independent rendering industry daily processes over 50 million pounds of animal fat and bone materials, along with dead animals, that would otherwise have to be suitably disposed of to prevent its becoming a national public health problem. The rendering industry has been in the recycling business for over a hundred years.

Payments by the independent renderers to the meat processing industry represent income to that industry and thereby reduces the cost of meat to the consumer. Final products include tallow for soap and derivatives for the chemical industry, and meal and inedible grease for animal and poultry feed.

The United States is the world's leading producer, consumer, and exporter of tallow and grease. The United States accounts for 55 to 60 percent of the world's tallow and grease output. The export market has been the largest single outlet for inedible tallow and grease consuming about 50 percent of the domestic output.

In 1967 there were 558 establishments in the animal and marine fats and oils industry. It was estimated that approximately 100 of these were processing marine fats and oils. In 1973 it was estimated by the industry that there were approximately 450 independent rendering establishments processing animal by-products.

B. Industry Segmentation

The major segments of animal and marine fats and oils (SIC 2094) are grease and inedible tallow (SIC 20941) and meat meal and tankage (SIC 20942). Table I-2 shows the value of shipments by all producers of grease and inedible tallow to be $302.6 million, and the value of shipments of meat meal and tankage to be $277.8 million in 1967. The above two segments account for over 80 percent of total shipments. Foots, animal, vegetable and fish acidulated scrap stock accounted for $33.3 million in shipments and fish scrap and meal accounted for shipments of $30.1 million for the next two most important categories.

The $709.4 million shipments in 1967 represent shipments by all industries whether classified as primary or secondary products. The major source of these products classified as "secondary" products was from the captive or on-site renderers associated with the meat packing industry. The independent renderers, with these products as primary products, accounted for $557.9 million in shipments in 1967.

Table I-2. Products and product classes - quantity and value of shipments by all producers, 1967 and 1963

Product	Unit of measure	Total shipments including interplant transfers			
		1967		1963	
		Quantity	Value (million dollars)	Quantity	Value (million dollars)
ANIMAL AND MARINE FATS AND OILS, TOTAL[13]	....	(X)	709.4	(X)	642.9
Grease and inedible tallow[13]	Million lbs...	5,381.3	302.5	4,706.3	264.2
Meat meal and tankage[13]	1,000 short tons.........	3,797.0	277.8	2,973.3	246.7
Meat meal and tankage (including meat meal, meat and bone meal, poultry byproduct meal, digester tankage, or any mixture of these, excluding pure blood meal, feather meal, and pure bone meal)	...do.........	3,156.2	225.7	2,136.1	176.1
Bone meal	...do.........	220.7	17.2	296.4	25.0
Feather meal	...do.........	145.0	12.2	466.0	41.0
Other feed and fertilizer, including dried blood, etc	...do.........	*235.0	19.8		
Feed and fertilizer, n.s.k.	....	*40.1	2.9	55.8	4.6
Animal and marine oil products, including foots	....	(X)	[illegible]	(X)	111.3
Foots, animal, vegetable and fish and acidulated soap stock	....	(NA)	33.3	(X)	30.0
Animal oil mill products, including inedible animal stearin and all other animal oil except fatty acids	Million lbs...	*109.7	11.4	116.2	10.7
Marine animal oil products:					
Fish and marine animal oil	....	(NA)	15.9	(X)	24.7
Fish scrap and meal	....	(NA)	30.1	(X)	42.0
Other fish and marine animal oil products	....	(NA)	3.6	(X)	3.3
Animal oils, n.s.k.	....	(X)	2.0	(X)	0.6
Animal and marine fats and oils, n.s.k. (For companies with more than 10 employees. See Note.)	....	(X)	26.2	(X)	20.7
Animal and marine fats and oils, n.s.k. (For companies with less than 10 employees. See Note.)	....	(X)	6.5	(X)	

Note: Includes quantity and value of the products reported not only by establishments classified in this industry, but also by establishments classified in other industries, and shipping these products as "secondary" products.

In terms of raw product volume the animal segment processes roughly three times the volume of the marine segment. In terms of finished product, there is an even larger differential since yields from animal rendering tend to run roughly 50 percent higher than for fish reduction. Raw product volume for 1971 is as follows:

Segment	Raw Product Volume (millions of pounds)
Animal rendering	10,854
Fish reduction	3,034
Total, SIC 2094	13,888

The raw product volume for the animal segment was estimated by applying product coverage ratios implied by the 1967 Census of Manufactures Report to the total U. S. production data of inedible tallow and grease and meat meal and tankage production as reported in the U. S. Department of Commerce Current Industrial Report Series M20J and M20K. An average yield factor of 50 percent was then assumed to calculate raw material volume. The resultant estimates compare favorably to the National Renderers Association's unpublished estimates of 10 to 12 billion pounds for 1971. In estimating raw product volume for the marine segment a similar approach was used, however, more reliance had to be placed on DPRA estimates of volumes of miscellaneous products and product coverage ratios. To the greatest extent possible, data published by the National Marine Fishery Service was included in the calculations.

Again it must be noted that these two segments do not represent 100 percent coverage of the industry. However, within the constraints of the study, it was not possible to examine the other miscellaneous categories of plants.

C. Number of Plants

The number of establishments listed in the primary product classification 2094 of the 1967 Census of Manufacturing was 588. It is estimated that approximately 500 of these were processing animal and poultry byproducts. It has been estimated that there are currently 450 plants involved in the latter activity and will processing approximately 10 to 12 billion pound of raw product in 1974 (1).

1. Type of Plants

Inedible rendering plants are of two basic types: (1) batch process and (2) continuous process. The batch process type is the older process and currently accounts for 75 to 80 percent of present plants. Most of the newer installations are using the continuous process type plant which is somewhat more efficient with better quality control. However, the continuous process does not appear feasible for the small independent rendering operators where new installations if any would probably continue to be the batch-type process.

A distinction should be made between the city and country renderers. The country renderers normally have older processing equipment of lower capacity, longer route runs with their trucks to pick up dead stock and other types of lower yield raw material. The lower yield results from higher moisture content. The average industry yield is estimated at 50 percent with the small rural plants running about 45 percent (1). The batch plants and continuous process plants would obtain the same yield relationships with identical raw material.

2. Size

The size distribution of establishments for 1967 is shown in Table I-3 for the independent inedible rendering industry. The data reflect approximately two-thirds of the total inedible rendering industry. The remaining one-third production derives from captive or on-site renderers associated with meat and poultry processing establishments. The value of shipments in 1967 ranged from less than $100,000 for those with one to four employees to over $7 million for those with more than 100 employees. The mean average establishment was characterized as having 23 employees with value of shipments of nearly $1 million. However, the use of the mean value to describe the "average" plant can be very misleading since the data are skewed considerably to the right of the size distribution. It can be noted that 362 (61%) of the 588 firms in SIC 2094 had average sales equal to or less than $489,700 during 1967. Furthermore, 519 (88%) of the 588 firms had average sales of $1,319,100 or less. It is estimated the median size plant had sales of approximately $475,000 compared to the mean size of $948,800 in 1967. As a result of some consolidation and increased final product prices, the current value of shipments of the average establishment is approximately 50 percent higher in 1972 than in 1967.

Table I-3. Size, structure of the Animal and Marine Fats and Oil Industry, (SIC 2094), 1967

Establishments with an Average of:	Number of Establishments	Value of Shipments	Average Value of Shipments per Firm
		($ 000's)	($ 000's)
1 - 4 Employees	132	12,000	90.9
5 - 9 "	103	27,900	270.8
10 - 19 "	127	62,200	489.7
20 - 49 "	157	207,100	1,319.1
50 - 99 "	51	117,700	2,307.8
100 - 249 "	18	131,000	7,277.7
Totals	588	557,900	948.8

Source: Size of Establishments, 1967 Census of Manufactures.

The National Renderers Association provided their estimate of the size distribution of the 450 independent rendering plants grouped by typical small, medium and large size plants. It is as follows:

Item	Small	Medium	Large
Pounds/day 1/	37,000	125,000	350,000
Pounds/year 1/	9,250,000	31,250,000	87,500,000
No. of Plants	210	200	40

1/ Raw product

3. Location

Geographic distribution of the independent inedible rendering industry is indicated by Table I-4. The rendering establishments are dispersed throughout the United States. The dispersion reflects the perishability of the raw product and therefore the necessity to have the rendering facilities near the source of supply.

Independent renderers are located in both urban and rural areas. It is estimated that over 50 percent of the members of the National Renderers Association are located in rural communities where small slaughterhouses and locker plants are located (1). These rendering plants also process the dead animals that originate from small farms and feedlots located in these areas.

D. Market and Product Concentration

1. Number and Size of Firms

Of those firms operating the estimated 450 plants in the inedible rendering industry, approximately 15 are multi-plant operations. One publicly-owned and two privately-owned firms are each operating 15 to 30 plants. Four firms (one of which is publicly-owned) are operating five plants each. Those operating two to four plants would include approximately 5 to 10 firms, and the remainder would be single owner plants. Most of the firms are family-owned enterprises.

The relative sizes of the 50 largest firms in the inedible rendering industry are given in Table I-5. Fifty-seven percent of total industry shipments in 1967 were accounted for by the 50 largest firms. This percentage remained relatively unchanged from 1963.

Table I-4. Distribution of establishments in the Animal and Marine Fats and Oils Industry, 1967

Geographic Area	No. of Establish. Total	with 20 or more employees	All Employees Number	Payroll ($ mil.)	Value of Shipments ($ mil.)
United States	588	226	13,700	91.3	557.9
Northeast Region	110	42	2,700	19.6	108.9
New England Div.	31	11	900	5.9	28.7
Middle Atlantic Div.	79	31	1,800	13.6	80.2
North Central Region	198	69	4,500	31.4	179.3
East North Central Div.	100	36	2,700	20.2	119.7
West North Central Div.	98	33	1,800	11.2	59.6
South Region	172	80	4,400	23.6	138.3
South Atlantic Div.	74	39	2,000	11.7	69.7
East South Central Div.	34	13	700	3.6	19.7
West South Central Div.	64	28	1,700	8.3	48.9
West Region	108	35	2,100	16.8	131.3
Mountain Div.	30	6	400	2.4	15.1
Pacific Div.	78	29	1,700	14.4	116.2

Source: 1967 Census of Manufactures.

Table I-5. Value of shipments accounted for by the largest companies from all sources, in SIC: 2094, 20941 and 20942 for 1967, 1963, and 1958

			4 Largest		5-8 Largest		9-20 Largest		21-50 Largest	
	Year	Total	% of Total	$ per Firm	% of Total	$ per Firm	% of Total	$ per Firm	% of Total	$ per Firm
		($ mil.)		(mil.)		(mil.)		(mil.)		(mil.)
2094										
Animal & Marine Fats & Oils	1967	709.4	18	31.9	8	14.2	15	8.9	16	3.8
	1963	642.9	18	28.9	9	14.5	13	6.9	16	3.4
	1958	534.3	19	25.3	9	12.0	NA	-	NA	-
20941										
Grease & Inedible Tallow	1967	302.6	23	17.4	10	7.6	16	4.0	16	1.6
	1963	264.2	26	17.2	8	5.3	12	2.6	16	1.4
	1958	246.7	23	14.2	11	6.8	13	2.6	14	1.2
20942										
Meat Meal & Tankage	1967	277.8	20	13.9	11	7.6	16	3.7	19	1.8
	1963	246.7	20	12.3	9	5.5	16	3.3	19	1.5
	1958	174.3	22	9.6	8	3.5	14	2.0	16	.9

Source: Concentration Ratios, Census of Manufacturers, 1967.

2. Level of Integration

The total inedible rendering industry is basically segmented into the "captive" sector which is integrated with the meat and poultry processing industry and the independent sector which operates free-standing plants apart from any allied industry.

In 1968 there were approximately 770 firms operating 850 facilities in the production of animal and marine fats and oils. It is estimated that 330 of the facilities were independent or captive renderers controlled by the meat and poultry processing industries. Four out of five of these establishments were engaged in edible as well as inedible rendering. Approximately 460 of the facilities were operated by independent renderers whose final product was 100 percent inedible material. The inedible final products are sold on the commodity market, and therefore the independent renderers would be characterized as being neither integrated forward to final product nor backward to the source of raw product.

3. Variety of Products Processed

The independent renderers reprocess discarded animal and poultry materials such as fats, bones, feathers, blood and offal into saleable by-products, all of which are inedible for human consumption. These products are obtained from slaughterhouses, meat markets, and eating establishments. A typical 1,000-pound beef animal butchered for human consumption would yield approximately 100 pounds of rendered finished product. The yield would consist of approximately 62 pounds of tallow, 33 pounds of 50 percent meat and bone meal, and five and one-half pounds of dried blood. (3)

The independent renderers also process cows, horses, sheep, poultry and other animals which have died from natural or accidental causes. This provides recycling of material that would have to be disposed of otherwise to prevent its becoming a public health problem.

4. Competition

Raw Product

On-site processors have a captive supply of raw product determined by primary operations. Raw product supply for independent renderers is usually arranged by contracts with suppliers. Raw product prices are generally more stable than finished product on both up and down markets. By its very nature, raw product is a relatively low-priced item, and therefore considerable service competition, rather than price competition, exists in the industry. Since raw product is a by-product of processing meat or poultry, supply is very inelastic. Because of perishability of raw product, sources of supply are usually limited to 150-mile radius of processing plant.

Finished Product

The export market represents the largest market sector for inedible grease and tallow, accounting for nearly 50 percent of total United States production. The United States is the leading producer and exporter of inedible tallow. The export market is, of course, subject to many and varied pressures, but has maintained a fairly constant percentage of domestic production. Demand pressures exert considerable influence on the domestic market price.

Since 1961, animal feeds use has displaced soap as the second highest consumer of inedible tallow and greases. However, the use of more non-detergent soap could reverse this trend in the future. The production of fatty acids, lubricants and similar oils, and other uses account for the balance of use.

A free market exists for inedible tallow and greases with price determined by supply and end-use demand. Fluctuations in average annual prices are shown in Table III-1.

Meat and bone meal is used basically as a high protein feed supplement for animals and poultry. For this use it competes in the market place with other high protein products. Two of the more important competitive products are fish meal and soybean meal. The annual average prices of these products are shown along with the prices of 50 percent meat and bone meal in Table III-1. A sharp decrease in the supply of fish meal in 1973 was reflected in extreme changes in the prices of not only fish meal, but also a meat and bone meal and soybean meal. The end-use demand for meat and bone meal has a high cross-elasticity with other high protein supplements and the renderers have little control over the market price.

E. Employment

Total employment in the inedible rendering industry has decreased over 40 percent from 14,600 employees in 1958 to 10,000 employees in 1972. Production workers represent approximately 80 percent of total employees, and during the above period decreased from 10,900 to 8,000. It should be noted that value of shipments increased from $389 million in 1958 to $910 million in 1972. A portion of the increase in value of shipments can be attributed to an increase in price of finished product, but there has also been a substantial increase in productivity. For instance, the production of tallow and inedible grease increased from 3.2 billion pounds in 1958 to over 5.2 billion pounds in 1971. (2) A major portion of the reduction in employees has occurred within the past five years and coincides with the introduction of continuous process rendering systems and more efficient materials handling equipment.

