TSD Update - Organic Liquids Distribution (OLD) NESHAP

April 2002

As a result of interagency review comments received on the Technical Support Document (TSD) for the proposed OLD standards, the project team has re-analyzed the HAP emission reductions and re-estimated control costs attributed to compliance with the proposed rulemaking. Information relative to the baseline emissions, level of control that exists for transfer racks, and the estimated costs for additional control of transfer racks has been updated (see attached telephone contact report). The updated analysis is presented in the attached revised Memo Nos. 2, 3, and 6. These revised memoranda should be considered as replacements for the corresponding memos in the original TSD.

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Telephone Contact Report

From: Greg LaFlam, Pacific Environmental Services, Inc. (PES)

Date: April 5, 2002

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Company: John Zink Company

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Contact Summary:

Mr. Scott Fox of John Zink Company, a manufacturer/vendor of air pollution control systems, was called on September 10, 2001, and again on March 14, 2002, to discuss current costs of flare type control systems that would be specified to control hazardous air pollutant vapor emissions from liquid transfer operations (transfer racks) at organic liquid distribution (OLD) facilities. I asked him to comment on the accuracy of the cost estimates that the EPA prepared for the OLD MACT rule proposal. These cost estimates were based on the flare costing methodology presented in the EPA's OAQPS Control Cost Manual.

Mr. Fox stated that the EPA's Cost Manual is a collection of information reflecting the costs for *open flare* technology that is frequently used to control processing operations at refineries and chemical manufacturing plants. However, approximately 90 to 95 percent of the flare systems installed to control emissions from liquid transfer operations are *enclosed ground flare* systems. The flame in open flares is situated at a height of 30 to 50 feet and is visible from ground level. Enclosed flares, on the other hand, burn just above ground level but are enclosed in a refractory-lined stack which is 30 to 50 feet high. Due to the addition of the stack and instrumentation related to the stack, the costs for enclosed systems are considerably higher than those for open flare systems.

Mr. Fox said that there are three principal reasons why enclosed ground flares are typically selected for loading operations. The first involves safety or "perceived safety." The open flare flame in proximity to potential ignition sources is often considered undesirable by operators and the surrounding community. Secondly, enclosed flares offer "reduced radiation," an important factor when the control unit is installed close to other equipment. The third factor affecting the selection of enclosed flare systems is that these units can be source tested to determine their control efficiency and are typically capable of higher efficiencies (99+ %) than open flares (. 98 %).

With regard to system costs, the stack (and instrumentation associated with the stack) is the primary reason that John Zink's enclosed flares are more expensive than their equivalent sized open flares. The upstream components and the burner itself are similar in both systems. The instruments used in both types of systems include detonation arrestors, anti-flashback burners, temperature indicators in the piping, and shutdown safety valves. Many States allow continuous pilot flame monitoring for enclosed flare systems, but increasingly are requiring that the system be monitored for in-stack temperature (during loading activities).

The following table presents the EPA capital cost estimates for flare systems that were used for the regulatory proposal, as well as John Zink's cost estimates.

Flare System Size	EPA Capital Cost Estimate in Rule Proposal	John Zink Company's Estimates[a]	
		Open Flare System	Enclosed Ground Flare System[b]
Small	$40,800	$45,000 (10%)	$70,000 (72%)
Medium	$49,400	$70,000 (42%)	$100,000 (102%)
Large	$58,800	$100,000 (70%)	$150,000 (155%)

[a]Best-guess estimates based on minimal design information, rather than the results of a detailed cost analysis.

[b]About 90-95% of flare systems installed on organic liquid transfer racks are of this type.

Note: Percentage increases over EPA estimates are shown in parentheses.

MEMO NO. 2

Model Plants for the OLD Source Category

MEMO NO. 2

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INTRODUCTION

Model plants have been developed to represent the HAP emission sources at organic liquids distribution (OLD) facilities and for use in the estimation of regulatory (cost and environmental) impacts. For each model plant, ranges of size and operational capacity have been selected in an attempt to characterize actual OLD operations. The calculation of total hazardous air pollutant (HAP) emissions for the nationwide model plant profile, and the estimation of regulatory impacts (presented in separate memos in this TSD), are intended to approximate the impacts expected for the entire OLD industry. This memorandum presents the methodology that was used to select parameters for the OLD model plants. These model plants cover all sizes of OLD operations within the industry segments believed to contain major source facilities involved in organic liquids distribution, based on data received in a comprehensive EPA survey.[1] The following industry segments were considered in developing the model plants:

1. OLD activities collocated with organic chemical manufacturing plant sites,
2. OLD activities collocated with petroleum refineries,
3. Bulk liquid terminals (especially independent, for-hire facilities),
4. Crude oil pipeline stations, and
5. Petroleum bulk terminals.

Although the basic operations and emission sources in the various OLD industry segments are very similar, data show that the liquids handled, volumes, and scope of equipment (number and types of tanks, etc.) can differ markedly. For this reason, separate model plants were developed to reflect each industry segment. A separation of model plants by individual industry segments is also useful for the consideration of economic impacts, because different industries have different economic profiles. However, the creation of model plants by industry is not intended to imply that the OLD regulation should or will contain separate requirements for different industry segments.

Sources of Data

The data base used for determining the model plant parameters consisted primarily of the information in responses to the EPA's 1998 survey of the OLD industry, which was sent to 167 companies in the chemical production, petroleum refining, bulk storage, and related industries. Responses were received for approximately 247 facilities at 77 companies. Table 2-1 shows the industry segments that responded, both by Standard Industrial Classification (SIC)

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[1]While the industry segments discussed in this memo are the major segments reported to contain OLD activities, there may be additional segments with OLD activity that fall outside of the five segments listed (such as certain types of manufacturing operations). However, based on survey data and discussions with stakeholders we presume that any additional segments would constitute a small percentage of the OLD category.

TABLE 2-1. RESPONDENTS TO THE EPA'S O.L.D. INDUSTRY SURVEY

Industry Segment/ Type of Facility	4-Digit SIC Code (s)	NAICS Code (s)	Number of Facility Responses[a]
Chemical production	2812, 2821, 2824, 2843, 2865, 2869, 2891	325110, 325120, 325132, 325181, 325192, 325193, 325199, 325211, 325222, 325520, 325613	117
Petroleum refinery	2911, 2992	324110, 324191	57
Liquid terminal	4226	493190	32
Crude oil pipeline station	4612	486110	24
Petroleum terminal	5169, 5171	422690, 422710	10

[a]A total of 247 facilities submitted responses. The seven responses not indicated in this table were for facilities in SIC codes 13, 30, 38, 39, and 44.

codes (1) and the equivalent North American Industrial Classification System (NAICS) codes. (2) In the remainder of this memo, SIC codes are used to indicate industry segments. The facilities in the survey consist only of those considered to have the potential to be a major source of HAP emissions. Under the EPA's extended potential to emit transition policy (3), this includes those plant sites with actual annual emissions of 5 tpy or greater of any single HAP, or 12.5 tpy or greater of any combination of HAP. Both dedicated OLD plant sites (such as for-hire storage terminals) and OLD operations collocated with a production plant site (such as a petroleum refinery) were included in the reporting. It should be noted that the major source determination is based on the total of all HAP emissions at a plant site; however, only OLD activities and equipment are considered in the development of these model plants.