Production workers in the industry are largely unskilled. Much of the labor is involved in collection and the handling of raw product. Average hours worked by production employees have remained relatively stable and totaled 2,125 hours per employee in 1972.

Although total number of employees declined by 40 percent during the 1958-1972 time frame, total payroll increased 60 percent from $67.9 million to $108 million. A doubling of wages per production worker man hour took place with wages increasing from $1.97 in 1958 to $4.00 in 1972. Value added per production worker man hour was quite volatile (resulting from price fluctuation of final product) but over the 14-year period increased from $6.42 to $19.18. Furthermore, the value of shipments per production worker increased from $58,000 to $96,200 during the same time period.

Table I-6. Employment statistics for the Animal and Marine Fats and Oils Industry, SIC: 2094, 1958-1971 1/ and 1972 2/

Year	All Employees No.	All Employees Payroll	Production Workers No.	Production Workers Man Hrs.	Production Workers Wages	Value of Shipments per Production Worker	Man Hrs. per Production Worker	Wage Per Production Worker Man Hour	Value Added Per Production Worker Man Hour
	(000)	($ mil.)	(000)	(Mil.)	($ mil.)	($000)	(000)	($)	($)
1958	14.6	67.9	10.9	23.6	46.4	35.7	2.165	1.966	6.42
1959	14.0	67.0	10.6	21.8	45.9	33.3	2.057	2.106	6.44
1960	13.7	69.9	10.0	21.8	46.9	31.8	2.180	2.151	5.92
1961	12.6	69.0	9.4	20.5	46.5	40.0	2.181	2.268	8.00
1962	13.3	74.2	9.8	21.2	50.0	40.9	2.163	2.358	7.93
1963	14.3	78.3	10.3	22.7	51.3	46.0	2.204	2.260	8.52
1964	14.2	84.6	10.4	23.9	54.7	52.9	2.298	2.289	8.82
1965	14.2	90.2	10.2	23.7	56.6	65.6	2.324	2.388	10.48
1966	13.3	89.3	8.7	19.8	50.6	88.0	2.276	2.556	15.48
1967	13.7	91.8	9.5	21.7	58.2	58.7	2.284	2.582	9.49
1968	13.1	92.8	9.2	20.1	58.7	56.0	2.185	2.920	9.50
1969	13.1	99.5	9.4	21.1	63.7	64.8	2.245	3.019	10.95
1970	12.9	108.6	9.4	22.2	66.1	87.5	2.255	3.118	13.73
1971	12.4	111.9	9.0	19.5	68.6	96.2	2.167	3.518	14.26
1972	10.0	108.0	8.0	17.0	68.0	113.7	2.125	4.000	19.18

1/ Source: 1971 Annual Survey of Manufacturing.

2/ Source: 1972 Census of Manufactures, Advance Report.

II. FINANCIAL PROFILE OF INDUSTRY

Firms in the rendering industry are family or closely-held corporations. As a result, financial information is considered proprietary and therefore extremely difficult to obtain. Information used to develop financial profiles for the industry was integrated from several sources. These sources include the 1967 and 1972 Census of Manufacturers, the Annual Survey of Manufacturers, interviews with equipment suppliers, National Renderers Association, consulting engineering firms and associated industry operation and financial statistics.

A. Sales

Total sales of the independent rendering industry were $910 million in 1972 (Table II-1). This compared to $557.9 million in 1967 and $389.3 million in 1958. The increase in total sales has resulted from both an expansion of production of livestock and poultry and an increase in the overall price level. During the past two decades the total production of inedible tallow and grease has increased from 2.3 billion pounds in 1950 to an estimated 5.4 billion pounds for 1971-1972.

Volume of production is predetermined by the availability of raw product. This is a finite quantity and the amount processed by the independent renderers in 1973 has been estimated by the industry at 10 to 12 billion pounds.

In 1971 the value of shipments for the animal and marine fats and oils industry (2094) was $865.9 million for 588 firms. This gives shipments for the average plant of $1,472,000. This compares to $948,800 for the average plant in 1967 (Table II-2).

While the average plant had sales of nearly one and one-half million in 1971 with 21 total employees, the actual plants varied considerably in size. Actual plants ranged in size from small operations employing one to four employees with annual sales less than $100,000 to large operations employing over 100 men with sales of $5 to $10 million.

Table II-1. Value of shipments by establishments in Primary Product Classification, SIC 2094, 1958 - 1972

Year	Value of Shipments
	($ millions)
1958	389.3
1959	353.1
1960	318.0
1961	376.3
1962	400.6
1963	474.0
1964	550.4
1965	669.2
1966	765.3
1967	557.9
1968	515.1
1969	608.7
1970	822.5
1971	854.9
1972	910.0 1/

Number of establishments in 1967: 588.

Source: 1971 Annual Survey of Manufactures
1972 Census of Manufactures

Table II-2. Shipments, value added, and employees in the independent rendering industry, 1967 and 1971

	1967 [1/]	Per Firm	1967 [2/]	Per Firm	1971 [3/]	Per Firm
Number of firms	15		588		588	
Value of shipments	$20.9 mil.	$1,393,000	$557.9 mil.	$948,000	$865.9 mil.	$1,472,000
Value added	9.3 mil.	620,000	206.0 mil.	350,000	278.1 mil.	473,000
Total employees	458	30	13,700	23.3	12,400	21

1/ 1967 Enterprise Statistics, Department of Commerce.

2/ 1967 Census of Manufactures.

3/ 1971 Annual Survey of Manufactures.

B. Distribution of Sales Dollars

Distinct changes have occurred in distribution of the sales dollar from 1967 to 1971. Some of the changes can be attributed to price effects, but some undoubtedly reflect the changes resulting from increased capital expenditure. Cost of material increased from $349 million in 1967 to $558 million in 1971. As a percent of sales dollar, this represented an increase from 62 percent to 66 percent.

The number of production workers declined from 9,500 in 1967 to 9,000 in 1971. During this period wages increased from $2.68 to $3.52 per hour. However, during the period production worker wages as a percent of sales declined from 10.5 percent to 7.9 percent of the sales dollar.

Other operating cost, taxes and profit declined from 27.5 percent in 1967 to 26.1 in 1971. The distribution of the total sales dollar derived from the Census of Manufacturers and Annual Survey of Manufactures is summarized below.

Distribution of Sales Dollar (Percent)

	1967	1971
Total Sales	100.0	100.0
Raw material	62.0	66.0
Production wages	10.5	7.9
Other operating cost taxes and profit	27.5	26.1

C. Earnings

No published data on earnings has been obtained on the rendering industry. From our discussion with industry and other information, we have estimated earnings for 1972 by size and type of plant in the financial profiles of the model plants. The reader should turn to Chapter III, Section F, for a discussion of earnings by type and size of plant.

D. Industry Cash Flow

See Chapter III, Section G

E. Ability to Finance New Investment

The ability of a firm to finance new investment for pollution abatement is a function of several critical financial and economic factors. In general terms, new capital must come from one or more of the following sources: (1) funds borrowed from outside sources, (2) equity capital through the sale of common or preferred stock, (3) internally generated funds--retained earnings and the stream of funds attributed to depreciation of fixed assets.

For each of the three major sources of new investment, the most critical set of factors is the financial condition of the individual firm. For debt financing, the firm's credit rating, earnings record over a period of years, stability of earnings, existing debt-equity ratio and the lenders' confidence in management will be major considerations. New equity funds through the sale of securities will depend upon the firm's future earnings as anticipated by investors, which in turn will reflect past earnings records. The firm's record, compared to others in its own industry and to firms in other similar industries, will be a major determinant of the ease with which new equity capital can be acquired. In the comparisons, the investor will probably look at the trend of earnings for the past five or so years.

Internally generated funds depend upon the margin of profitability and the cash flow from operations. Also, in publicly held corporations, stockholders must be willing to forego dividends in order to make earnings available for reinvestment.

The condition of the firm's industry and general economic conditions are also major considerations in attracting new capital. The industry will be compared to other similar industries (i.e., other processing industries) in terms of net profits on sales and on net worth, supply-demand relationships, trends in production and consumption, the state of technology, impact of government regulation, foreign trade and other significant variables. Declining or depressed industries are not good prospects for attracting new capital. At the same time, the overall condition of the domestic and international economy can influence capital markets. A firm is more likely to attract new capital during a boom period than during a recession. On the other hand, the cost of new capital will usually be higher during an expansionary period. Furthermore, the money markets play a determining role in new financing.

These general guidelines can be applied to the inedible independent rendering industry by looking at general economic data and industry performance over the recent past.

1. General Industry Situation

Although difficult to assess, the industry appears to be in a relatively healthy position at the present time. Apparently the industry has been alert to adopt changes in technology which have increased productivity at an above-average rate since 1958.

Because of the inelasticity of supply for raw product and the high cross-elasticity of demand for final product, profit levels vary widely from year to year. Profits in 1973 were probably at an all-time high resulting from the generally high prices for commodities. The higher prices reflected increased world demand as well as the drastic curtailment of the supply of fish meal. Supply and demand pressures will undoubtedly force profit levels to return to the more normal ranges.

Considerable concern is apparent in the industry with regard to controls relating to odor control, water pollution and occupational safety and health. The investment needed to meet these requirements contribute little to increased productivity, and it was felt the major portion of these costs must be absorbed within the industry. A major concern was the fact that the feasibility of controls for each of these areas is considered separately, but the impact is additive.

2. Capital Expenditure

Capital expenditures in the rendering industry are compiled on an annual basis by the Annual Survey of Manufactures. These data are shown in Table II-3. Total industry expenditures for new plants and equipment have expanded rapidly from $13.9 million in 1960 to $43 million in 1972. Expenditures were averaging about $20 million per year during the latter part of the 60's but increased to $28.5 million in 1970, then jumped to $43 million in

1971 and 72. On a per plant basis, average expenditures increased from about $35 thousand to $48.5 in 1970 and $73.0 in 1971 and 1972. This is largely due to the installation of new continuous process plants which are rapidly replacing the older batch type plants as well as expenditures for odor control and waste-water treatment.

3. Capital Availability

In summary, it would appear that the industry has been able to maintain a profit position comparable to the average manufacturing plant in the United States. Another important consideration is that the industry also has been able to maintain a relatively stable profit margin over the recent years. In addition, sales in the industry have been constantly increasing at a 5 percent rate per year over the decade.

The industry has a large number of single plant firms, many of which are family-owned and operated. This is especially true among the smaller size categories. Family-owned plants would tend to have a high ratio of net worth to total assets. Most likely they would tend to self-finance any additional capital project as indicated in the report by the Committee on Small Business.

New capital expenditures by the industry have been constantly increasing over the past 10 years and averaged 73,000 dollars per plant for 1972, for all plants in the industry.

The rendering industry is in a reasonably good financial position and is constantly making new capital investment in existing plants. On this basis it appears that industry does have the ability to raise reasonable amounts of capital for pollution control equipment, either through retained earnings or debt capital. It should be recognized, however, that there are a number of plants operating at profit levels lower than the averages reported herein that may conceivably incur substantial difficulty in obtaining the necessary capital to invest in pollution control equipment. The lower profit levels would tend to be associated with the rural renderers and these are the ones that would face limited capital availability.

Table II-5. Annual expenditures for new plant and equipment in the independent rendering industry, 1958-1972

Year	Total industry expenditures[1/] S.I.C. 2094	Expenditures as percent of value of shipments	Average expenditures per plant[2/]
	($1,000)		($1,000)
1972[3/]	43.0	4.7	73.1
1971	43.4	5.0	73.8
1970	28.5	3.5	48.5
1969	19.5	3.2	33.2
1968	18.7	3.6	31.8
1967	21.7	3.9	36.9
1966	22.6	3.0	38.4
1965	12.7	1.9	21.6
1964	14.7	2.7	25.0
1963	13.7	2.9	23.3
1962	20.6	5.2	35.0
1961	15.3	4.1	26.0
1960	13.9	4.4	23.6
1959	19.2	5.4	32.7
1958	12.7	3.3	21.6

1/ 1971 Annual Survey of Manufactures

2/ Based upon number of establishments in 1967 of 588

3/ 1972 data from 1972 Census of Manufactures

III. MODEL PLANTS

A. Types of Plants

Two types of plants, the batch system and the continuous system, are basic to the rendering industry.

Batch rendering is a cooking and moisture-evaporation operation performed in a horizontal steam jacketed cylindrical "cooker" equipped with an agitator. It is referred to as a dry rendering process because the raw material is cooked with no addition of steam or water and because the moisture in the material is removed from the cooker by evaporation. It is a batch process because it follows the repetitive cycle of charging with raw material, cooking under controlled conditions, and finally discharging of the material. Average process time per cooker charge is approximately two hours. Plant capacity is a function of the number of "cookers" and these usually range from 3 to 10.

Continuous rendering systems represent a relatively new technology and most of these systems have been introduced within the past five years. A continuous system has the ability to provide an uninterrupted flow of material. Other advantages claimed for the continuous system are: improved quality control; better confinement of odor and fat aerosol particles within the equipment, thereby requiring less cleanup; less space; and less labor for operation and maintenance. Continuous systems permit increased throughput and sometimes can facilitate the consolidation of two or more plants. Seldom are continuous systems used for very small operations of independent renderers, although some are used by small on-site processors.

The model plants used in this analysis reflect both batch and continuous process systems.

B. Sizes of Plants

The value of shipments of independent renderers in 1967 was $557.9 million (7). This gives an average for the 588 firms of $948.8 thousand. Using the average weighted price of 5.3 cents per pound of inedible tallow and meat meal and tankage results in 19.8 million pounds of final product per firm in 1967. This average weighted price is calculated on the basis of 60 percent inedible tallow at 5.6 cents per pound and 10 per cent meat meal and tankage at 3.7 cents per pound.

The total value of shipments in 1971 was $865.9 million which results in shipments per firm in 1971 of $1,473,000. Applying the average 1971 price of 6¢ per pound (60 percent inedible tallow at 7 cents per pound and 40 percent meat meal and tankage at 4.6 cents per pound) indicates shipments of 24.5 million pounds of finished product per average firm in 1971 (8).

The criterion for defining size of plant is the hourly raw product capacity. For the batch process, three sizes of model plants were used for the analysis, and these were designated small, medium and large. The small batch plant has a raw product input capacity of 4,650 pounds per hour. The medium plant has an input capacity of 11,760 pounds of raw product per hour. The large plant has the capacity to process 29,400 pounds of raw product per hour. Normally a plant is operated at 100 percent of capacity when operating. Processing capacity can be expanded by increasing the number of hours operated (see Page III-5).

Annual sales of the model batch process plants for 1971-1972 were: (1) small plant $252,000; (2) medium plant $882,000; and (3) large plant $2,200,000. Two sizes were used for the continuous rendering process. These were designated medium and large. The medium plant can process 14,285 pounds of raw product per hour while the large plant can process a raw product input of 35,700 pounds per hour. Annual sales of the model continuous process plants for 1971-1972 were $1,080,000 for the medium size and $2,690,000 for the large size.

C. Investment and Assumptions

1. Source of Data

Since there were no published data for individual firms within the rendering industry, a synthesis was derived from composite industry statistics found in the Census of Manufactures, Annual Survey of Manufactures, 1967, Enterprise Statistics, interviews with equipment suppliers, consulting engineers, and the National Renderers Association.

2. Age of Plants

The 1971-1972 period was taken as the year of operation of the model plants. Severe price distortions occurred in 1972-1973 and it was felt the later period would not reflect the true relationships which exist within the industry.

The age of the batch process plants was estimated at 13 years. Buildings were depreciated over a 30-year period, whereas equipment was depreciated over a 12-year period. Equipment was depreciated to 50 percent of its original cost and it was assumed additional investment and modernization over the years would maintain the book value of the equipment at 50 percent of the original cost.

The age of the continuous process plants was estimated at 2 years. The majority of installations of the continuous plants have been made within the past five years. The buildings were depreciated on a 30-year basis with equipment being depreciated on a 10-year basis.

3. Exclusion of Mobile Equipment for Assembling Raw Product

Particular attention should be directed to the fact that mobile equipment and employees for operation of this equipment have been excluded from the model plants. However, a charge has been included for the provision of this function. The charge includes allowance for normal return on investment, wages and other normal operating expenses associated with this function. Some renderers have contracts with sources of raw material, and regular daily truck routes are used to collect the raw product. Independent collectors also provide this function. It was felt that the salvage value of this sector of the rendering plant would differ considerably from the actual rendering operations. Therefore, a separate cost factor was derived for transportation of raw product. The number of employees in the transportation of raw product normally equals or exceeds the other production employees. This factor reduces the wages and salaries for the model plants, but is offset by the higher transportation cost. The major portion of transportation cost would be reflected in value added for the firm or industry.

4. Wages

Wage rates for production workers were calculated at $4.00 per hour with hours worked per year of 2,167. The average wage in 1971 for the industry was $3.51 and it was estimated to increase to the $4.00 per hour rate.

5. Price of Final Product

The price of final product varies quite widely for the rendering industry. The price variation for recent years are shown in Table III-1. A high degree of interdependence exists between the prices of high protein ingredients used as livestock and poultry feed supplements. The shortage of fish meal in 1972-1973 caused prices of inedible tallow and meat meal

Table III-1. Comparative average prices of inedible tallow, 50 percent meat and bonemeal, fish meal and soybean meal, 1965-1973

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	June 1973
Tallow, Prime 1/ (¢ per pound)	7.3	5.5	4.6	5.8	7.5	7.6	6.4	12.8	16.8 2/
50% Meat & Bonemeal 1/ (# per ton)	105.30	94.00	88.80	91.60	106.80	95.60	111.25	--	395.00 2/
Fish Meal 3/ Imported East Coast ($per ton)	146.40	119.90	118.25	156.75	178.00	173.20	172.70	--	570.00
Soybean Meal 3/ 49-50% solvent Decatur, $ per ton	89.60	86.30	84.30	82.50	86.60	84.30	98.20	--	450.00

1/ Source: The Feeds Situation

2/ Estimated

3/ Source: U.S. Fats and Oils Statistics to rise dramatically. It was felt the most recent price structure reflecting a stable relationship in the industry was 1971-1972. Using a weighted average of $128.00 per ton (6.4¢/lb.) for tallow and $111.25 per ton for meat and bone meal, a price of $120.30 per ton of final product (55 percent inedible tallow and 45 percent of meat and bone meal) was derived.

6. Assets, Liabilities and Net Worth

Current assets were estimated to be 16.4 percent of sales and conforms to the relationship existing in the meat processing industry. This ratio is about one-half the current asset structure in the leather industry, but the lower level would be reasonable because of the lower inventory requirements and faster throughput. Inventories for the inedible rendering industry tend to be 5 to 6 percent of the value of shipments. Current liabilities normally are 50 percent of current assets and result in a current ratio of two to one. Net worth for the model plants was estimated at 55 percent of the total assets. Book value of assets vary considerably between the batch process and continuous process plants. The major difference is accounted for by the age of the plants which reflect differences in original cost and depreciation.

7. Operating Capital

Current assets, current liabilities and net working capital are also shown in Tables III-5 and 6. Current assets were estimated at 16.4 percent of sales and current liabilities estimated at 8.2 percent of sales. This gives a current ratio of 2.0 which would be financially sound and comparable to related firms in the meat processing industry where there is a relatively high rate of inventory turnover.

D. Utilization

Plant utilization in the rendering industry is at a fairly stable rate. The perishable nature of the raw product requires processing within a short time interval that can be measured in hours. Total raw product is a function of the overall production in the livestock and poultry industry. It is estimated by the industry that the raw product handled has remained essentially constant from 1971 to 1973. However, there has been an indicated 5 to 10 percent production increase in the Midwest and West which has been offset by a corresponding decrease in the Eastern region, primarily due to the introduction of "boxed" or fabricated beef and the slaughtering and processing of beef continually moving closer to the production area. Therefore, the utilization rate in the Midwest and West would be greater than that in the East. Some consolidation has taken place in the rendering industry which has been encouraged somewhat by the newer continuous process plants.

The medium and large batch process plants are assumed to be on a 10-hour day, operating 250 days per year. The small batch process plant is assumed to be operating 8 hours per day, 250 days per year. Most of the small batch plants would be located in the more rural areas. The continuous process model plants are assumed to be operating 10 hours per day, 250 days per year.

Processing capacity can be increased by extending the hours per day as well as the days per year. However, 10 hours per day and 250 days per year seems to be the minimum desirable utilization rate for allocation of investment overhead.

E. Annual Throughput

Yield of raw product varies according to the type and quality of material and processing. A yield of 45 percent by weight was assumed for the small batch plant and 50 percent for the medium and large plants. It was assumed the medium and large plants would be more urban and would, on the average, have slightly higher quality of raw product.

The major output of independent renderers is inedible tallow and meat and bone meal. Using quoted prices and total sales for the industry, it was estimated that the value of shipments of the model plants would be 55 percent from inedible tallow and 45 percent from meat and bone meal.

Annual throughput of the model plants is summarized in Table III-2. The small batch plant is assumed to be operating 8 hours per day, 250 days per year. The small batch plant has a daily input of 37,000 pounds per day or 9.3 million pounds per year. A yield of 45 percent results in 4.2 million pounds of finished product annually (55 percent inedible tallow and 45 percent meat and bone meal). The medium and large batch plants are assumed to be operating 10 hours per day, 250 days per year. The medium batch plant processes 29.5 million pounds of raw product with a resultant 14.7 million pounds of finished product annually. The large batch plant has an input of 73.5 million pounds which yields an annual finished product of 36.8 million pounds. The medium and large continuous process plants are assumed to be operating 10 hours per day, 250 days per year.

The medium continuous process plant has an annual input capacity of 36 million pounds of raw product based upon 250 days per year operation. A yield of 50 percent gives annual finished product of 18 million pounds. The large continuous process plant has a raw product input of 89 million pounds annually with a resultant finished product of 44.6 million pounds.

Table III-2. Input-output of model plants in the meat by-products inedible rendering industry

	Batch			Continuous	
	Small	Medium	Large	Medium	Large
Raw Product					
(000's) lbs/hour	4.65	11.76	29.4	14.3	35.7
lbs/day	37	118	294	143	357
lbs/year	9,300	29,500	73,500	36,000	89,000
Finished Product[1/]					
(000's) lbs/hour	2.1	5.88	14.7	7.15	17.0
lbs/day	16.8	58.8	147	71.5	179
lbs/year	4,200	14,700	36,800	18,000	44,600
Hours/day	8	10	10	10	10
Days/week	5	5	5	5	5
Weeks/year	50	50	50	50	50
Yield (Average)	45%	50%	50%	50%	50%

1/ Finished Product: 55% inedible tallow and 45% meat and bone meal.

F. Annual Profits

After-tax income, return on sales, both pre-tax and after-tax, and return on invested capital, both pre-tax and after-tax, for various types and sizes of model plants are shown in Table III-3.

It should be noted that the model plant profiles were based on average 1971-1972 conditions and no published sources of performance data are available. Industry sources indicated this time frame was a "good" year for the rendering business--perhaps slightly above the average for profits. However, the rendering industry is characterized by wide swings in profitability resulting from the major changes which occur in final product prices. The major upswing in the 1972-1973 time period provided inflated earnings that probably resulted in an all-time high for profits. However, it was felt this unusual profit performance in 1972-1973 was not representative of the industry.

Generally, industries with widely fluctuating profit margins must maintain a higher average return on investment than those with a higher degree of stability. The R. O. I. must reflect an adequate margin for risk and uncertainty if sufficient capital is to be supplied to maintain modern efficient facilities. The actual profit levels as a percent of sales on invested capital are higher for the larger and more modern plants. The small batch plants represent a larger portion of the rural renderers who provide a necessary sanitary service particularly in the disposal of dead inedible carcasses. These are the more marginal operations, and the low after-tax R. O. I. makes modernization difficult to accomplish.

The differences in age of plants' profitability can be seen in pre-tax return on sales. The differences are minimized somewhat when one analyzes R. O. I. The narrowing of differences in R. O. I. reflects the lower book value of the older plants and of course less depreciation having been taken by the newer continuous process plants.

G. Annual Cash Flows

Estimated annual cash flow for the types and sizes of plants analyzed in this study are shown in Table III-4. Cash flow as calculated is the sum of after-tax income plus depreciation. It is shown in absolute dollars as well as a percent of sales and as a percent of total invested capital. As a percent of sales, cash flows range from a low of 3.9 percent to a

Table III-3. Net income, returns on sales and returns on total invested capital for model plants

Type and size of plant	After-tax income ($000)	Pre-tax return on sales (percent)	After-tax return on sales (percent)	Pre-tax* R.O.I. (percent)	After-tax* R.O.I. (percent)
Batch process plants					
Small	5.0	2.6	2.0	5.8	4.5
Medium	18.6	2.7	2.1	11.0	8.5
Large	42.0	3.1	1.9	13.7	8.4
Continuous process plants					
Medium	51.0	8.0	4.7	15.2	9.0
Large	125.0	8.1	4.6	20.5	11.7

* Return on total invested capital by financial statement method.

Table III-4. Annual cash flows for model rendering plants

Type and size of plant	Annual cash flow ($000)	Cash flow as percent of sales (percent)	Cash flow as percent of total investment (percent)
Batch process			
Small	16.0	6.3	14.2
Medium	38.6	4.4	17.6
Large	86.0	3.9	17.1
Continuous process			
Medium	98.0	9.0	17.3
Large	219.0	8.1	20.5

high of 9 percent. The higher cash flows as a percent of sales for the newer continuous process plants are a function of the higher investment costs resulting in considerably higher actual annual depreciation charges.

Cash flows when considered as a percent of total investment are much more tightly grouped. The narrower range reflects the lower investment base for the older plants. Another factor narrowing the differences is the difference in income tax as a percent of pre-tax earnings. The small firm with less than $25,000 income would be at an assumed rate of 22.5 percent whereas, earnings in excess of $25,000 are assumed to be taxed at the 48 percent rate.

The small batch process plant remains in an unfavorable competitive cash flow position in relation to the larger rendering operations.

H. Value of Assets

The estimated replacement costs, book value and salvage for each model plant in the different classifications and size group are shown in Tables III-5 and III-6. Separate estimates are shown for land, building and facilities, installed plant and equipment. In addition, current assets, current liabilities and net working capital are shown.

The investment costs for storage were not included in engineering estimates for the medium and large plants. The amount and cost of storage would be a function of raw material pickup and processing procedures as well as the finished product material handling procedures (i.e., sacked or bulk) and inventory policies. Therefore, investment costs would be understated somewhat for these sizes of plants.

1. Replacement Values

The plant replacement cost estimates reflect current construction costs of the general design under which the plants would be built today. They reflect technological advances in processing equipment that may not be included in many of the existing plants. In other words, the cost estimates reflect replacing the prototype plants the way they would be built today. These costs were based upon estimates provided by industry engineers.

It should be noted that no estimates for transport equipment are included in the replacement cost estimates. A separate item for transportation is included in raw material costs to provide for raw material pickup. It was felt mobile equipment represented a totally different problem for maintenance and for salvage purposes.

Table III-5. Estimated investment capital for model batch process rendering plants

	Small 4,650 lbs/hr			Medium 12,000 lbs/hr			Large 30,000 lbs/hr		
	Replmt.	Salvage	Book	Replmt.	Salvage	Book	Replmt.	Salvage	Book
	$1,000								
Land	20	20	10	30	30	15	40	40	20
Building									
Sq. ft.	(2,000 sq. ft.)			(3,150 sq. ft.)			(8,000 sq. ft.)		
Cost	50	5	15	79	8	22	200	20	58
Equipment	200	20	67	331	33	110	734	73	244
Total	270	45	92	440	71	147	974	133	322
Current assets	42	42	42	144	144	144	360	360	360
Current liabilities	21	21	21	72	72	72	180	180	180
Net working capital	21	21	21	72	72	72	180	180	180
Total invested capital	291	66	113	512	143	219	1,154	313	502

Table III-6. Estimated investment capital for model continuous process rendering plants

	Medium 14,400 lbs/hr			Large 36,000 lbs/hr		
	Replmt.	Salvage	Book	Replmt.	Salvage	Book
	----------	----------	----------	$1,000	----------	----------
Land	30	30	27	40	40	36
Building						
Sq. ft.	(3,240 sq. ft.)			(5,000 sq. ft.)		
Cost	81	20	67	125	31	103
Equipment	513	128	382	950	238	708
Total	624	178	476	1,115	309	847
Current Assets	178	178	178	440	440	440
Current Liabilities	89	89	89	220	220	220
Net working capital	89	89	89	220	220	220
Total invested capital	713	267	565	1,335	529	1,067

Economies of scale for building and equipment costs for new plants exist in both the batch and continuous process rendering plants. The highest cost per 1,000 pounds of raw product input per hour is for the small batch process plant and amounts to $58.06. This cost decreases to $36.67 for the medium and $32.47 for the large batch process plants. New plant and equipment investment costs for medium and large continuous process plants are $43.33 and $30.97 respectively.

2. Book Value of Investment

To achieve an estimate of book value of plant and equipment, the age of batch and continuous process plants were discussed with industry representatives. Since the model plants were assumed to be operating in the 1971-1972 time period, the batch plants were considered to have been built in 1958 and the continuous plants were considered to have been built in 1969-1970. This resulted in 13 years depreciation for the batch plants and 2 years depreciation for the continuous plants. Replacement costs were deflated to arrive at original costs. Buildings were then depreciated on a 30-year straight line basis. Equipment was depreciated on a 12-year straight line basis for batch equipment and on a 10-year straight line basis for continuous equipment. In the case of the older batch plants, it was assumed additional capital investment would be made for replacement and modernization to maintain book value at 50 percent of original investment. Land was included in book value at the estimated purchase rate.