Survey recipients were instructed to exclude gasoline from their responses (since gasoline is already regulated under the Gasoline Distribution MACT rule, 40 CFR Part 63, subpart R), as well as liquids with an annual average true vapor pressure of less than 0.1 psia at handling temperatures or a HAP content less than 1,000 ppm by weight. Only liquids transferred into or out of the plant site (as opposed to those that were produced in the plant and used or consumed in a process) were reported. Also, information was requested only for storage tanks larger than 5,000 gallons in capacity. Liquid storage and handling equipment that was covered by an existing 40 CFR Part 63 regulation (MACT standard), or was expected to be covered by a future MACT rule, was not included in the survey responses. The Attachment to this memo is a listing of the survey respondents, including company and facility name, 2-digit SIC code, and associated model plant designation where sufficient data were available to make the determination.

In addition to the EPA survey, the membership directory for the Independent Liquid Terminals Association (ILTA) (4) was consulted for facility sizing information. This reference provided information on liquids handled, tank numbers and sizes, and other data for actual facilities (primarily SIC code 42 storage terminals). The project team also made site visits to several OLD facilities, where further information on facility operations was obtained.

OLD Emission Sources

As discussed in other materials developed under this project, the principal HAP emission sources associated with OLD operations are:

1. Storage tanks (standing and working losses),
2. Transfer racks (liquid transfer to tank trucks and railcars),
3. Container filling operations,
4. Equipment leaks (pumps, valves, connectors, etc.),
5. Wastewater with volatile HAP content, and
6. Semi-aqueous waste.

The EPA survey requested information on these sources and how emissions are currently controlled. The survey revealed that transfer racks are not typically used at facilities in the crude oil pipeline industry (SIC 46); therefore, transfer racks are not included in the model plants for these facilities. Also, data on generation rates and HAP compositions of wastewater and other HAP wastes were very limited in the EPA survey responses, making it difficult to characterize these sources. However, it was apparent that relatively small amounts of these waste products are produced from most OLD activities. Thus, estimations of the compositions and quantities of these waste materials were not included in the model plants.

MODEL PLANT DEVELOPMENT

This section discusses the development of model plants for the five principal OLD industry segments described in the introduction. The model plants in this analysis were constructed using data from actual OLD operations. Each model plant is specified as a set of several parameters, each of which is important in estimating HAP emissions and the potential impacts of emission controls. Each parameter value actually implies a range of values which is based on data from several similar facilities.

Due to the difficulty of identifying every individual OLD operation and obtaining enough information to calculate their HAP emissions, the model plants will be used for estimating the nationwide baseline HAP emissions from OLD operations.

Distributed Liquids

In order to increase the precision of the impacts estimation, average liquid vapor pressures were estimated for each type of storage tank within each industry segment (as represented by two-digit SIC codes). These averages were then weighted by the amount of storage capacity devoted to each liquid at the facilities in the survey responses. The results are presented in Table 2-2. Separate vapor pressures were developed for each tank type in common use to reflect the differences that exist in the data. The development of the parameters used to characterize OLD liquids is further explained in another memorandum that can be found in docket A-98-13. (5)

The remaining liquid properties that affect volatile organic emissions from storage tanks and liquid transfers at transfer racks are the molecular weight of the vapors and the temperature of the liquid. Molecular weight was not reported for most of the liquid mixtures in the survey data base. Analysis of molecular weights and relative quantities of the HAP components in reported liquids showed that the molecular weight of benzene, 78.1 g/g-mole, is a reasonable average value to represent all of the liquids. A uniform temperature of 60EF was selected for liquid temperature, which is considered a representative annual average based on meteorological data found in the EPA's emission factor document, AP-42. (6)

Based on data in the survey responses, the overall weighted average ratio of HAP to total organic compounds for all liquids in all industry segments is 54 percent (note that pure HAP liquids, such as straight benzene or methanol, are 100 percent HAP). This overall value includes the relatively low average ratio (approximately 6 percent) for crude oil, which applies for SIC code 46 pipeline stations. The facility data were also reviewed to determine whether this ratio varies significantly by industry segment. As presented in Table 2-3, the ratio for individual segments is in fact variable, and these different ratios have been used in defining the model plants. Note that HAP percentages in the *liquids* were used to generate the ratios in Table 2-2 (except for SIC code 46), even though emissions are a function of the *vapor* HAP percentages. Vapor HAP data were incomplete or not provided for many of the non-crude oil mixtures reported in the survey, and the liquid data are believed on the average to provide a good approximation of the HAP in the vapors.

Storage Tanks

The average storage tank capacities as reported in the OLD survey data are used to describe storage tanks at the model plants. As noted above, tanks below 5,000 gallons in size are not considered cost-effective to control and were excluded from the survey. The diameter of each tank (which was not reported) was estimated because this parameter is required in the emissions calculations. According to the proposal background information document for the VOC Storage Tanks NSPS (7), the height of a tank is a function of its capacity as shown in Table 2-4. Based on these figures, approximate ratios of tank diameter to height can be determined as a function of tank capacity range, as shown in Table 2-5. These ratios were used to calculate the dimensions of each tank type within each industry segment. Table 2-6 presents the capacities, diameters, and heights for each of these tanks.

TABLE 2-2. AVERAGE O.L.D. LIQUID VAPOR PRESSURES

SIC Code	Annual Average True Vapor Pressure for OLD HAP Liquids (psia)			
	FXRT	IFRT	EFRT	All Tanks
28	3.4	2.6	---[b]	3.1
29	1.7	2.0	3.7	3.2
42	1.6	3.0	5.2	2.8
46[a]	3.5	---[b]	3.5	3.5
51	2.8	2.1	2.7	2.4

FXRT = fixed-roof tanks.
IFRT = internal floating roof tanks.
EFRT = external floating roof tanks.
[a]Crude oil is essentially the only liquid reported for pipeline stations in this SIC code.
[b]This tank type is not prevalent at OLD operations within this SIC code.

TABLE 2-3. HAP PERCENTAGES IN O.L.D. LIQUIDS

SIC Code	Average HAP-to-Total Organics Ratio (percent)[a]
28	64
29	32
42	74
46	6[b]
51	85
Total OLD	54

[a]Values represent average HAP weight percent in the *liquid* (except for SIC 46).
[b]Value represents average HAP weight percent in the crude oil *vapors*.

TABLE 2-4. STORAGE TANK HEIGHT AS A FUNCTION OF CAPACITY (7)

Tank Capacity[a]		Tank Height (feet)
gallons	cubic feet	
0 - 11,970	0 - 1,600	8.6
11,970 - 24,125	1,600 - 3,225	17.2
24,125 - 81,170	3,225 - 10,850	25.8
81,170 - 300,175	10,850 - 40,125	34.5
300,175 - 3,061,975	40,125 - 409,300	43.0
> 3,061,975	> 409,300	51.5

[a]Values are rounded.

TABLE 2-5. RATIO OF TANK DIAMETER (D) TO TANK HEIGHT (h)

Tank Capacity[a]		Ratio of Diameter to Height (D/h Ratio)[a]
gallons	cubic feet	
0 - 748,100	0 - 100,000	1.0
748,100 - 1,496,200	100,000 - 200,000	1.5
1,496,200 - 2,992,400	200,000 - 400,000	2.0
2,992,400 - 5,984,800	400,000 - 800,000	2.5
5,984,800 - 8,229,100	800,000 - 1,100,000	3.0
> 8,229,100	> 1,100,000	3.5

[a]Values are rounded.

Based on the actual facilities reflected in the survey data base, several model plants have been constructed that reflect the numbers and types of OLD storage tanks at those facilities. The number of model plants developed was a compromise between a large number (more specific characterization and impacts) and a smaller number (more manageable within the resource constraints of the project). An examination of the data indicated that the industry could be reasonably represented by 13 model plants.

TABLE 2-6. STORAGE TANK SIZE PARAMETERS, BY INDUSTRY SEGMENT

SIC Code/ Tank Type	Average Tank Capacity		Tank Diameter (ft.)	Tank Height (ft.)
	gallons	cubic feet		
28				
FXRT	480,000	64,160	43.4	43.4
IFRT	430,000	57,480	41.8	41.8
EFRT	–[a]	--[a]	–[a]	--[a]
29				
FXRT	293,000	39,170	36.8	36.8
IFRT	2,123,600	283,900	131.4	65.7
EFRT	5,290,500	707,200	131.1	52.4
42				
FXRT	1,418,000	189,500	71.3	47.5
IFRT	2,616,500	349,800	96.2	48.1
EFRT	9,744,000	1,302,500	179.7	51.3
46				
FXRT	2,814,500	376,200	106.2	42.5
IFRT	–[a]	--[a]	--[a]	--[a]
EFRT	7,524,400	1,005,800	156.6	52.2
51				
FXRT	8,620	1,150	11.4	11.4
IFRT	3,028,300	404,800	108.8	43.5
EFRT	5,285,700	706,500	131.0	52.4

[a]This tank type is not prevalent at OLD operations facilities within this SIC code.

The total tank throughput as reported for the facilities in each industry segment (SIC or NAICS code) has been distributed among these model plants in proportion to their total storage capacity. Using these throughputs and the total storage capacity at each model plant, the annual number of tank product turnovers was calculated. Table 2-7 presents this tank information for each model plant.

TABLE 2-7. MODEL PLANT STORAGE TANK PARAMETERS

SIC Code	Model Plant	No. of Tanks by Type				Storage Tank Throughput at each Plant (10^3 gal/yr)	Model Plant Storage Capacity (10^3 gal)	Turnovers/yr[a]
		FXRT	IFRT	EFRT	Total (Range)			
28	28-1	4	0	0	4 (1-6)	19,799	1,920	10
	28-2	10	2	0	12 (7-20)	58,473	5,660	
	28-3	29	3	0	32 (>20)	157,080	15,210	
29	29-1	2	1	0	3 (1-3)	66,546	2,710	25
	29-2	2	1	4	7 (4-9)	586,160	23,870	
	29-3	4	4	4	12 (>9)	757,240	30,830	
42	42-1	3	3	1	7 (1-10)	103,420	21,850	5
	42-2	6	8	1	15 (11-25)	185,330	39,185	
	42-3	20	20	2	42 (>25)	474,470	100,180	
46	46-1	5	0	0	5 (1-10)	140,610	14,070	10
	46-2	0	0	13	13 (>10)	975,460	97,820	
51	51-1	4	0	0	4 (1-5)	314	34.5	10
	51-2	0	7	3	10 (>5)	348,400	37,055	

[a]Quotient of total throughput divided by total storage capacity.

Liquid Transfer (Transfer Racks)

Transfer rack throughputs were assigned to each model plant based on the throughputs reported for transferred liquids in the EPA survey. First, a total throughput was determined for each industry segment (SIC or NAICS code). Then, based on the storage tank throughput of each model plant, the total *rack* throughputs were divided up among the plants in proportion to the *tank* throughputs. Table 2-8 presents the total and single model plant throughputs for transfer racks in each industry segment, and indicates the number of each model plant that is represented in the survey data. Analyses of the data base performed after the regulatory proposal package had been completed showed that not all of the facilities were carrying out transfer operations of organic liquids into tank trucks or railcars. Therefore, the number of model plants representing transfer rack activities is significantly lower than the total number of plants in each industry segment.

From a review of the EPA survey results, 75 percent of OLD transfer rack filling positions use submerged fill or bottom loading and 25 percent use the higher-emitting splash fill method to load HAP-containing liquids into tank trucks and railcars (referred to together as cargo tanks). Also, about 65 percent of the filling positions are for tank trucks, while the remaining 35 percent are for railcars. Control devices, considered to have an approximate average control efficiency of 95 percent, are reported to be in use for approximately 60 percent of the transfer rack organic liquid throughput. The control technique known as *vapor balancing* (the piping of cargo tank vapors back to the storage tank as the liquid is being loaded into the cargo tank) was reported by only a small number of the facilities responding to the EPA survey.

Container Filling

The filling of smaller, portable (non-cargo tank) containers at OLD facilities was reported as a HAP emission source at 26 facilities in responses to the EPA survey. After a review of the data revealed that small and medium container filling were being carried out by only seven facilities and there were no emission controls in use, a decision was made to continue the analysis only for the filling of *large* containers (at least 55-gallon size). These include 55-gallon drums and the “totes” (usually constructed of a plastic material or stainless steel) that are used to transport some liquids. Totes have been observed at OLD operations to range up to 550 gallons or more in capacity.

The major source facilities reporting large container filling are in SIC codes 28 (71 percent), 29, 30 42, and 51. The annual volume loaded ranges from approximately 2,500 gal/yr to 4 million gal/yr on a facility-wide basis. A total of 24 facilities reported large container (drum or tote) filling operations. Table 2-9 shows the annual volume loaded for each facility, those using control measures on the filling operation, and the apparent number of separate drum filling stations at each facility.

TABLE 2-8. MODEL PLANT TRANSFER RACK THROUGHPUTS

Industry Segment (SIC Code)	Model Plant	Transfer Rack Throughput for all Model Plants (10^3 gal/yr)[a]	Number of Model Plants[b]	Transfer Rack Throughput for each Model Plant (10^3 gal/yr)
28	28-1	87,360	14	6,240
	28-2	229,904	14	16,422
	28-3	617,612	18	34,312
29	29-1	30,148	5	6,030
	29-2	265,515	4	66,379
	29-3	343,055	4	85,764
42	42-1	83,674	4	20,918
	42-2	168,900	6	28,150
	42-3	383,910	7	54,844
46	46-1	c	c	c
	46-2	c	c	c
51	51-1	47	2	23.5
	51-2	51,814	2	25,907

[a]Organic liquids for facilities in the EPA survey data base.
[b]Represents actual facilities in the EPA survey data base that perform organic liquid transfer operations expected to be covered by this NESHAP.
[c]Data indicate that transfer racks are not typically found at facilities in SIC code 46.