3. Salvage Value

The salvage value of processing plants will vary widely from plant to plant, depending on the age of plant and its condition, and the age of the equipment and its condition. In many instances the salvage value of old, obsolete plants will be equal to the site value only. If the building is remodeled or refurbished for other uses such as a warehouse, the salvage value of the building may approach 10 or 20 percent of its replacement cost.

There is a limited market for used machinery and equipment; however, this is limited to modification of present operating lines or the overseas market Virtually all new plants would begin with all new equipment. As a result, used equipment may be purchased at 10 to 50 percent of replacement cost, but the cost of dismantling an old plant is high and value of used in-place equipment is rather low.

Since no data are available on actual salvage values for inedible rendering plants and only a very limited market exists for used equipment, it is difficult to estimate the salvage value of a closed plant because of the added costs of water pollution. We are assuming the land equal to the current market value and the salvage values of batch process building and equipment will approximate 10 percent of replacement value. Since the continuous process buildings and equipment are relatively new, salvage value has been estimated at 25 percent of replacement cost. All operating capital will be recovered intact. The combined value of land, buildings, equipment and operating capital for each model plant is shown in Tables III-5 and 6.

I. Cost Structure

The cost structure for the model rendering plants is contained in Tables III-7 and III-8. Major items are discussed below.

1. Raw Product

Raw product for off-site renderers is acquired by regular daily truck routes to pick up fat and bone trimmings, meat scraps, bone and offal, blood, feathers and entire animal carcasses from a variety of sources. These sources include butcher shops, supermarkets, eating establishments, slaughterhouses and meat packing plants, farmers and ranchers. In some cases contracts with these suppliers provide for a somewhat stable supply for the renderer and a source of income to the supplier. Raw product cost, as well as yield, varies considerably according to the type of material. Fat gives the best yield and can yield as much as 70 percent tallow and 10 percent meat scraps (3). The cost of fat to the renderer during the first quarter of 1974 was 5 to 6 cents per pound, f.o.b. slaughterhouse in Manhattan, Kansas. Bones yield approximately 50 percent meat and bone meal. The cost of bones on a basis similar to that of fat was 1-2 cents per pound. Viscera yield is much lower and more variable, and cost f.o.b. slaughterhouse was 5/10 to 6/10 cents per pound. Raw product ingredient cost approximated 50 percent of the sales dollar of the model plants.

Transportation for assembling raw product represents a major cost factor for total raw material cost. The transportation costs include labor, fuel, maintenance, taxes, insurance, depreciation and other miscellaneous costs associated with the operation of this type of function as well as return on investment. Total transportation costs for the model plants ranged between 20 and 22 percent of the sales dollar.

It is estimated that the labor and fuel portion of transportation represents approximately 10 percent of the sales dollar. The rural renderer has greater mileage per pound of raw product, but generally the labor rate is somewhat lower than for the urban renderer with shorter routes.

2. Operating Costs

Derivation of both direct and indirect operating costs was based upon a synthesis of several sources. Direct labor was estimated from census data averages for the industry and discussions with industry representatives. Allowance was made for personnel involved in raw product pickup to be included in the transportation item. Utilities were calculated directly on a per hour basis. Supplies and containers were estimated from allied industries. The container portion of this cost would vary considerably depending upon whether or not final product was shipped bulk. According to industry sources, the major portion of output is shipped bulk.

Repairs and maintenance are estimated at 1.3 to 1.6 percent of sales, and seem to be compatible with another standard approach of using 3-5 percent of the cost of equipment. The eight-tenths to one percent appears adequate to cover taxes (other than income) and insurance. The 5.4 to 7.1 percent for general and administrative expense approximates those averages for allied industries and in the absence of published data on this specific industry are assumed to be reasonable approximations.

3. Depreciation and Interest

Depreciation was calculated directly from original costs and ranged from a low of 2.0 percent of sales in the large batch plant to 4.3 percent on the medium continuous process plant. The lower percentage for the batch plants reflect the lower original costs and the 12-year depreciation schedule on equipment as contrasted to the newer continuous process plants where higher costs resulted from inflation and a 10-year depreciation schedule was followed.

Interest was estimated at three-tenths of one percent of the sales dollar.

4. Cost Relationships

Total raw material costs range from 70.9 percent to 73.9 percent of the sales dollar for the medium and large plants. These costs include the total costs for the transportation function but exclude the variable costs of supplies, containers and utilities. When adjustments are made for these items, the costs of materials approximate the 66 percent for the industry in 1971 as shown in Section II-B. The total raw material cost of 67.6

Table III-7. Pro forma income statements for batch process model plants

	Small		Medium		Large	
Hourly raw material input	4,650 lbs.		11,760 lbs.		29,400 lbs.	
Daily raw material input	37,000		118,000		294,000	
Annual output finished product	4,200,000		14,700,000		36,800,000	
	Annual ($1,000)	Percent	Annual ($1,000)	Percent	Annual ($1,000)	Percent
Sales	252	100	882	100	2,200	100
Raw material cost						
Material	117	46.3	450	51.0	1,155	52.5
Transportation	52	20.6	187	21.2	470	21.4
Total	169.5	66.9	637	72.2	1,625	73.9
Direct c[illegible]						
Labor	18	7.1	48	5.5	97	4.4
Supplies and containers	9	3.6	30	3.4	66	3.0
Utilities	12	4.7	39	4.4	94	4.3
Total	39	15.4	117	13.3	257	11.7
Indirect [illegible]						
Repairs & maintenance	4	1.6	11	1.3	30	1.4
Taxes & insurance	2	0.8	7	0.8	17	0.8
General & admin.	20	8.0	63	7.1	150	6.8
Total	26	10.4	81	9.2	197	9.0
Total expense	233.5	92.7	835	94.7	2,079	94.5
Interest	1	0.4	3	0.3	8	0.4
Depreciation	11	4.3	20	2.3	44	2.0
Total cost	245.5	97.4	858	97.3	2,131	96.9
Net income B.T.	6.5	2.6	24	2.7	69	3.1
Income tax	1.5	0.6	5.4	0.6	27	1.2
Net income A.T.	5.0	2.0	18.6	2.1	42	1.9
Cash flow	16	6.3	38.6	4.4	86	3.9
Total invested capital	113		219		502	
R.O.I. before taxes	5.8%		11.0%		13.7%	
R.O.I. after taxes	4.5		8.5		8.4	

Table III-8. Pro forma income statements for continuous process model plants

	Medium		Large	
Hourly raw material input	14,300 lbs.		35,700 lbs.	
Daily raw material input	143,000		357,000	
Annual finished product	18,000,000		44,600,000	
	Annual ($1,000)	Percent	Annual ($1,000)	Percent
Sales	1,080	100.0	2,683	100.0
Raw material cost				
Material	541	50.1	1,362	50.8
Transportation	225	20.8	566	21.1
Total	766	70.9	1,928	71.9
Direct Cost				
Labor	25	2.3	51	1.9
Supplies & containers	32	3.0	81	3.0
Utilities	36	3.3	86	3.2
Total	93	8.6	218	8.1
Indirect Cost				
Repairs & maintenance	16	1.5	40	1.5
Taxes and insurance	9	0.8	26	1.0
General & admin.	58	5.4	146	5.4
Total	83	7.7	212	7.9
Total Expense	942	87.2	2,358	87.9
Interest	5	0.5	12	0.5
Depreciation	47	4.3	94	3.5
Total cost	994	92.0	2,464	91.9
Net income B.T.	86	8.0	219	8.1
Income tax	35	3.2	94	3.5
Net income A.T.	51	4.7	125	4.6
Cash flow	98	9.0	219	8.1
Total invested capital	565		1,067	
R.O.I. before taxes	15.2		20.5	
R.O.I. after taxes	9.0		11.7	

percent for the small batch plant is 4 to 6 percent less than the larger plants. The lower cost is attributed to the lower quality of raw product. The small batch plants would usually have a higher percentage of "dead" stock.

Production labor varies from 7.1 percent for the small batch plant down to 1.9 percent for the large continuous process plant. However, if labor for raw product acquisition is included, these percentages are estimated to double for the small plant to triple for the large continuous plant. Given these adjustments, the direct labor compares with the 7.9 percent average for the industry in 1971.

Total indirect costs range from 7.7 to 9.4 percent. Total expense before interest and depreciation then ranges from 88.8 to 94.6 percent.

IV. PRICE EFFECTS

A. Raw Material

Raw material processed by the inedible rendering industry consists of discarded animal and poultry materials such as fats, bones, hides, feathers, blood, offal and "dead stock." Supply sources for these raw materials are butcher shops, supermarkets, restaurants, poultry processors, slaughterhouses, meat packing plants, farmers and ranchers.

Approximately one-third of the inedible rendering output is produced by "captive" renderers owned primarily by the slaughtering and meat packing companies. The raw materials used by the "captive" renderers are not subject to the competitive market place as are those materials used by the independent renderers. For this reason, the "captive" renderers are enabled to plan production efficiently without having to cope with the uncertainties of supply in a competitive market.

The independent renderers sometimes enter into contracts with suppliers, and then have regular truck routes for the pickup of raw materials. This procedure provides some assurance of a regular supply of raw material input. The contracts also have a tendency to stabilize prices for the contract period.

The more stable relationship between raw material costs and finished product prices accrue an advantage to the renderer during up markets, but can create a hardship during a period of declining prices.

Considerable competition exists between renderers for the limited supply of raw materials. In fact, the independent renderers look upon their suppliers as their "customers." For the urban renderers, both price and non-price competition is keen in order to have adequate supplies for efficient operations. While the rural renderers may not be subjected to the degree of price competition experienced by the urban renderers, they are confronted with other problems. Usually the rural renderers have a lower quality product (i.e., dead stock) and longer routes for pickup.

Actual prices, as well as changes in prices paid for raw materials, are difficult to determine since this is closely guarded information within the industry. Variables influencing the prices paid by the renderers would be type of product, quantity, continuity of supply, competition and prices of final product. Since raw product prices are relatively low, they do not fully reflect changes in prices of final product. As a result, margins fluctuate to a considerable extent as the industry experiences fluctuations in prices of final product. There is a tendency for deterioration in quality of the final product due to the repeated handling and extended storage of the final product which precludes lengthy storage or geographic shifts in supply, thereby contributing to the inelasticity of supply.

The rural renderers probably have less flexibility to make cost adjustments in raw product than the urban renderers. The reasoning for this is the fact that the rural renderer is operating from a lower base price associated with lower yield product, and therefore downward adjustments would be more limited. An example of this situation is where dead stock are picked up as a service without payment. If charges were made to the owner of the dead stock, it might be more feasible to make disposition of the dead stock on the farm and thereby create a health hazard.

It is concluded that major shifts in the prices of raw product are unlikely. The changes that do occur are more likely to be reflected in the urban areas for the higher quality raw product.

The National Renderers Association has estimated the amount of raw product processed by the independent renderers for the past three years to be between 10 and 12 billion pounds. Supply is very inelastic and is primarily a function of the amount of livestock and poultry processed in the United States.

B. Finished Product

The renderer sells his products on the open commodity market where competition is keen and the law of supply and demand prevails. Prices of inedible tallow and meat and bone meal have experienced wide fluctuations in price over the past years with accentuated price movements during the past two years.

Table IV-1 shows the utilization of inedible tallow and grease for the years 1958 through 1971. The export market accounts for the largest single sector with Western Europe and Japan being large consumers. Actual tonnage shipped to the export market has remained relatively stable for the past 10 years. Animal feeds have displaced soap as the second most important use for inedible tallow. However, tight supplies and high prices stifled use in soap and animal feeds during 1973. Use of tallow in animal feeds is highly elastic and responds readily to changes in price.

Table IV-1. Inedible tallow and grease: utilization, by-products,

Year	Soap	Animal Feeds	Fatty Acids	Lubricants and similar oils	Other	Total Domestic	Export
	(million pounds)						
1970 1/	616	1,140	568	89	214	2,628	2,242
1969	601	1,093	610	97	320	2,721	1,896
1968	637	1,061	585	98	289	2,670	2,240
1967	631	990	576	89	291	2,577	2,222
1966	665	972	547	98	283	2,565	1,975
1965	649	855	575	107	208	2,393	2,127
1964	690	714	530	102	203	2,239	2,399
1963	660	861	478	91	230	2,320	1,874
1962	688	774	433	78	151	2,124	1,595
1961	702	732	402	79	177	2,093	1,805
1960	732	443	351	70	151	1,745	1,696
1959	735	439	391	80	162	1,806	1,462
1958	732	476	353	66	182	1,808	1,115

1/ U. S. Fats and Oils Statistics, 1950-1971

The price of inedible tallow tripled from the fall of 1972 to reach an all-time high of 24 cents per pound in August of 1973. The season average was approximately 13.8 cents per pound. An overall world fats and oils shortage and rising prices for all major fats and oils were major factors behind the sharp increases. Tallow prices in the first quarter of 1974 were averaging around 17 cents per pound, about double that of the previous year. However, they were down sharply from the record 24 cents per pound in August, 1973.

Although the supply of animal fat is quite inelastic, the production of vegetable oils will undoubtedly respond to the high price levels and become a depressant in the future of high prices in the world fats and oils market.

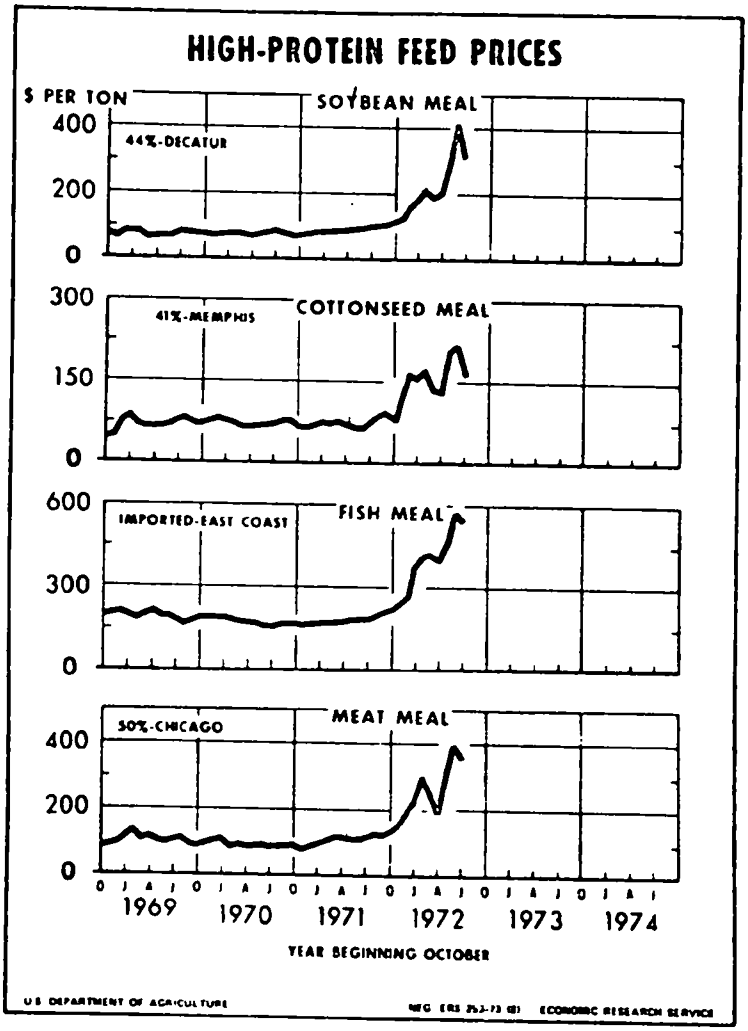
Meat meal is used primarily as a high protein feed supplement and has a high cross-elasticity with fish meal and soybean meal. The price of meat meal in June, 1973, reached $395 per ton which was more than triple the price of a year earlier. At the same time the price of soybean meal soared from $109 per ton in October, 1972 to over $400 per ton in June of 1973. The price relationship of meat meal to other high-protein feed supplements is shown graphically in Exhibit IV-1.

Part of the dramatic increase in prices of high-protein feed supplements resulted from the sharply reduced supply of fish meal from Peru. It was estimated that Peru would produce not more than 3 million tons of fish meal in 1973, which was down from normal production of 10 million tons. Under favorable conditions, experts believe anchovy concentrations will return to normal in 2 years, and the 1974 catch could reach 7-8 million tons. Devaluation of the dollar also contributed to greater export demand, putting further upward pressure on prices.

Production of soybeans in 1973 was a record 1.567 billion bushels, around 300 million bushels above the previous year. Soybean supplies for 1973/74 marketing year were a record 1.6 billion bushels which were about a fifth above the previous year. Many uncertainties persist as to the production and price behavior for the current year. Many of the uncertainties stem from the world-wide energy crisis which will have an effect on both production and consumption.

Overall it can be expected that the supply of other high protein supplements will respond to favorable prices and the increased supply will be a depressant to the price structure.

Exhibit IV-1



Source: Feed Situation, August, 1973.

While the relationship between raw product prices and finished product prices have been extremely favorable to the rendering industry during the past year, declining finished product prices will narrow the profit margins in the rendering industry. A profit squeeze is a distinct possibility for those firms that have bid up the prices of raw product.

C. Expected Price Impact

The impact resulting from increased cost of stricter effluent standards on the independent rendering industry are lower profits for renderers and to a limited extent lower returns to the suppliers of raw product.

It is very doubtful that the increased cost could be passed forward to final product price where a high degree of cross-elasticity exists between the renderer's final product and alternate products.

The amount to be absorbed or passed back to suppliers depends on several factors, including the incremental amount the rendering plants will be required to pay for pollution controls. Also, the incremental cost increase will be subject to economies of scale. Therefore, stricter standards would result in a smaller incremental unit cost for large plants than for smaller plants. The larger plants appear to be in a more favorable position to pass a greater portion of their costs back than the small rural plants. Depending upon the magnitude of the increased costs, the small plant would be forced to absorb the major portion of the pollution abatement cost in the form of reduced profits, operate temporarily on their built-up reserves with eventual closure or shut down immediately.

V. ECONOMIC IMPACT ANALYSIS METHODOLOGY

The following economic impact analysis utilizes the basic industry information developed in Chapters I-IV plus the pollution abatement technology and costs provided by Environmental Protection Agency. The impacts examined include:

Price effects
Financial effects
Production effects
Employment effects
Community effects
Other effects

The impact analysis will not be a simple sequencial analysis but rather will be composed of a number of interacting steps. The schematic of the analytical approach is shown in Exhibit V-1. Because of the fundamental importance of potential plant shutdowns (financial and production effects) relative to the other impacts, a disproportionate amount of time will be devoted to the plant closure analysis.

The fundamental aspect of the impact analysis is similar to that normally done for any capital budgeting study of new investments. Simply stated, the problem is one of deciding whether a commitment of time or money to a project is worthwhile in terms of the expected benefits derived. The decision in this case is complicated by the fact that benefits will accrue over a period of time and that in actuality no analyst is sufficiently clairvoyant or physically able to reflect upon all of the required cost and benefit analysis information which relates to projections of the future. In the face of imperfect and incomplete information, the industry segments were reduced to money relationships insofar as possible and the key non-quantifiable factors were incorporated into the analysis to modify the quantified data. The latter process is particularly important in view of the use of model plants in the financial analysis. In practice, actual plants will differ from the model, and these differences must necessarily be considered in any interpretation of analytic data reflecting the behavior of model plants.

A. Fundamental Methodology

Much of the underlying analysis regarding price, financial, and production effects is applicable to all other impact effects. Consequently, the case methodology described here is conceptually integrated and the specific impact interpretations are discussed under their appropriate headings.

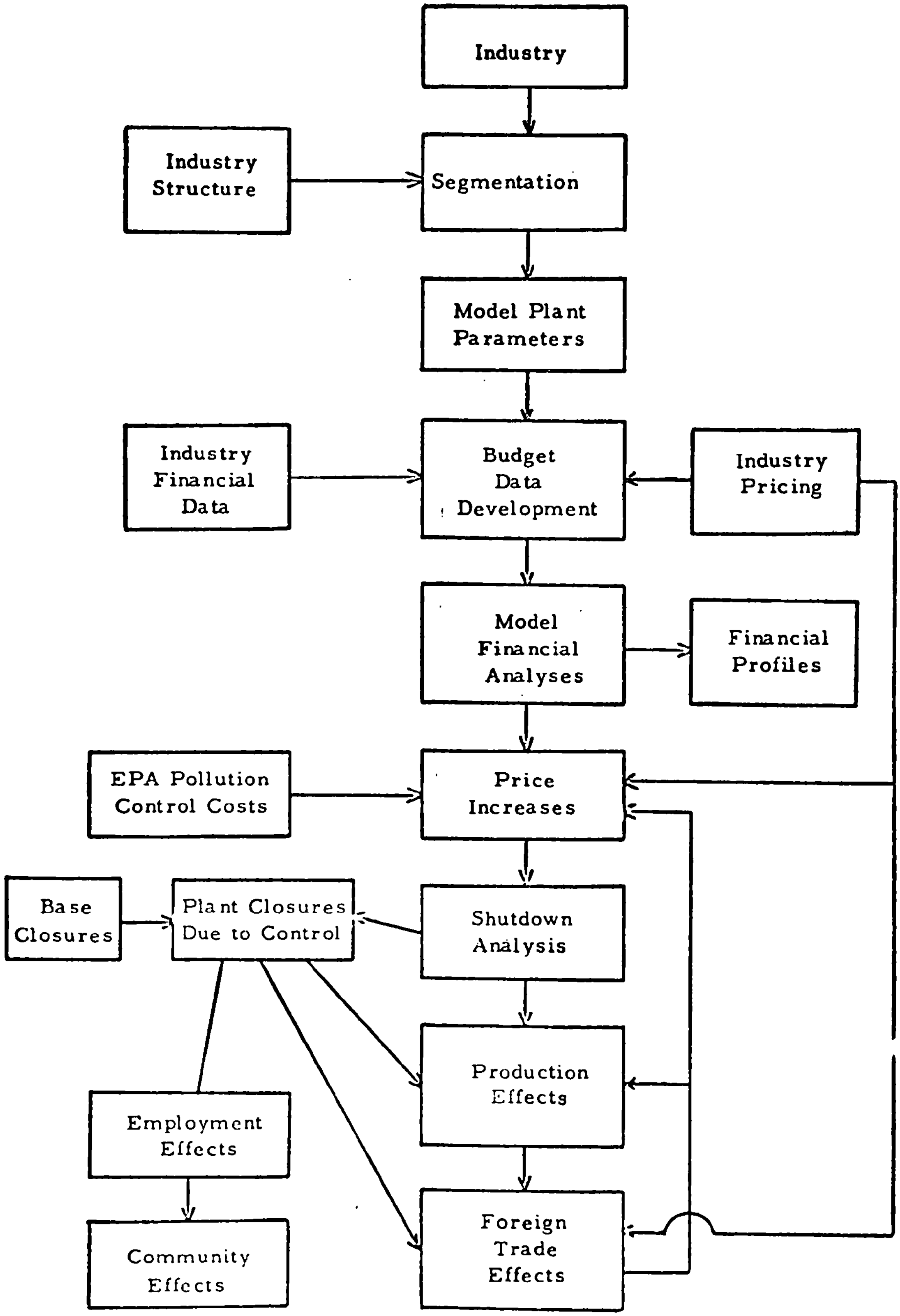


Exhibit V-1. Schematic of impact analysis of effluent control guidelines.

The core conceptual data used in this analysis are the physical and financial characteristics of the various industry segments as projected on the basis of model plants. The estimated cash flows for these model plants are summarized in Chapter III.

The primary factors involved in assessing the financial and production impact of pollution control are profitability changes; and these, in turn, are a function of the cost of pollution control and the ability to pass along these costs in higher prices. In reality, of course, closure decisions are seldom made on the basis of well defined common economic rules; such decisions invariably include a wide range of personal values, external forces such as the ability to obtain financing, or the role of the production unit in an integrated larger cost center. Such non-economic variables include but are not limited to the following conditions and are generally characteristic of proprietorships and closely held enterprises rather than publicly held corporations.

1. Production units may lack sufficient financial accounting data. This is especially likely to occur among small, independent operators who do not have effective cost accounting systems.

2. Production units may be so old and fully depreciated that management has no intention of replacing or modernizing them. Production continues only so long as it covers labor and materials costs and/or until the equipment becomes inoperative.

3. Marginally productive units may be acquired by new ownership that can reevaluate existing assets or that can absorb temporary low returns with the expectation of eventual acceptable profit returns.

4. Production unit ownership may have value as psychic income. Such ownership, may answer personal values that are great enough to override rational economic decisions.

5. The production unit, if part of a larger economic entity, may (1) use raw materials produced in another plant within the firm that must have an assured market or (2) supply intermediate products to another unit within the firm. When the profitability of the second operation offsets the losses in the first plant, the unprofitable operation may continue indefinitely because the total enterprise is profitable.

6. The owner-operator expects that adverse conditions and consequent losses are temporary. His ability to absorb short-term losses depends upon his access to funds through credit or personal resources not presently utilized.

7. There are very low (approaching zero) opportunity costs for the fixed assets and for the owner-operator's managerial skills and/or labor. As long as the operator can meet labor and materials costs, he will continue to operate. He may even operate with gross revenues below variable costs until he has exhausted his working capital and credit.

8. The value of the land on which the plant is located is appreciating at a rate sufficient to offset short-term losses; funds are available to meet operating needs and opportunity costs of the owner-operator's managerial skills are low.

While these factors are present in and relevant to business decisions, it is argued that common economic rules are sufficient to provide useful and reliable insight into potential business responses to required investment and operating costs in pollution control facilities.

The following discussion presumes investment in pollution control facilities. However, the rules presented apply to on-going operations. In the simplest case, a plant will be closed when variable expenses (Vc) are greater than revenues (R) since by closing the plant, losses can be avoided.

A more probable situation is where $VC < R$ but revenues are less than variable costs plus cash overhead expenses (TCc) which are fixed in the short run. In this situation a plant would likely continue to operate as contributions are being made toward covering a portion of these fixed cash overhead expenses. The firm cannot operate indefinitely under this condition, but the length of this period is uncertain. Basic to this strategy of continuing operations is the firm's expectation that revenues will increase to cover cash outlay. Identification of plants where $TCc > R$, but $Vc < R$ leads to an estimate of plants that should be closed over some period of time if revenues do not increase. However, the timing of such closures is difficult to predict.

The next level is where $TCc < R$. So long as $TCc < R$ it is likely that plant operations will continue so long as the capitalized value of earnings (CV), at the firm's (industry) cost of capital, is greater than the realiable value (S) of sunk plant investment. If S > CV or CV - S > O, the firm could realize S in cash and reinvest and be financially better off, assuming reinvesting at least at the firm's (industry) cost of capital.

Computation of CV involves discounting the future earning flows to present value through the discounting function:

$$NPV = \sum_{n=1}^{t} A_n (1+i)^{-n}$$

where

NPV	=	net present value
A_n	=	future after-tax income in n^{th} year or salvage value in year t
i	=	discount rate at cost of capital
n	=	number of conversion periods, i.e., 1 year, 2 years, etc.

It should be noted that a more common measure of profitability is return on investment (ROI) where profits are expressed as a percent of invested capital (book value), net worth or sales. These measures should not be viewed so much as different estimates of profitability as compared to present value measures but rather an entirely different profitability concept.

The data requirements for ROI and NPV measures are derived from the same basic financial information although the final inputs are handled differently for each.

1. Returns

For purposes of this analysis, returns for the ROI analysis have been defined as pre-tax and after-tax income and for the NPV analysis after-tax cash proceeds. The computation of each is shown below:

Pre-tax income = (R-E-I-D)

After-tax income = (1 - T) x (R - E - I - D) where

T	=	tax rate
R	=	revenues
E	=	expenses other than depreciation and interest
I	=	interest expense
D	=	depreciation charges

Interest in the cash proceeds computation is omitted since it is reflected in the discount rate, which is the after-tax cost of capital. Depreciation is included in the NPV measure only in terms of its tax effect and is then added back to obtain cash flow.

A tax rate of 22 percent on the first $25,000 income and 48 percent on amounts over $25,000 was used throughout the analysis. Accelerated depreciation methods, investment credits, carry forward and carry back provisions were not used due to their complexity and special limitations.

2. Investment

Investment is normally thought of as outlays for fixed assets and working capital. However, in evaluating closure of an on-going plant with sunk investment, the value of that investment is its liquidation or salvage value (opportunity cost or shadow price). 1/ For this analysis, sunk investment was taken as the sum of liquidation value of fixed assets plus net working capital (current assets less current liabilities) tied up by the plant (see Chapter II for values). This same amount was taken as a negative investment in the terminal year.

The rationale for using total shadow priced investment was that the cash flows do not include interest expenses with interest charges reflected in the weighted cost of capital. This procedure requires the use of total capital (salvage value) regardless of source. An alternative would be to use as investment, net cash realization (total less debt retirement) upon liquidation of the plant. (In the single plant firm debt retirement would

1/ This should not be confused with a simple buy-sell situation which merely involves a transfer of ownership from one firm to another. In this instance, the opportunity cost (shadow price) of the investment may take on a different value.

be clearly defined. In the case of the multi-plant firm, delineation of debt by plant would likely not be clear. Presumably this could be reflected in proportioning total debt to the individual plant on some plant parameter such as capacity or sales.) Under this latter procedure, interest and debt retirement costs would be included in the cash flows.

The two procedures will yield similar results if the cost of capital and interest charges are estimated on a similar basis. The former procedure, total salvage value, was used as it gives reasonable answers and simplifies both computation and explanation of the cash flows and salvage values.

Replacement investment for plant maintenance was taken as equal to annual depreciation, which corresponds to operating policies of some managements and serves as a good proxy for replacement in an on-going business.