Model plants for drum (or tote) filling have been developed as separate entities from the general OLD model plants, because only about 10 percent of the survey respondents reported drum filling activities. A decision was made to generate a large and a small model plant so the impacts on both small and large operations could be estimated. A cutoff was selected at 10 percent of the maximum throughput value of 71,920 drums per year, or about 7,200 drums/yr (20 drums/day). Thus, the small model plant loads # 20 drums/day, and has a nominal throughput of 5 drums/day (the average of the 11 facilities below 20 drums/day). While the data on number of filling stations were uncertain, the small model plant was assigned one

TABLE 2-9. LARGE CONTAINER FILLING MODEL PLANT PARAMETERS[a]

Response No.	SIC Code	Annual Liquid Throughput		Controls?[c]	No. of Filling Stations per Facility[d]
		gal/yr	drums/yr[b]		
1	28	3,955,560	71,920	N	1
2	28	2,938,670	53,430	Y	1
3	28	2,882,065	52,400	N	6
4	30	1,508,710	27,430	N	1
5	29	1,256,260	22,840	Y	3
6	42	1,102,515	20,045	Y	6
7	28	929,970	16,905	N	1
8	28	929,875	16,910	N	2
9	28	613,840	11,160	N	4
10	28	605,000	11,000	N	1
11	28	574,710	10,450	N	1
12	28	547,365	9,950	N	2
13	51	443,750	8,070	Y	2
14	28	330,305	6,005	N	1
15	28	282,000	5,125	N	1
16	28	208,000	3,780	N	1
17	28	150,530	2,735	Y	1
18	51	100,735	1,830	N	1
19	28	70,265	1,280	Y	1
20	28	53,650	975	N	3
21	29	17,860	325	N	1
22	28	6,100	110	Y	1
23	28	3,080	55	N	1
24	42	2,395	45	N	1

[a]Large containers are 55-gallon drums or larger portable containers (totes).
[b]Equivalent throughput in 55-gallon (drum) units.

[c]Control device or vapor balancing.
[d]Survey data were unclear in many cases; these values represent “best guess” estimates.

station as a nominal value (maximum of two stations). The large model plant is defined to load more than 20 drums/day (nominally 70 drums/day), and has three or more separate filling stations.

Equipment Components

The EPA survey data were used to develop an estimate of the number of equipment components at facilities for six types of equipment: pumps, compressors, connectors (such as flanges), valves, pressure relief devices, and sampling connection systems. As the rule development proceeded, the number of component types under consideration was reduced based on the practices of the OLD industry and the proposed rule provisions. Contacts with industry representatives indicated that compressors are not used, or are used in a very limited capacity, at OLD operations facilities. It was also determined that the types of pressure relief devices that are typically subject to control requirements under other Federal regulations are not commonly associated with OLD operations. Thus, final component counts were developed for four types of equipment components: pumps, connectors, valves, and sampling connection systems.

From the survey data, it was found that two sets of equipment counts could be used to characterize all of the model plants; that is, the smaller plants could be assigned one set of counts and the larger plants could be assigned another set of counts. In arriving at representative equipment counts for OLD operations, some very high counts reported by certain facilities were considered outliers and were not included in the averaging calculations. These high count facilities are discussed in a project memorandum. (8) Table 2-10 presents the average equipment counts used for each model plant.

Model Plant Summary

Tables 2-11 and 2-12 summarize all of the parameters specified for the model plants. An extrapolation of the model plant populations in the EPA survey data base to the number of each model plant estimated to exist nationwide is discussed in the Baseline Emissions memo contained in this TSD (Memo No. 3).

TABLE 2-10. MODEL PLANT EQUIPMENT COUNTS

SIC Code	Model Plant	No. of Equipment Components at each Model Plant[a]			
		Pumps[b]	Connectors	Valves	Sampling Connection Systems
28	28-1	10	500	200	5
	28-2	10	500	200	5
	28-3	50	2,000	500	15
29	29-1	10	500	200	5
	29-2	10	500	200	5
	29-3	10	500	200	5
42	42-1	10	500	200	5
	42-2	10	500	200	5
	42-3	50	2,000	500	15
46	46-1	10	500	200	5
	46-2	10	500	200	5
51	51-1	10	500	200	5
	51-2	10	500	200	5

[a]Represents only equipment used directly in OLD activities.
[b]Each pump has two seals (emission points).

TABLE 2-11. SUMMARY OF O.L.D. MODEL PLANT PARAMETERS

Model Plant	Distributed Liquids: Annual Average Liquid Vapor Pressure (psia)				Distributed Liquids: HAP Content (wt. percent)	Storage Tanks: No. of Storage Tanks				Total Tank Storage Capacity (10^3 gal)	Storage Tank Throughput (10^3 gal/yr)	Product Turnovers per Year	
	FXRT	IFRT	EFRT	All Tanks		FXRT	IFRT	EFRT	Total (Range)				
28-1	3.35	2.61	---	3.06	64	4	0	0	4 (1-6)	1,920	19,799	10	Table concluded on next page.
28-2						10	2	0	12 (7-20)	5,660	58,473		
28-3						29	3	0	32 (>20)	15,210	157,080		
29-1	1.73	2.01	3.67	3.18	32	2	1	0	3 (1-3)	2,710	66,546	25	
29-2						2	1	4	7 (4-9)	23,870	586,160		
29-3						4	4	4	12 (>9)	30,830	757,240		
42-1	1.59	2.98	5.16	2.84	74	3	3	1	7 (1-10)	21,850	103,420	5	
42-2						6	8	1	15 (11-25)	39,185	185,330		
42-3						20	20	2	42 (>25)	100,180	474,470		
46-1	3.52	---	3.52	3.52	6	5	0	0	5 (1-10)	14,070	140,610	10	
46-2						0	0	13	13 (>10)	97,820	975,460		
51-1	2.83	2.12	2.70	2.36	85	4	0	0	4 (1-5)	34.5	314	10	
51-2						0	7	3	10 (>5)	37,055	348,400		
All Model Plants					54								

TABLE 2-11. (Concluded)

Model Plant	Transfer Racks			Number of Equipment Components at each Model Plant			
	No. of Cargo Tank Loading Positions		Transfer Rack Throughput (10^3 gal/yr)	Pumps	Connectors	Valves	Sampling Connection Systems
	Tank Truck	Railcar					
28-1	1	1	6,240	10	500	200	5
28-2	2	2	16,422	10	500	200	5
28-3	3	2	34,312	50	2,000	500	15
29-1	1	1	6,030	10	500	200	5
29-2	1	2	66,379	10	500	200	5
29-3	2	2	85,764	10	500	200	5
42-1	2	2	20,918	10	500	200	5
42-2	4	5	28,150	10	500	200	5
42-3	8	7	54,844	50	2,000	500	15
46-1	---	---	---	10	500	200	5
46-2	---	---	---	10	500	200	5
51-1	1	1	23.5	10	500	200	5
51-2	1	1	25,907	10	500	200	5

TABLE 2-12. SUMMARY OF LARGE CONTAINER FILLING MODEL PLANT PARAMETERS

Drum/Tote Filling Model Plant	Liquid Throughput (drums /day)		Number of Drum or Tote Filling Stations	
	Nominal	Range	Nominal	Range
1	5	# 20	1	1 - 2
2	70	> 20	3	$ 3

REFERENCES

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5. Memorandum from G. LaFlam, Pacific Environmental Services, Inc., to Air Docket A-98-13, document no. II-B-17. Determination of Representative Hazardous Air Pollutant (HAP) Weight Fractions and True Vapor Pressures for Liquids in the OLD Industry. December 22, 1999.

6. Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. Section 7, Liquid Storage Tanks. January 1995.

7. VOC Emissions from Volatile Organic Liquid Storage Tanks--Background Information for Proposed Standards. EPA-450/3-81-003a. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC 27711. July 1984. Page 8-2.

8. Memorandum from G. LaFlam and B. Haneke, Pacific Environmental Services, Inc., to M. Smith, U.S. EPA:ESD. Air Docket A-98-13, document no. II-B-12. SIC Code 28 Facilities Reporting High Equipment Counts. October 14, 1999.

Attachment to Memo No. 2 (Model Plants).
Company and Facility Information from OLD Data Base[a]

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Allied Marine Industries, Inc.	Allied Terminals, Inc.-Charleston Marine Terminal	50	42	1	NA
Allied Signal, Inc.	Allied Signal Inc., Specialty Chemicals, Delaware Plant	37-B	28	1	NA
	Allied Signal Inc., Specialty Chemicals, Detroit Refinery	37-C	28	2	1
	Allied Signal Inc., Specialty Chemicals, Ironton Refinery	37-D	28	2	NA
	Laminate Systems, LaCrosse, WI	37-E	28	1	NA
	Laminate Systems, Pendleton, SC	37-F	28	2	NA
	Allied Signal Inc., Polymers, Hopewell Facility	37-G	28	2	NA
	Allied Signal, Inc., Baton Rouge South Works	37-A	28	1	NA
Amerada Hess Corporation	Corpus Christi Terminal	59-A	42	1	NA
	Houston Terminal	59-B	42	3	NA
Amerada Hess Pipeline Co., Mobil, Phillips, BP, Unocal, Exxon AK Pipeline Corps, and ARCO Trans., Inc	Trans Alaska Pipeline System, Pump Station 2	46-B	46	1	NA
	Trans Alaska Pipeline System, Pump Station 1	46-A	46	1	NA
	Trans Alaska Pipeline System, Pump Station 12	46-K	46	1	NA
	Trans Alaska Pipeline System, Pump Station 3	46-C	46	1	NA
	Trans Alaska Pipeline System, Pump Station 4	46-D	46	1	NA
	Trans Alaska Pipeline System, Pump Station 5	46-E	46	1	NA
	Trans Alaska Pipeline System, Pump Station 6	46-F	46	1	NA
	Trans Alaska Pipeline System, Pump Station 9	46-I	46	1	NA
	Trans Alaska Pipeline System, Pump Station 10	46-J	46	1	NA
	Trans Alaska Pipeline System, Pump Station 8	46-H	46	1	NA
	Trans Alaska Pipeline System, Pump Station 7	46-G	46	1	NA
	Trans Alaska Pipeline System, Valdez Marine Terminal	46-L	44	ND[c]	NA
Amoco Corporation	Amoco Chemical Company, Cooper River Plant	32-A	28	1	NA

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Amoco Corporation	Amoco Chemical Company, Decatur Plant	32-B	28	1	NA
	Amoco Polymers, Inc. - Piedmont Plant	32-C	28	ND	NA
	Amoco Chemical Co.	32-D	28	1	NA
	Amoco Chemicals, Plant B	32-F	28	1	NA
	Amoco Chemicals, Docks	32-G	28	1	NA
	Amoco Polymers - Marietta Plant	32-E	28	1	NA
	Lewis Station	9-B	51	ND	NA
	Amoco Chemical Company, Texas City, Texas Chemical Dock Facility	32-H	28	2	NA
	Amoco Chemical Company, Greenville, South Carolina Facility	32-I	28	1	1
	Amoco Corporation, Shinn-Pence Terminal	9-A	46	3	NA
	LaBarge Station	9-C	46	1	NA
	Bowie, Texas Station	9-D	46	1	NA
	Broome Station	9-E	46	1	NA
	Beaumont Terminal	9-F	46	2	NA
Ashland Chemical Company	Ashland Chemical Co., Calumet City, IL	17-B	28	1	2
	Neville Island Plant, c/o Ashland Chemical Co.	17-D	28	ND	NA
	Los Angeles (City of Commerce) Plant, c/o Ashland Chemical Co.	17-C	28	ND	NA
	Ashland Chemical Co., Ashland, OH	17-A	28	ND	2
BASF Corporation	Joliet Polystyrene Plant	38-E	28	1	NA
	Wyandotte, Michigan Plant	38-G	28	2	NA
	Beaumont Plant	38-A	28	2	NA
	Freeport Plant	38-B	28	ND	NA
	Geismar Plant	38-C	28	3	NA
	Greenville Plant	38-D	28	3	NA
Bayer Corporation	Bushy Park Plant	61-A	28	2	NA
	Orange Site	61-B	28	2	NA
	Addyston Plant	61-C	28	ND	NA
	Bayer-New Martinsville	61-D	28	1	NA
BP Exploration and Oil Company	Alliance Refinery	18-A	29	1	NA
	BP Oil Lima Refinery	18-B	29	1	NA
	BP Oil, Toledo Refinery	18-C	29	2	NA
Bridgestone/Firestone, Inc.	Firestone Synthetic Rubber & Latex Co.	63-B	28	2	NA
	Firestone Synthetic Rubber & Latex, Co., Lake Charles, LA	63-A	28	2	NA

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Catlettsburg Refining LLC	Catlettsburg Refinery	21-B	29	ND	NA
Celanese Acetate LLC	Celanese Acetate Celriver Plant	13-B	28	2	NA
	Celanese Chemicals, Inc.	13-H	28	1	NA
	Celanese Ltd., Bay City Site	13-C	28	2	NA
	Celanese Ltd., Pampa Plant	13-A	28	1	NA
	Corpus Christi Technical Center	13-G	28	1	1
	Bayport Terminal	13-I	51	1	2
Chalmette Refining L.L.C.	Chalmette Refinery	12-C	29	ND	NA
Chevron Corporation	Chevron Chemical Co., Cedar Bayou Plant	27-B	28	2	NA
	Chevron Products Richmond Refinery	27-C	29	ND	NA
Chevron Corporation	Richmond Distribution Center	27-Ca	29	ND	NA
	Hawaii Refinery	27-E	29	3	NA
	Chevron El Paso Refinery (North Facility)	27-H	29	2	NA
	Fourchon Terminal	27-A	13	ND[c]	NA
	Chevron Products Company, Pascagoula Refinery	27-D	29	ND	NA
	El Segundo Refinery	27-F	29	ND	NA
CITGO Petroleum Corporation	Corpus Christi Refinery-Deep Sea Terminal	11-A	51	2	NA
Clark Port Arthur Pipeline Company	Lucas Station	39	46	ND	NA
Colonial Terminals, Inc.	Colonial Terminals, Inc.	51	42	2	NA
CONDEA Vista Company	Aberdeen Chemical Plant	42-A	28	1	NA
	Lake Charles Chemical Complex	42-B	28	2	NA
Cosmar Company	Cosmar Company	10-B	28	ND	NA
Delta Terminal Services, Inc.	Queen City Terminals, Inc.	64-A	42	2	NA
	Delta Terminal Services, Inc., Harvey, LA	64-B	42	3	2
E.I. Dupont Co., Inc.	Front Royal Plant	53-C	28	ND	NA
	Belle Plant	53-A	28	1	NA
	Conoco Denver Products Terminal	55	29	1	NA
	Dupont-Automotive Products	53-D	28	ND	NA
	Cape Fear	53-B	28	ND	NA
	Dupont, Mt. Clemons Plant	53-E	28	ND	NA
Eastman Chemical Company	Distillation Products Industries	35-A	28	1	NA
	Tennessee Eastman Division	35-B	28	3	1
	Texas Eastman Division, Eastman Chemical Company	35-C	28	3	NA
	Carolina Eastman Division	35-D	28	ND	NA
	Arkansas Eastman Division	35-E	28	3	1