Investment in pollution control facilities will be from estimates provided by EPA. Only incremental values will be used, to reflect in-place facilities and only the value of the land for control will be taken as a negative investment in the terminal year, i.e., pollution control equipment is assumed to have no salvage value.

The above discussion refers primarily to the NPV analysis. Investment used in estimating ROI was taken as invested capital--book value of assets plus net working capital.

3. Cost of Capital - After Tax

Return on invested capital is a fundamental notion in U. S. business. It provides both a measure of a firm's actual performance as well as its expected performance. In the latter case, it is also called the cost of capital. In this analysis the cost of capital is defined as the weighted average of the cost of each type of capital employed by the firm, generally its equities and interest bearing liabilities. There is no methodology that yields the precise cost of capital, but the cost can be approximated within reasonable bounds.

The cost of capital was determined for purposes of this study by estimating performance measures of the industry. The weights of the two respective types of capital for the independent rendering industry were estimated at 40 percent debt and 60 percent equity. The cost of debt was assumed to be 7.0 percent. The cost equity was determined from the ratio of earnings to net worth at 11.08 percent.

To determine the weighted average cost of capital, it is necessary to adjust the before tax cost to after tax costs (debt capital only in this case). This done by multiplying the costs by one minus the tax rate (assumed to be 48 percent).

Weighted average after tax cost of capital

Item	Weight	Before tax cost	Tax rate	After tax cost	Weighted cost
Debt	.40	7.0	.48	3.6	1.44
Equity	.60	-	-	11.1	6.66
					8.10

4. Construction of the Cash Flow

The cash flow to be used in the analysis of BPT (Best Practicable Technology) and BAT (Best Available Technology) effluent control and will be constructed as follows:

1. Sunk investment (salvage market value of fixed assets plus net working capital) taken in year t_o, assumed to be equivalent to 1976
2. After tax cash proceeds taken for years t_1 to t_n
3. Annual replacement investment, equal to annual current depreciation taken for years t_1 to t_n.
4. Terminal value equal to sunk investment taken in year t_n.
5. Incremental pollution control investment taken in year t_o for 1977 standards and year t_6 for 1983 standards.
6. Incremental pollution expenses taken for years t_1 to t_n for 1977 standards and years t_7 to t_n for 1983 standards if additive to the 1977 standards.
7. Replacement investment taken in year t_n on incremental pollution investment in BPT on assumption of life of facilities as provided by EPA.

8. No terminal value of pollution facilities to be taken in year t_n. Land value will probably be assumed to be very small and/or zero, unless the costs provided indicate otherwise.

The length of the cash flow will depend upon the life of the pollution control technology provided by EPA. It is anticipated that the length of the cash flow will be equal to the life of control equipment specified for 1983 installation.

Construction of the cash flows for analyzing new source standards will be similar to BPT and BAT, excepting plant investments, costs and returns will be based on current values as if being built now.

B. Price Effects

As shown in Figure V-1, price and production effects are interrelated with each having an impact upon the other. In fact, the very basis of price analysis is the premise that prices and supplies (production) are functionally related variables which are simultaneously resolved, thus the feedback loop shown in Figure V-1.

Solution of this requires knowledge of demand growth, price elasticities, supply elasticities, the degree to which regional markets exist, the degree of dominance exerted by large firms in the industry, market concentration exhibited by both the industry's suppliers of inputs and purchasers of outputs, organization and coordination within the industry, relationship of domestic output with the world market, existence and nature of complementary goods, cyclical trends in the industry, current utilization of capacity and, exogenous influences upon price determination (e.g., governmental regulation).

In view of the complexity and diversity of factors involved in determination of the market price, a purely quantitative approach to the problem of price effects will not be feasible for this study. Hence, the simultaneous considerations suggested above will be made. The judgment factor will be heavily employed in determining the supply response to a price change and alternative price changes to be employed.

As a guide to the analysis of price effects, the estimated required price increase to leave the model plant as well off after the investment in pollution control facilities as before, will be computed. The required price increase can be readily computed using the NPV analysis described above, but dealing only with the incremental pollution cash flow and sales.

Application of the above NPV procedure to pollution control costs will yield the present value of pollution control costs (i.e., investment plus operating cost less tax savings excluding interest expenses). Given this, the price increase required to pay for pollution control can be calculated as

$$P = \frac{(PVP)(100)}{(1-T)(PVR)}$$

where:

P = required percentage increase in price

PVP = present value of pollution control costs

PVR = present value of gross revenue (sales) starting in the year pollution control is imposed

T = tax rate appropriate following imposition of pollution control

The next step would be to evaluate the required price increases against expectations regarding the ability to raise prices. As pointed out above, this will be a function of a number of factors. In cases where a few large plants represent the bulk of production, their required price increase will likely set the upper limit. For the products in this study, other factors will be overriding. These include expected price changes for basic fertilizer materials due to future supply-demand conditions and impacts such as pollution control, as well as the declining consumption of these products per se. From this analysis, which will be quantitative, an initial estimate of expected price increases would be made.

Following this, the initial shutdown analysis (production curtailment) will be made. The decrease in production will be evaluated in light of impact on prices and if warranted by production decreases, the expected price increase would be revised upward.

C. Shutdown Analysis

The basic shutdown analysis would be based upon the technique described above under Section A and the expected price increase from the preceding step.

Based on the results of the NPV analysis of model plants, likely closures would be identified where NPV < O. Segments or plants in the industry would be equated to the appropriate model (on interpolation) results. Mitigating items, such as association with a complex, captive raw material sources, unique market advantages and existing in place controls and ability to finance new non-productive investment would be factored in quantitatively to obtain an estimate of likely closures. If BAT costs differ from BPT costs, closure estimates would be required for each condition. It is recognized that the use of model plants to represent an industry is imperfect and that not all of the relevant factors can be included in the models. In other words, for any given model plant one would expect to find some actual plants with profits lower and some higher than shown for the model plant. In a statistical sense, one can describe this phenomenon via distribution functions. By examining various financial publications, the standard deviation of net profit as a percent of sales can be estimated or approximated.

The methodology employed implicitly assumes that the model plant represents the median plant for the distribution and that there will be a different standard deviation for each plant.

Furthermore, the procedure implies that the standard deviation will be larger for the more profitable industry segments. By utilizing the net present values calculated under alternative effluent treatment assumptions, the standard deviations described above, and the assumptions that plants with a negative net present value will be forced to close, the percentage of firms closing in each industry segment can be readily estimated through accepted statistical techniques.

The impact of these closures would be evaluated as the next step (see Figure V-1). If production impacts were of sufficient magnitude, the expected prices would be re-evaluated and the shutdown analysis is repeated.

D. Production Effects

Potential production effects include changes of capacity utilization rates, plant closures and stagnation of industry growth. Plant closures may be offset in total or in part by increases in capacity utilization on the part of plants remaining in operation. Expected new production facilities would be estimated. The end result would be estimated production under the conditions presumed for the above closure analysis.

The estimated production under these expectations would feed back into the price analysis to verify or revise expected price changes.

E. Employment Effects

Given the production effects of estimated production curtailments, potential plant closings and changes in industry growth, a major consideration arises in the implications of these factors upon employment in the industry. The employment effects stemming from each of these production impacts in terms of jobs lost will be estimated using the model plant information.

To the extent possible,the location of closed plants, the major employee classification involved and potential for re-employment will be evaluated.

F. Community Effects

The direct impacts of job losses upon a community are immediately apparent. However, in many cases, plant closures and cutbacks have a far greater impact than just the employment loss. These multiplier effects will be reflected in evaluating payroll losses and income multipliers.

G. Other Effects

Other impacts such as direct balance of payments effects will also be included in the analysis. This will involve qualitative analyses.

VI. EFFLUENT CONTROL COSTS

Water pollution control costs used in this analysis were furnished by the Effluent Guidelines Division of the Environmental Protection Agency from materials developed in part for the Environmental Protection Agency by North Star Research Institute. These basic data were adapted to the types and sizes of plants specified in this analysis.

Three effluent guidelines were considered:

BPT	-	Best Pollution Control Technology Currently Available, to be achieved by July 1, 1977
BAT	-	Best Available Pollution Control Technology Economically Achievable, to be achieved by July 1, 1983
NSPS	-	New Source Performance Standards, apply to any source for which construction starts after the publication of the proposed regulations for the Standards

A technical document describing the recommended technology for achieving the three guidelines will be published as a separate report by EPA. To avoid duplication and possible confusion, no technical descriptions of BPT, BAT and NSPS guidelines are given in this report. The interested reader is referred to EPA's technical report for technology descriptions.

A. Current Status of Effluent Control in the Industry

The Development Document (5) outlines the current status of effluent control now assumed to be practiced in the industry. This information is based on the North Star sample of the industries and is presented in Table VI-1 for information purposes. There are no other recent publications with reliable estimates of the proportion of the meat plants which dispose of waste water through the various types of treatment facilities. As a result, the data as presented in Table VI-1 was used as the basis of our impact analysis.

Table VI-1. Current status of rendering plants by waste treatment practices

Plant size	Discharge to municipal system		No discharge; irrigation or evap. pond		Treatment with discharge into waterway		Total number of plants in industry	
Batch plants	No.	%	No.	%	No.	%	No.	%
Small	55	34.1	94	88.7	61	65.6	210	58.3
Medium	95	59.0	11	10.4	29	31.2	135	37.5
Large	11	6.9	1	0.9	3	3.2	15	4.2
Total Batch	161	100.0	106	100.0	93	100.0	360	100.0
Continuous Plants								
Medium	45	70.3	6	85.7	14	73.7	65	72.2
Large	19	29.7	1	14.3	5	26.3	25	27.8
Total continuous	64	100.0	7	100.0	19	100.0	90	100.0
Total Plants	225	50.0	113	25.1	112	24.9	450	100.0

No pretreatment requirements are assumed in the Development Document and as a result no additional cost for those plants disposing into municipal systems was considered. It may be noted, however, that individual plants may face an increase in surcharges imposed by the local municipal treatment facility resulting in increased cost of operation in the future.

Plants now disposing of waste water through secondary treatment facilities will incur additional costs as described in the following section and it is to these plants that the impact analysis is directed.

Plants now using land disposal methods such as irrigation systems or evaporation ponds that tend to be located in arid regions of the Southwest and California have achieved a "no discharge" treatment level according to the Development Document. As a result, these systems will incur no additional costs under the proposed standards. These methods are provided as a lower cost alternative to meet the proposed standards. Use of this method is dependent upon land availability and meeting all requisite Federal, State and Local regulations. If some form of primary treatment is required prior to discharge (and possibly some secondary treatment), the cost would increase substantially through land disposal methods.

B. "Typical" Effluent Control Costs

The additional investment and operating costs required of a "typical" plant, in each size plant group, to achieve indicated performance standards were specified in the Development Document. Typical plants in each size group, as defined by EPA, are as follows:

1. Small: A "small" plant would have a raw material processing range of less than 100,000 pounds per day with a corresponding average of 37,000 pounds processed per day. The average waste water flow rate would be 5,300 gallons per day.

2. Medium: The "medium" plant would have a raw material processing range of 100,000 to 250,000 pounds per day, with an average of 168,000 pounds per day. The average waste water flow rate would be 24,000 gallons per day.

3. <u>Large:</u> The "large" plant would have a raw material processing range exceeding 250,000 pounds per day. with an average of 530,000 pounds per day. The average waste water flow rate would be 76,000 gallons per day.

The additional investment required by "typical" plants to achieve the indicated performance standards is shown in Table VI-2. (These costs are based on whatever 50 percent of the plants in a particular category will incur to meet the proposed standards). The estimate of the cost of achieving BPT limitations is based on the following assumptions: (5)

80 percent of the small plants with treatment systems will need to install pumps and piping to recirculate waste water to the barometric condensers.

50 percent of all plants with treatment systems will need to add an aerobic lagoon or the equivalent.

50 percent of all plants with treatment systems will need to install chlorination.

The BAT limitations will require the following additions to the existing treatment systems, over and above the BPT limitations. (5)

90 percent of all plants with treatment systems must add sand filters, or the equivalent.

50 percent of all plants with treatment systems will have to make capital improvements in their primary treatment facilities.

12 percent of all plants with treatment systems will have to eliminate direct blood drainage to the sewer and recover it in their product streams.

20 percent of all plants with treatment systems will have to install ammonia stripping equipment.

Investment and annual operating costs are shown in Table VI-2 for disposal through irrigation. Irrigation is provided as a lower cost alternative to meet the proposed standards. Use of the irrigation method, however, is dependent upon land availability and meeting all requisite Federal, State, and Local regulations.

Table VI-2. Incremental effluent control costs for "typical" independent rendering plants (1971 costs)[1/]

Plant size	1977 Standards: Invest-ment	1977 Standards: Annual operating cost	1977 Standards: Total Annualized cost	1983 Standards: Invest-ment	1983 Standards: Annual operating cost	1983 Standards: Total Annualized cost
Small	26,500	11,900	16,500	53,000	25,100	40,300
Medium	27,000	12,200	16,200	85,000	27,300	48,200
Large	52,000	14,000	21,600	119,000	31,300	62,600
	Irrigation			New Point Source Standards		
Small	5,000	500	1,500	38,000	14,700	20,500
Medium	14,000	700	3,500	78,000	18,800	30,600
Large	37,000	230	7,600	133,000	24,100	44,100

Source: Development Document

1/ "Typical" independent rendering plants as defined in the Development Document. This should not be confused with the DPRA "model" plants as used in this report.

C. Effluent Control Costs for Model Plants

The effluent control costs provided by EPA were "single point" estimates in that they applied specifically to a given type of plant with a given production volume. Obviously, effluent treatment costs will vary with wasteflow and, hence, processing volume. Based on discussions with EPA and North Star Research Institute personnel, DPRA estimated investment and annual treatment cost data for alternative plant sizes. These estimates were made by assuming that, for a given treatment level, both investment and operating costs were a function of quantity of wasteflow. Given that assumption, the three "typical" plants were plotted on a graph and a smooth curve was drawn to "fit" the points. Although the points representing the "typical" plants do not fall precisely on the line, it is believed that the fit is acceptable.

Basic operating parameters for model rendering plants developed by DPRA are shown in Table VI-3. Incremental investment costs to meet the proposed BPT Standards shown in Table VI-4 range from $28,500 for the small batch plant to a high of $36,000 for the large continuous plant. Because of the nature of monitoring the system, there are large economies of scale in operating costs from the small to the large plants. Operating costs range from $12,800 for the small batch plant to $14,500 for the large continuous plant.

Incremental investment costs to achieve BAT Standards for plants disposing of waste water into streams range from $57,100 for the small batch plant to a high of $118,400 for the large continuous plant. Operating costs range from approximately $27,000 to a high of $32,000.

Table VI-3. Operating parameters for DPRA model independent rendering plants

	Batch Plants			Continuous Operation	
	Small	Medium	Large	Medium	Large
Pounds raw material processed per day	37,000	118,000	294,000	143,000	357,000
Waste water flow gal/ 1,000 lb RP [1/]	143	143	143	143	143
Average waste water flow gal/day	5,300	16,874	42,042	20,449	51,050

1/ The constant 143 gallons per 1,000 pounds of raw product processed is based on the assumption of implementation of proper in-plant water management in the small and medium plants which can be readily accomplished without capital expenditures.

Table VI-4. Incremental effluent control costs for independent rendering

Effluent Control Level	Cost Item	Batch Plants			Continuous Operation Plants	
		Small	Medium	Large	Medium	Large
BPT (1977)	Investment	28,500	29,100	35,000	29,100	36,000
	Annual Cost					
	Capital	1,200	1,200	1,400	1,200	1,500
	Depreciation	2,850	2,910	3,500	2,910	3,600
	Operating cost	12,800	12,900	14,100	12,900	14,500
	Total Annual cost	16,850	17,010	19,000	17,010	19,600
BAT (1983)	Investment	57,000	80,200	111,900	86,100	118,400
	Annual Cost					
	Capital	2,300	3,200	4,500	3,500	4,800
	Depreciation	5,700	8,020	11,190	8,610	11,840
	Operating cost	27,000	28,400	30,700	28,700	31,500
	Total annual cost	35,000	39,620	46,390	40,810	48,140
New source standards	Investment	40,900	63,700	108,700	79,100	118,400
	Annual cost					
	Capital	1,700	2,600	4,400	3,200	4,800
	Depreciation	4,090	6,370	10,870	7,910	11,840
	Operating cost	15,800	18,500	23,000	19,400	24,100
	Total annual cost	21,590	27,470	17,570	30,510	40,740
Irrigation system only	Investment	5,400	11,300	24,700	12,900	29,000
	Annual cost					
	Capital	220	460	1,000	520	1,200
	Depreciation	540	1,130	2,470	1,290	2,900
	Operating cost	540	750	320	750	320
	Total annual cost	1,300	2,340	3,790	2,560	4,420

Table VI-4. Incremental effluent control costs for independent rendering (Continued)

Effluent Control Level	Cost Item	Batch Plants Small	Batch Plants Medium	Batch Plants Large	Continuous Operation Plants Medium	Continuous Operation Plants Large
Percolation and evap. pond	Investment	15,000	11,300	50,600	32,300	56,500
	Annual cost					
	Capital	600	460	2,000	1,300	2,300
	Depreciation	1,500	1,130	5,060	3,230	5,650
	Operating cost	810	1,600	2,700	1,600	2,800
	Total annual cost	2,910	3,190	9,760	6,130	10,750

VII. IMPACT ANALYSIS

The imposition of effluent controls on the independent rendering industry will have both direct and indirect impacts on the industry, on consumers, on its suppliers and on communities in which plants are located. An analysis was made, for specified effluent control levels, in both quantitative and qualitative terms, of the impacts which are expected.

The following types of impacts have been analyzed:

A. Price Effects
B. Financial Effect
C. Production Effects
D. Employment Effects
E. Community Effects
F. Balance-of-payment Effects

A. Price Effects

Considerable competition exists among renderers for the limited supply of raw products. Urban renderers face both price and service competition whereas rural renderers may not be subjected to the degree of price competition experienced by urban renderers. However, they have a lower quality product (i.e., dead stock) and longer routes and more costly pickup. On the demand side, the renderer sells his product on the open commodity market where competition is keen and prices are set through the prevailing supply and demand conditions.

As a result of these existing pricing conditions (and further elaborated on in Chapter V), the renderer is faced with a difficult situation in terms of his ability to pass increased costs forward to the consumer or backward to the suppliers of raw product. In addition, approximately 22 percent of the total volume of rendered products are processed in the meat packing industry in on-site plants. These factors will be further discussed in the following section.

1. Required Price Increase

For the segment of plants that are now discharging wastes through some type of secondary treatment system, the price increases required to pay for incremental pollution control facilities are shown in Table VII-1. These price changes were calculated as a percent of sales, where a 21-year cash flow was used. Both treatment costs and revenues were discounted back to year zero prior to calculating the percentage increase required. This increase indicated the change necessary to keep the Net Present Value of the plant constant.

The price increases were calculated from the wholesale selling prices f.o.b. plant stated in the description of the model plants (Chapter III).

Price increases required to meet BPT Standards range from 0.6 percent for the large continuous plant to a high of 5.6 percent for the small plant. Price increases required by the medium size plants will range from 1.3 to 1.7 percent.

A major price increase is required to achieve BAT Standards. An incremental .8 percent is required by the large plants but the small plants will require an additional 7.1 percent to achieve the Standards. Thus, to achieve the BAT above the baseline will require a price increase of 1.5 percent for large plants, 2.8 to 3.9 for medium size plants and 12.7 percent for the small renderers.

2. Expected Price Increase

The ability for firms incurring increased costs resulting from the imposition of Effluent Control Guidelines to pass these costs through the market system either forward or backward is considered to be negligible. Several factors are considered in reaching this conclusion.

According to the Development Document, plants linked to municipal systems will not incur increased costs. As pointed out earlier, however, municipalities may readjust their rates resulting in higher costs for their users. We are assuming no additional costs will be incurred by those plants resulting from the imposition of the Standards.

Plants achieving no discharge into a waterway through irrigation or evaporation ponds are also assumed to incur no additional cost to meet the proposed Standards.

Table VII-1. Percent price increase required to pay for incremental pollution control

Type and size of plant	BPT above baseline	BAT above baseline	BAT above BPT
Batch:			
Small	5.57	12.67	7.10
Medium	1.72	3.85	2.13
Large	.67	1.48	.81
Continuous:			
Medium	1.25	2.76	1.51
Large	.64	1.53	.89

It is estimated that 50 percent of the plants dispose of waste water through municipal systems and an additional 25 percent have achieved a no discharge level (Table VI-1). Based upon the size distribution of the plants disposing of waste water through these two methods, we estimate that they would account for 78 percent of the total production by this industry or 61 percent of the total rendered products.

A review of the expected price increases for the meat packing industry (SIC 2011) which processes 22 percent of the total shipments of rendered products indicates that a price increase of 0.05 percent was projected for BPT (5). This was considered too small to be traced through the market system.

The estimated price pass-through resulting from BAT Standards was judged unlikely to prevail in the long-run. About 55 percent of the meat packing plants are connected to municipal sewers. Except for possibly a few isolated areas, the competitive powers of those plants connected to municipal systems that will incur no additional costs should be sufficient to hold margins down to the levels expected with BPT treatment.

As a result of the combination of product produced in the independent rendering industry that will not incur increased costs and that produced in the meat packing industry, a total of 82 percent of all rendered products will be produced in plants incurring no increased costs.

In addition to the above, the renderer sells his products on the open commodity market where no one seller can affect price, and where competition from other products that can be used as substitutes is keen. Therefore, we conclude that those plants incurring higher costs resulting from pollution controls will not be able to effectively pass these costs forward.

The ability of the renderer to pass his increased cost backward to the supplier of raw materials is also limited. This is especially true of the small renderer located primarily in rural areas. The reasoning for this is the fact that the rural renderer is operating from a lower base price associated with lower yield product, and therefore downward adjustments would be more limited. An example of this situation is where dead stock are picked up as a service without payment. The value of final product from a $1,000 pound carcass is estimated at about $34.00. With rendering cost of $10.00 and pick up costs ranging from $15.00 to $25.00, there is very little margin left. If charges were made to the owner of the dead stock, it might be more feasible to make disposition of the dead stock on the farm and thereby create a health hazard.

In the urban areas, the competitive factor on raw material acquisition would prevent effective backward price pass through.

As a result of the high percentage of production represented by plants that will not experience higher costs from pollution controls and other factors discussed above, we conclude that the plants incurring higher costs will not be able to effectively pass these costs either forward to the consumer or backward to the supplier of the raw material.

B. Financial Effects

Two primary types of analyses were completed to assess the financial impacts of the proposed pollution control costs on the model plants' (1) profitability and (2) the present value of future net income stream.

Profitability impacts include the following:

1. Pre-tax net income
2. After-tax return on sales
3. Pre-tax rate of return on invested capital
4. After-tax rate of return on invested capital
5. Annual cash flow

1. Pre-tax Net Income

The impact of alternative effluent treatment levels on pre-tax net income for model rendering plants is shown in Tabl VII-2. The imposition of BPT Standards severely reduces net income in the small conventional batch plants from 6,500 to a negative $10,400. The pre-tax net income of the medium sized batch plants is also reduced to a very low level but remains positive. The net incomes for large batch plants and for the continuous type plants are reduced, but not to the critical point as for small and medium size batch plants.

BAT Standards further depress profits to the extent that medium size batch plants would be operating in a loss position. Large conventional plants have annual profits reduced to $3,000 from an estimated baseline position of $69,000.

Table VII-2. Pre-tax and after-tax income for model independent rendering plants, assuming no price change ($1,000)

Type and size of plant	Pre-tax income			After-tax income		
	Baseline	BPT	BAT	Baseline	BPT	BAT
Batch:						
Small	6.5	-10.4	-45.4	5.0	-10.4	-45.4
Medium	24.0	7.0	-32.6	18.6	5.4	-32.6
Large	69.0	50.0	3.6	42.0	32.4	2.8
Continuous:						
Medium	86.0	69.0	28.2	219.0	42.3	21.2
Large	51.0	199.4	154.5	125.0	110.1	86.8

2. Return on Sales

The after-tax return on sales for model rendering plants at alternative treatment levels is shown in Table VII-3. Basically, the returns follow the same general pattern as net income. A significant point is the low rate of after return on sales for the batch type plant of approximately 2 percent and the higher rate of about 5 percent on the new continuous process plants. This, we feel is consistent with general industry performance.

After tax income is reduced to a negative - 4.1 percent of sales for the small plant with the imposition of BPT Standards. For the medium size plant, income is reduced to 0.6 percent. Incomes for the large size batch plant and continuous plants are reduced but not seriously with the imposition of BPT standards.

BAT Standards reduces the medium size conventional plant to negative levels and the large plant to a 0.1 percent. Profits on continuous plant operations are reduced by more than 50 percent after the imposition of BAT Standards.

3. Return on Invested Capital

Return on invested capital before and after tax for model rendering plants with alternative effluent treatment levels is shown in Table VII-4. After tax income as a percent of invested capital is shown ranging from 4 to 8 percent for batch type plants and 9 to 12 percent for continuous plants. The small plant follows a similar trend that we have seen in the meat processing industry as well as the leather tanning and other industries; that is, the return on invested capital is substantially lower for the small plant than for the medium and large plants.

As shown in Table VII-4, the after-tax return on invested capital drops to a negative value for the small plant with the imposition of BPT Standards. For medium plants it drops to a 2.5 percent after-tax. Profits on the large batch plant and continuous process medium and large plants are reduced. However, after-tax profits still remain about 8 percent.

The imposition of BAT Standards severely reduces the profits of the medium size batch plant to a negative position. Profits in the large batch plant are reduced to an after-tax rate of .6 percent. After-tax income is reduced to 4 percent and 8 percent respectively for the continuous medium and large plant.

Table VII-3. Pre-tax and after-tax return on sales for model independent rendering plants, assuming no price change

Type and size of plant	Pre-tax income			After-tax income		
	Baseline	BPT	BAT	Baseline	BPT	BAT
Batch:						
Small	2.6	-4.1	-18.0	2.0	-4.1	-18.0
Medium	2.7	0.5	- 3.7	2.1	.6	- 3.7
Large	3.1	2.3	.2	1.9	1.5	.1
Continuous:						
Medium	8.0	6.4	2.6	4.7	3.9	2.0
Large	8.2	7.3	5.8	4.7	4.1	3.2

Table VII-4. Pre-tax and after-tax rate of return as a percent of average invested capital for model independent rendering plants, assuming no price change

Type and size of plant	Pre-tax income			After-tax income		
	Baseline	BPT	BAT	Baseline	BPT	BAT
Batch:						
Small	5.8	- 9.2	-40.2	4.4	- 9.2	-40.2
Medium	11.0	3.2	-14.9	8.5	2.5	14.9
Large	13.7	10.0	0.7	8.4	6.5	.6
Continuous:						
Medium	15.2	12.2	5.0	9.0	7.5	3.8
Large	20.5	18.7	14.5	11.7	10.3	8.1

4. Cash Flow

Estimated cash flows (after-tax income plus depreciation on invested capital for the model rendering plants) are shown in Table VII-5. In the baseline case cash flows range from 14 to 21 percent with the highest cash flow attributed to the large continuous processing plant.

After the imposition of BPT Standards, all cash flows remain in a positive position, although the cash flow for small plants is reduced to 3 percent of invested capital.

The annual cash flow for the large batch plant and continuous processing plants ranges from 12 to 18 percent following the imposition of the BAT Standards. Cash flows for small and medium size plants are reduced to negative values.

5. Net Present Value (NPV)

Another measure of the financial viability of a plant is the net present value (NPV) of projected streams of cost and revenues. With this measure, it is possible to assess the likelihood of continued plant operation versus closure. By discounting future cost and revenue stream at the estimated cost of capital (see Chapter V-Section A-3). positive NPV's would indicate the likelihood of continued plant operation whereas negative values would indicate probable plant shutdown. To complete this analysis, the following assumptions were made:

1. Existing plants have sunk investments but they presumably could be scrapped or salvaged and the salvage value reinvested elsewhere as an alternative to the processing operations. we assumed the salvage value of the batch type operations at 10 percent of the replacement cost. This relatively low value is based on little opportunity for use of the equipment outside the industry and low prospects for use as replacement equipment in existing plants. With the newer type continuous operations we used 25 percent of the replacement cost. It is assumed that this equipment which is newer would have more opportunity for use in other plants. Land was considered at the current valuation.

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Table VII-5. Estimated cash flow on average invested capital for model independent rendering plants, BPT and BAT treatment levels, assuming no price change

Type and size of plant	Baseline		BPT		BAT	
	($000)	(%)	($000)	(%)	($000)	(%)
Batch:						
Small	16	14.2	3.5	3.1	-28.7	-25.4
Medium	38.6	17.6	28.3	12.9	-4.6	-2.1
Large	86	17.1	79.9	15.9	58.0	11.6
Continuous:						
Medium	98	17.3	92.2	16.3	76.8	13.6
Large	219	20.5	207.7	19.5	189.4	17.8

2. Revenue and expenses are assumed to remain constant over time; i.e., 20 years of operation.

3. The after-tax cost of capital for the industry is estimated at 8.1 percent (see Chapter V-Section A-3 for description of after-tax cost of capital). The net persent value of model rendering plants before and after the imposition of alternative effluent treatment standards are shown in Table VII-6. All plants have a positive net present value prior to the imposition of standards. It is well to note that the small plants have a relatively low net present value before the imposition of controls and they are considered to be in a marginal situation.