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Equilon Enterprises L.L.C.	Wood River Refining Company	58	29	1	NA
Ergon Oil Purchasing, Inc.	Ergon Oil Purchasing, Inc., Baton Rouge	71	42	ND	NA
Exxon Corporation	Exxon Chemical Americas, Bayway	19-A	28	2	NA
	Baton Rouge Chemical Plant	19-D	28	ND	NA
	Baytown Olefins Plant	19-C	28	ND	NA
	Mont Belvieu Plastics Plant	19-B	28	ND	NA
	Exxon Chemical Company, Leland Terminal	44-D	42	ND	NA
	Exxon Chemical Company, South Wilmington Terminal	44-E	42	2	NA
	Exxon Baytown Refinery	20-A	29	ND	NA
	Exxon Company USA, Baton Rouge Refinery	20-B	29	ND	NA
	Exxon Benicia Refinery	20-C	29	ND	NA
	Exxon Co. USA, Billings Refinery	20-D	29	ND	NA
	King Ranch Gas Plant	20-E	13	ND[c]	NA
FINA Oil & Chemical Company	FINA-Bayport Plant	10-A	28	3	NA
FINA Oil & Chemical Company	Big Spring Refinery	10-C	29	1	NA
GATX Corporation	Argo Terminal	54-A	42	ND	NA
	Carson Facility	54-C	42	ND	NA
	Galena Park Facility	54-D	42	ND	NA
	Pasadena Facility	54-E	42	ND	NA
	Paulsboro Terminal	54-F	42	ND	NA
	GATX Terminals Corporation-Philadelphia	54-G	42	3	NA
	GATX Terminals Corporation-Gulf Region	54-H	42	3	NA
	GATX Carteret Terminal	54-B	42	ND	NA
GenCorp, Inc.	Penn Racquet Sports, Phoenix, Arizona	66-A	39	ND[c]	NA
	Aerojet Sacramento Site	66-B	38	ND[c]	NA
Georgia Gulf Corporation	Plaquemine Facility	1-A	28	3	NA
	Pasadena Facility	1-B	28	ND	NA
Hoechst AG	Celanese Bishop Plant	13-D	28	1	NA
Hollywood Marine Terminals, Inc.	Matagorda Terminal Limited	67-A	42	1	NA
	Red River Terminals	67-B	42	1	NA
Huntsman Corporation	Bayport Plant	62-B	28	1	NA
	Aromatics and Olefins Plant, Light Olefins Unit	62-C	28	2	NA
	Odessa Complex	62-A	28	2	NA
ICI American Holdings Inc.	Atlas Plant Site	40	28	ND	NA

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Intercontinental Terminals Company	Intercontinental Terminals Company	34	42	3	NA
International Matex Tank Terminals (IMTT)	IMTT-Bayonne	5	42	3	NA
JLM Industries, Inc.	JLM Terminals, Inc.	2	51	1	NA
Kaneb Pipeline Partners, L.P.	Stan Trans., Inc.-Texas City Terminal	33	42	3	NA
Koch Refining Company, L.P.	Wilmington South Terminal	24-A	29	1	NA
	Corpus Christi West Refinery	24-B	29	3	NA
	Corpus Christi East Refinery	24-C	29	3	NA
	Pine Bend Facility	24-D	29	3	NA
Lyondell-Citgo Refining Company Ltd.	Lyondell-Citgo Refining Company Ltd.	14	29	1	NA
Marathon Ashland Petroleum LLC	Illinois Refining Division-Robinson Refinery	21-A	29	1	NA
	Louisiana Refining Division	21-C	29	2	NA
	Michigan Refining Division	21-D	29	ND	NA
	Ohio Refining Division	21-F	29	ND	NA
	Marathon Ashland Petroleum LLC	21-H	51	1	NA
	Minnesota Refining Division-St. Paul Park Refinery	21-E	29	2	2
Marathon Oil Company, formerly USX for 1997	Texas City Refinery	21-G	29	1	NA
Mid-Continent Pipe Line Co.	Enid Station	43-B	46	1	NA
Mid-Continent Pipe Line Co.	Ringwood Station	43-C	46	1	NA
	Velma Station	43-D	46	2	NA
	Seminole Station	43-E	46	1	NA
Mobil Corporation	Mobil Oil Beaumont Refinery	12-D	29	1	NA
	Mobil Oil Torrance Refinery	12-A	29	3	NA
New Haven Terminal, Inc.	New Haven Terminal, Inc.	15	42	1	NA
Occidental Corporation	Houston Chemical Complex, Deer Park Site	4-A	28	1	2
	Niagara Falls Plant	4-B	28	1	1
Oiltanking Houston, Inc.	Oiltanking Houston, Inc.	8	42	2	NA
Paktank Corporation	Paktank	44-B	42	1	NA
	Wilmington Terminal	44-C	42	2	NA
	Deer Park Terminal	44-A	42	3	NA
PDV Midwest Refining, LLC	PDV Midwest Refining, L.L.C., Lemont Refinery	11-B	29	ND	NA
Peerless Oil and Chemicals, Inc.	Peerless Oil and Chemicals, Inc.	6	29	3	NA

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
Petro-Diamond Incorporated	Petro-Diamond Terminal Company	65	51	2	NA
Petroleos De Venezuela S.A.	Lake Charles Manufacturing Facility	11-C	29	ND	NA
PetroUnited Terminals, Inc.	Sunshine Terminal	48-A	42	3	NA
	Bayport Terminal	48-B	42	ND	NA
Phillips Petroleum Company	Sweeny Refinery and Petrochemical Complex	16-A	29	3	NA
	Phillips Borger Refinery & NGL Center	16-D	29	2	NA
	Philtex/Ryton Complex	16-E	28	3	NA
	Phillips 66 Company--Freeport Terminal	16-B	51	2	NA
	Phillips 66 Company--San Bernard Terminal	16-C	51	1	NA
Refinery Holding Company, L.P.	Refinery Holding Co. Refinery (South Facility)	27-G	29	1	NA
Reichhold Inc.	Reichhold, Middlesex, NJ	31-A	28	ND	1
	Reichhold, Newark, NJ	31-B	28	ND	2
	Reichhold, Pensacola, FL	31-C	28	ND	NA
	Reichhold, Chickamauga, GA	31-D	28	ND	2
	Reichhold, Morris, IL	31-E	28	ND	2
	Reichhold, Bridgeville, PA	31-F	28	2	2
	Reichhold, Cheswold, DE	31-G	28	3	1
Rohm & Haas Company	Louisville, Kentucky Plant	49-C	28	ND	NA
	Bristol Plant	49-A	28	ND	NA
	Knoxville Plant	49-B	28	ND	2
Shell Oil Company	Point Pleasant Polyester Plant	41-A	28	1	NA
	Shell Deer Park Chemical Complex	41-B	28	3	NA
	Shell Norco Refining Company	41-C	29	2	NA
	Shell Norco Chemical Company - East Site	41-D	29	2	NA
Shell Oil Company	Shell Norco Chemical Company - West Site	41-E	29	2	NA
Sinclair Oil Corporation	Sinclair, Wyoming Refinery	60-A	29	1	NA
	Tulsa Refinery	60-B	29	ND	NA
	Sinclair, Little America Refinery	60-C	29	ND	NA
Solutia Inc.	Solutia-Choc. Bayou	29-A	28	1	NA
	Indian Orchard Plant	29-B	30	ND[c]	2
	John F. Queeny Plant	29-C	28	1	NA
	Solutia Trenton Plant	29-E	30	ND[c]	NA
	W.G. Krummrich Plant	29-F	28	ND	NA
	Decatur Plant	29-G	28	ND	NA
	Delaware River Plant	29-H	28	ND	NA
	Greenwood Plant	29-I	28	ND	NA

Model Plants Memo Attachment. (Continued)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
	Pensacola Plant and Technical Center	29-D	28	1	NA
Specialty Chemical Co., Inc.	Specialty Chemical Co., Inc.	56	51	1	1
Sterling Chemicals, Inc.	Texas City Plant	52	28	ND	NA
Stolthaven North America	Stolthaven Chicago Inc.	36-B	42	2	NA
	Stolthaven Houston Inc.	36-A	42	2	NA
Sun Pipe Line Co.	Nederland Marine Terminal	43-A	46	2	NA
The BF Goodrich Company	BF Goodrich Hilton Davis, Inc.	68-A	28	1	NA
	BF Goodrich, Akron, OH	68-B	28	2	NA
	BF Goodrich Kalama, Inc.	68-C	28	1	NA
The C. P. Hall Company	The C. P. Hall Company	57-A	28	1	NA
	STAFLEX PRODUCTS, an affiliate of The C. P. Hall Company	57-B	28	1	NA
The Coastal Corporation	Coastal Refining and Marketing, Inc.	3	29	1	NA
The Dow Chemical Company	Dow Chemical Company, Dalton, Georgia	30-B	28	1	NA
	Dow Chemical Company, Freeport, Texas	30-C	28	3	NA
	Dow Chemical Company, Hanging Rock, Ohio	30-D	28	1	NA
	Dow Chemical Company, Joliet, Illinois	30-E	28	2	NA
	Dow Chemical Company, La Porte, Texas	30-F	28	ND	NA
	Dow Chemical Company, Long Beach Terminal, California	30-G	51	2	NA
	Dow Chemical Company, Midland, Michigan	30-H	28	1	NA
	Dow Chemical Company, Plaquemine, Louisiana	30-I	28	1	NA
	Dow Chemical Company, Russellville, Arkansas	30-K	28	1	NA
	Dow Chemical Company, Torrance, California	30-L	28	1	NA
	Dow, Texas Operations, Specialty Chemicals	30-Q	28	1	NA
	Dow Chemical-Riverside, Missouri Site	30-J	28	1	NA
	Dow Allyn's Point Plant	30-A	28	ND	NA
The Goodyear Tire & Rubber Company	Bayport Chemical Plant, Pasadena, TX	22-A	28	ND	NA
	Beaumont Chemical Plant	22-B	28	ND	NA
Ultramar Diamond Shamrock	Ultramar Inc.	23-A	29	ND	NA
	Alma Refinery	23-C	29	ND	NA
	Colorado Refining Company	23-E	29	ND	NA
	TRI Petroleum, Inc. Ardmore Refinery	23-D	29	ND	NA

Model Plants Memo Attachment. (Concluded)

Company Name	Facility Name	Facility Number	SIC Code	Model Plant No.[b]	Container Filling Model Plant No.
	McKee Plants	23-F	29	ND	NA
	Three Rivers Refinery	23-G	29	ND	NA
Union Carbide Corporation	Seadrift Plant	47-A	28	3	NA
	Taft/Star Manufacturing Complex	47-B	28	2	NA
	South Charleston Plant	47-C	28	3	NA
	Texas City Marine Terminal	47-D	28	3	NA
	Texas City Main Plant	47-E	28	3	NA
Valero Energy Corporation	Valero Refining Company-Houston Refinery	26-A	29	1	NA
	Valero Refining Company-Corpus Christi, Texas	26-C	29	ND	NA
	Valero Refining Company - Louisiana	26-B	29	ND	NA
	Valero Refining Company-Texas City Refinery	26-D	29	ND	NA
Westway Trading, Inc.	Westway Terminal Company, Inc.	25	42	2	1

ND = Insufficient data were available to determine the appropriate model plant.

NA = Not applicable.

[a]Table lists fewer facilities than the data base because some chemical manufacturing plant sites are considered as more than one facility in the data base, but have been consolidated into a single facility in this table. Examples include facility numbers 30-C, 30-H, 47-C, and 62-C.

[b]Based on the number of storage tanks at individual facilities.

[c]No model plant information was developed for this SIC code.

MEMO NO. 3

Baseline Emissions for the OLD Source Category

MEMO NO. 3

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

This memorandum presents the methodology for and results of the calculation of baseline HAP emissions for the organic liquids distribution (non-gasoline), or “OLD”, industry. Baseline emissions are the emissions that would occur, in the base year, if there were no new Federal MACT rule specific to OLD operations. The purpose of establishing an emissions baseline is to enable an estimation to be made of the emission reduction impact of new controls applied to these operations.

The following section briefly describes the OLD industry and its principal HAP emission sources. Since the baseline emissions calculations rely on the parameters of the model plants, data sources for these plants are described and the model plants are summarized. The next sections explain the emission estimation procedures for the model plants, and present the results of those calculations. Finally, the data and techniques used to estimate nationwide baseline emissions for all OLD activities are presented.

O.L.D. INDUSTRY AND EMISSION SOURCES

Most of the types of facilities that distribute organic liquids have been studied as part of the source categories covered by previous MACT rule development projects. These facilities primarily include chemical manufacturing plants, petroleum refineries, storage and marketing terminals, and pipeline stations. Generally speaking, these facility types have the following HAP emission sources in common:

1. Storage tanks;
2. Liquid transfer activities involving tank trucks and railcars (transfer racks);
3. Container filling operations;
4. Leaks from equipment components (pumps, valves, etc.);
5. Wastewater collection and treatment; and
6. Semi-aqueous waste.

These emission sources have been described in a report prepared previously under this project (1), and these descriptions will not be repeated here. It should be stressed that only activities and equipment that are used in the distribution of organic liquids (into or out of the plant site) are considered part of the OLD source category. Distribution activities may be collocated with liquid production operations (for example, a solvent manufacturing facility distributing its own products), or they may be carried out at dedicated for-hire storage and distribution terminals. At production plant sites, the major portion of liquid handling (and HAP emissions) is likely to be associated with non-distribution activities such as chemical process units or other MACT-covered operations. These other non-OLD HAP emissions are not considered part of the OLD baseline.