The imposition of BPT controls reduces the NPV of the small batch plants to a negative position of approximately -$100,000. This suggests that the small plant would not be able to bear the cost of the BPT controls and would be forced to shut down. (It is well to note at this point the net present value of control costs are higher for the small plants than for the larger plants. This is due to tax considerations involved in computing net present value.) For example a large plant taxed at the .48 percent tax rate for income greater than $25,000 will have a tax saving of $0.48 per $1.00 of pollution control expenses or a net cost of $0.52. A small plant with a net income of less than $25,000 will have an effective tax rate of $0.22 percent; as a result the net cost to the plant will be $0.78 on incurred pollution control cost of $1.00.

The imposition of BAT Standards reduces the net present value of small plants even further. It also reduces the medium size plant to a negative of $148,000. This suggests that the medium size plants would not be able to incur the cost of the BAT Standards.

C. Production Effects

The imposition of BPT and BAT Standards will cause serious production effects in the rendering industry. Plants most seriously impacted are the small and medium size plants primarily located in rural areas. In many cases the pick-up routes of these plants may cover a radius of 150 to 200 miles. With only one plant serving the area the closure of such a plant by the imposition of pollution control standards will result in a serious disruption of service to the livestock farms, local slaughtering

Table VII-6. Net present values of model independent rendering plants before and after the imposition of BPT and BAT effluent treatment standards

Type and size of plant	NPV of Plant before controls	BPT		BAT	
		NPV of BPT controls	NPV of Plant after controls	NPV of BAT controls	NPV of Plant after controls
	($000)	($000)	($000)	($000)	($000)
Batch:					
Small	39.5	-136.7	-97.2	-174.4	-271.6
Medium	150.2	-114.9	35.3	-183.3	-148.0
Large	347.4	-90.6	219.7	-134.3	85.4
Continuous:					
Medium	463.6	-79.8	383.8	-109.5	274.3
Large	1,118.4	-92.5	1,025.9	-129.7	896.2

houses, retail stores and others that provide meat scraps, trimmings and carcasses in the rural area that are served by the rendering industry. Coverage of such pick-up routes may, in some cases, be accomplished by existing plants located in relatively close proximity. In many cases, however, it is expected that coverage of long pick-up routes, particularly in low population areas and service to individual farms may not be economically viable for remaining plants if distances to the plant are considerable.

I. Production Curtailment

No significant long-run curtailment in total production resulting from the imposition of increased water pollution control requirements is expected. If plants continue to operate it is highly unlikely that they would reduce volume to meet the proposed standards.

It is currently estimated that the industry is operating at an approximate capacity of 85 percent. Therefore, it is theoretically possible that the existing industry could cover the production loss from plant shutdowns with little problem. However, the problem is the spatial dispersion of the raw material sources that may make it uneconomical for plants surviving the BPT and BAT Standards to cover territories vacated by the closing plants.

The size distribution and percent of total production accounted for by each segment is summarized below:

Size	No. of Plants	Volume of Production
Small	210	16.6
Medium	200	53.5
Large	40	29.9
Total	450	100.0

It is estimated that there are approximately 90 continuous operation plants in existence today. Of this number, 25 are estimated to be large and 65 in the medium size category.

2. Plant Shutdowns Resulting from Pollution Control Guidelines

A conventional analyses of the firm profitability including absolute reduction in income as well as net profits as a percent of sales and as a percent of invested capital was used to appraise the firm ability to recover capital expenditure in pollution control equipment. The NPV analysis was used to view the present value of the future earnings of the firm with and without the imposition of pollution controls. This present value is then compared with the present salvage value of the firm. If the present salvage value of the firm is greater than the present value of future earnings with the imposition of controls a shutdown situation is suggested. By using both the conventional analysis and the NPV analysis it is believed a clearer picture of the firms financial picture can be obtained.

The imposition of the proposed BPT Standards will impact the small and medium size plants that dispose of their wastewater into waterways very severely. The small plants will be impacted to the point of shutdown. This will include 61 of the 210 small plants and will account for 4.8 percent of the total production of the industry (Table VII-7). Medium size plants will incur serious financial damage resulting in limited ability to finance new pollution control facilities if required. However, most of the increased costs are in terms of operating cost which will not require financing.

The imposition of the proposed BAT Standards will seriously impact the conventional batch type medium plants to the point of shutdown and seriously impair the financial position of the large conventional plants. It may be possible that even some of the large plants with lower profits will not be able to finance the needed investment and be forced to close down. We are not projecting any shutdowns at this point, however. We are projecting 29 medium size plants (all medium plants discharging into waterways with the exception of the continuous operations plants). It is estimated that these 29 medium size plants account for 7.8 percent of the total production in the industry.

The plant shutdown can be summarized as follows:

Size	No. of Plants	Plant Shutdown		Percent Loss of Total Production	
		BPT	BAT	BPT	BAT
Small	210	61	0	4.8	0
Medium	200	0	29	0	7.8
Large	40	0	0	0	0

Table VII-7. Estimated plant closures resulting from the effluent control standards

Plant size	Total Plants	Number on municipal system	No discharge: irrig. or evap. pond	Treatment with discharge into waterway	Estimated plant closures BPT	Estimated plant closures BAT	Total plants remaining
Batch Plants							
Small	210	55	94	61	61	0	149
Medium	135	95	11	29	0	29	106
Large	15	11	1	3	0	0	15
Total Batch	360	161	106	93	61	29	270
Continuous Plants							
Medium	65	45	6	14	0	0	65
Large	25	19	1	5	0	0	25
Total Continuous	90	64	7	19	0	0	90
Total Plants	450	225	113	112	61	29	360

As discussed earlier, the industry has the production capability to absorb this lost production. However, because of the spatial dispersion of the raw material supplies and the plants projected for closure, severe local problems will be encountered.

D. Employment Effects

Total employment in the independent rendering industry has declined from 14,600 employees in 1958 to 10,000 in 1972 (7, 8). The closure of an estimated 61 plants resulting from BPT Standards and 29 medium size plants resulting from BAT Standards will have approximately the following overall impact on employment.

Closures resulting from	No. & Size of Plant	Employees Dislocated	
		Per Plant	Industry
BPT Standards	61 small	10	610
BAT Standards	29 medium	27	783
			1,393

Because of the geographical dispersion of plants in the industry and the size of plants that are likely to close down, the employment impact will be generally dispersed nationally. Most likely, the majority of the plants that are forced to close will be located in small cities and towns of less than 25,000 population.

Although the average number of employees per plants is relatively low, the impact on a small town may be significant.

A further complication will result from the relatively unskilled status of at least 80 percent of the workers. Because most of the plants that will close are in rural areas and small towns where in many cases the job market is poor or declining, new employment for the displaced workers will be scarce. There will be very little opportunity for displaced workers to find comparable jobs in the existing plants.

E. Community Effects

As previously discussed, many of the small plants that will be forced to close are located in rural areas. The impact to communities will be a loss of jobs, loss of economic base and, possibly the most severe, a loss or serious decline in the service provided by the rendering plant.

The closure of a plant could result in a reduction in payrolls of $80,000 and $270,000 for small and medium sized plant respectively. This would approximate 1.6 to 4.3 percent of the total payroll of a small rural community of 2,500 (based on 625 employed workers earning $8,000 each). Assuming a multiplier of 3.5, the loss of a small or medium size plant could reduce the economic base of the community by as much as $280,000 to $950,000.

The major impact of the closure of the small and medium size plants would be the loss of service to the raw material collection area. In most rural areas pick up coverage is provided by only one plant. It will be uneconomical in many cases for surviving plants to extend their pick up routes. If they did extend their coverage to the impacted areas, the quality of service would most likely deteriorate. Not only would it take longer to respond to farmer calls, but also the frequency of pick up would be reduced to offset the added cost of additional miles.

It is impossible to determine precisely the number and location of the communities where plant closures would occur. However, a high proportion of these plants are in small rural communities. Also, among the small and medium size plants nearly all are family owned single plant firms.

Given the above information we estimate the number of communities impacted by the estimated plant closures to be approximately as follows:

BPT	-	61 communities
BAT	-	29 communities.

F. International Trade

International trade plays a vital role in the marketing of inedible tallow and grease. In 1970 46 percent of the total production was exported. The estimated impact from the imposition of BPT and BAT Standards on the rendering industry will have only very slight impact on our international trade and balance of payment.

There are no projected price increases resulting from the imposition of controls. As a result the competitive position of the U.S. in international trade should not be changed.

VIII. LIMITS OF THE ANALYSIS

A. General Accuracy

There is a tremendous lack of published information regarding the independent rendering industry. Ninety-five percent of the firms are privately held and publish no annual reports. The National Renderers Association, an active trade organization, does not collect any type of financial information on the member companies nor do they publish financial results of a limited number of firms such as the American Meat Institute. Financial information obtained from the Internal Revenue Service and published in Troy's Almanac of Business and Industrial Financial Ratios is aggregated with all meat packing and meat processing firms and provide little insight into the financial structure of the industry.

Financial information concerned with investments, operating costs and returns was not available for individual plants or firms. As a result, the financial aspects of the impact analysis were, of necessity, based on synthesized costs and returns for "representative" types and sizes of model plants. These costs and returns were developed from a variety of sources including information obtained from industry sources, equipment suppliers, plant architects, University sources and other knowledgeable individuals.

Water pollution control costs were furnished by EPA, Effluent Guidelines Division and resulted from costs developed for EPA by North Star Research Institute. These costs were developed for "typical" rendering plants as described earlier in this report. It was necessary to adapt these costs to the types and sizes of model plants used in this analysis. This adaption process required the making of assumptions and adjustments related to these data which are critical to the impact analysis. In addition, it was necessary to make specific assumptions regarding the current status of effluent disposal and treatment in the meat processing industry. These assumptions are described in detail in the "Critical Assumptions" section of this report. The validity of these assumptions and of the effluent control costs which are imposed on the model plants introduce an additional element of uncertainty and possible inaccuracy.

However, given the accuracy of the pollution control costs to be acceptable, it is believed that the analysis represents a usefully accurate evaluation of the economic impact of the proposed effluent guidelines on the meat processing industry.

B. Range of Error

Different data series and different sections of the analysis will have different possible ranges of error.

1. Errors in Data

Estimated data error ranges as an average for the industry are as follows:

		Error Range %
1.	Information regarding the organization and structure of the industry, number location and size of plants, and other information descriptive of industry segments	± 15
2.	Price information for products and raw materials	± 20
3.	Cost information for plant investments and operating costs	± 15
4.	Financial information concerning the meat industry	± 20
5.	Salvage values of plants and equipment	± 20
6.	Water pollution control costs	Unknown
7.	Plant closures	± 20

C. Critical Assumptions

Because of an almost total lack of any published information on the independent rendering industry (the exception is the Census of Manufactures; however, marine fats and oils are also included in the same SIC code but not addressed in this report) a series of assumptions had to be made. This was necessary to keep the analysis within manageable limits and to develop "representative" plants which would permit further development of industry-wide impacts. These assumptions fall into seven general areas.

1. Assumptions regarding industry structure
2. Assumptions concerning raw material and product prices
3. Assumptions concerning "representative" model plants
4. Assumptions concerning water pollution control costs
5. Assumptions concerning current status of effluent disposal systems in use by the industry
6. Assumptions concerning the salvage value of plants and equipment.
7. Assumptions concerning "shutdown" decisions of the independent renderers.

1. Industry Structure

A critical assumption affecting the analysis is the number and size of independent rendering plants. At the time of writing the detailed Census of Manufactures for 1972 is not available. The Census data is further limited by the inclusion of marine fats and oils processors. Thus the industry structure had to be developed from the 1967 Census data plus the added knowledge of the National Renderers Association. It is believed the industry as described is reasonably close to the existing situation. Various checks and cross checks performed tend to enforce this view.

2. Price Assumptions

Published prices for final products were obtained from the USDA Fats and Oils Situation (2) (4) and the USDA Feed Situation (10). Raw product prices are not obtained by any statitiscal office and had to be obtained through direct industry contacts.

Because of the tremendous variability in product prices during the past year, we felt that 1973 was atypical. Since we did not have sufficient information to construct a profile over time for the operation of the industry, we determined that 1972 was a more "normal" year. As a result, we based our "model" plant financial profiles on that year.

3. "Representative" Model Plants

No single plant is "representative" of the types and sizes of plants which constitute the independent rendering industry. Our categorization of small through large for conventional batch rendering plants and medium through large for the newer continuous processing plants, we believe, adequately represent the major types of plants found in the industry.

The essence of the categorization scheme is to show the various impacts on the different sizes and types of plants. In this effort we feel the categorization is successful to demonstrate the much greater impacts felt by the smaller firms.

4. Water Pollution Control Costs

Data on water pollution control costs were supplied to DPRA by the Effluent Guidelines Division of EPA. We are not in a position to evaluate these costs but they were assumed to be reasonably accurate and adjusted through generally accepted techniques to "fit" our model plants.

5. Current State of Waste Water Treatment in the Industry

Data on waste water treatment in the industry was obtained from the Development Document and considered to be reasonably correct.

6. Salvage Values

Salvage values of buildings, equipment and land will vary greatly from one location to another and with the type and condition of structures and equipment.

In order to avoid problems which would be inherent in attempting to establish differential salvage values, a set of "standard" assumptions concerning salvage values was developed.

a. Land was salvaged at its 1973 value.
b. Buildings and equipment for conventional plants were salvaged at a net amount equipment to 10 percent of their 1972 replacement value.
c. Continuous process plants were salvaged at 20 percent of their 1972 replacement value.
d. Net operating capital was recovered intact.

7. "Shutdown" Decisions

The general purpose of the "shutdown" model is to examine profitability of the model plants before and after the imposition of effluent limitation guidelines, to determine the likelihood of forced closures which would result and to calculate the price changes required to cover the added effluent control costs.

The model required assumptions relative to numerous factors.

These assumptions are described in detail in previous sections of this report. Assumptions used, while arbitrary, were made in accordance with estimates of conditions prevailing in the independent rendering industry.

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15. Supplementary Notes

16. Abstracts

The economic impacts of proposed effluent guidelines on the independent rendering industry are assessed. The analysis includes classification and description of types of firms and plants; financial profiles, investments and operating costs and profits for selected model plants. Plants are segmented by size and type including: batch rendering and continuous process. Pricing mechanisms and price relationships are evaluated. The financial impact of proposed effluent treatment technology was assessed in terms of prices, industry profits, volume of production, employment, community impacts and international trade.

The imposition of BPT Standards (1977) and BAT standards (1983) will have a serious impact on the industry if control costs and the present level of control in the industry are as stated by EPA. An estimated 50 percent of the plants are linked to municipal

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treatment facilities and will not incur additional costs resulting from the imposition of proposed Guidelines. The remaining plants will not be able to pass their increased costs through the marketing system and will experience a reduction of profits. An estimated 61 of 210 small batch plants will be forced to close upon imposition of BPT Standards and 29 medium size batch plants will close upon imposition of BAT Standards

The loss of plants will reduce production capacity by 4.8 percent from the imposition of BPT Standards and 7.4 percent from BAT Standards. Existing plants can theoretically pick up the lost volume but because of the spacial dispersion of the smaller plants service to some rural communities will be substantially reduced. Approximately 1,400 employees located in 90 communities will be directly effected.