SOURCES OF FACILITY DATA

The OLD industry consists of liquid storage and distribution activities carried out within several industry segments. For example, petroleum refineries receive crude oil and send out large volumes of liquid finished products that have a volatile HAP content (both activities are considered distribution in the context of this rule). As mentioned above, some liquid transfer activities (such as transfers between process units or tanks *within* the plant site) are not considered to be distribution functions within this source category. Thus, the tanks and other liquid-handling equipment involved solely in activities within the plant site would not be considered to be OLD emission sources in the baseline calculations.

Also excluded from the baseline calculations are those distribution activities that are already being regulated (or are expected to be regulated in the future) by other MACT standards under 40 CFR Part 63. An example of current MACT standards that may affect OLD operations are the hazardous organic NESHAP (HON) and the Refinery NESHAP. These regulations cover certain storage tanks and organic liquid transfer activities that may be in the OLD category. A MACT standard currently under development is the miscellaneous organic NESHAP (MON), which is expected to regulate some distribution-related activities. The emission calculations in this memo are only intended to include HAP emissions from activities that would potentially be covered by the new OLD regulation.

The published data for the industry segments with OLD functions (chemical manufacturing, petroleum refining, etc.) typically are not specific to activities that qualify as distribution and that also are not covered by existing MACT rules. For example, the storage capabilities, throughputs, and other data available for the chemical production and refining industries apply to all production and storage for the liquids processed at the facilities. Even for stand-alone liquid terminals, which usually perform only OLD activities, some MACT rule coverage may be in place (such as for marine vessel loading or benzene storage). Also, many of the liquids handled at these sites do not contain HAP and detailed data on the specific liquids are not readily available. The non-distribution or MACT-covered activities, as well as the handling of non-HAP liquids, need to be quantified in order to exclude them from the baseline calculations. However, the information necessary to extract the OLD emission sources from the general industry data is not readily available.

Data specific to OLD activities were received by the EPA in response to a survey that was sent to 167 companies in April 1998. (2) Information was requested on HAP liquids distributed, storage tanks, transfer racks, wastewater and waste, and equipment leak detection and repair. Respondents were asked to provide information only for HAP-containing liquids ($0.1 psia annual average true vapor pressure, $1,000 ppmw HAP content) that were transferred into or out of each of their plant sites during the base year of 1997. Also, only sites with actual annual HAP emissions of 5 tons per year (tpy) or greater of any single HAP or 12.5 tpy or greater of all HAP were surveyed. The survey instructions also requested that activities covered by another MACT rule (or expected to be covered in the future) be excluded from the responses. Responses were received from 77 companies in five main industry segments as shown in Table 3-1. These industry segments are characterized by both Standard Industrial Classification (SIC) codes (3) and the equivalent North American Industrial Classification System (NAICS) codes.

(4) In the remainder of this memo, SIC codes are used to indicate industry segments.

TABLE 3-1. RESPONDENTS TO THE EPA'S O.L.D. INDUSTRY SURVEY

Industry Segment/ Type of Facility	Principal SIC Code (s)	Corresponding NAICS Code (s)	Number of Facility Responses[a]
Chemical production	2821, 2865, 2869	325211, 325110, 325120	118
Petroleum refinery	2911	324110	37
Liquid terminal	4226	493190	35
Crude oil pipeline station	4612	486110	35
Petroleum terminal	5169, 5171	422690, 422710	14

[a]A total of 246 facilities submitted responses. The seven responses not shown in the table were for facilities in SIC codes 13, 30, 38, 39, and 44.

It was determined, for the reasons outlined above, that the data in these survey responses were likely to be the only pertinent information specific to the emission sources encompassed by the OLD industry. Therefore, a methodology was developed for using these data to calculate baseline emissions for this industry. This approach involved first calculating current HAP emissions, by industry segment, for the OLD emission sources reflected in the survey responses. Then, based on reference data on the size of each segment, the emissions were adjusted to reflect the entire industry segment (see section on Nationwide Baseline Emissions). The total nationwide baseline OLD emissions were then assumed to be equal to the total of all of the segments.

A review of the survey data base, which is a compilation of all items of information from the survey responses, showed that the calculation of OLD HAP emissions for each specific plant site would be a time-consuming and potentially inefficient task. For example, over 1,600 storage tanks were reported in the survey, and separate emission calculations would be needed for each tank. For most of these tanks, the properties of the stored liquid and the physical parameters of the tank (which are needed to calculate volatile organic emissions) were not supplied in the response. Similarly, various details needed for calculating emissions from liquid transfers and leaks from equipment components were ambiguous or were missing from the survey responses. Thus, the calculation of facility-specific HAP emissions was deemed to be impracticable and outside the scope of this effort.

Due to these considerations, a decision was made to calculate baseline emissions through the use of model plants. The function of model plants is to serve as a surrogate for actual OLD operations by simulating their known emission characteristics. For example, the liquid terminals (SIC 4226) reported in the survey have a range of approximately 5 to 65 storage tanks. For this industry segment, therefore, three model facilities could be developed that have 7 (range 1 to 10), 15 (11 to 25), and 42 (greater than 25) tanks (which are then broken down further into fixed-roof, internal floating roof, and external floating roof types). Since all parameters that affect emissions are specified (often through assumptions) in developing the model plants, HAP emissions can be calculated for each facility and then adjusted upward to estimate the total emissions represented in the data base. In turn, the emissions for the entire industry can be estimated through a similar ratioing process.

The OLD model plants are summarized in the next section.

SUMMARY OF MODEL PLANTS

The development of model plants for the OLD industry was documented in the *Model Plants* memo (Memo No. 2), which is included in this TSD. The model plant characteristics that are used in the baseline emissions calculations are summarized below.

Distributed Liquids

The annual average vapor pressures for all distributed liquids by industry segment and type of storage tank, as reported in the EPA survey responses, are summarized in Table 3-2. Additional liquid properties that appear to be representative and are used in the analysis include a molecular weight of 78.1 g/g-mole and a temperature of 60 EF (16 EC). Finally, the average HAP content (percent by weight in the liquids) ratios found for each industry segment are as follows: SIC 28 (64%), SIC 29 (32%), SIC 42 (74%), SIC 46 (6%), and SIC 51 (85%). The overall average HAP content for all of the liquids reported (approximately 48.1 billion gallons) is approximately 54 percent.

Since it was impractical in this analysis to perform separate emission calculations for each individual HAP component, emissions of total organic compounds were calculated using the accepted calculation techniques discussed below and then the HAP-to-total organic compound ratios were used to determine total HAP emissions.

TABLE 3-2. AVERAGE O.L.D. LIQUID VAPOR PRESSURES

SIC Code	Annual Average True Vapor Pressure for OLD HAP Liquids (psia)			
	FXRT	IFRT	EFRT	All Tanks
28	3.35	2.61	---[b]	3.06
29	1.73	2.01	3.67	3.18
42	1.59	2.98	5.16	2.84
46[a]	3.52	---[b]	3.52	3.52
51	2.83	2.12	2.70	2.36

FXRT = fixed-roof tanks.
IFRT = internal floating roof tanks.
EFRT = external floating roof tanks.
[a]Crude oil is essentially the only liquid reported for pipeline stations in this SIC code.
[b]This tank type is not prevalent at OLD operations within this SIC code.

Storage Tanks

The model plant characteristics for storage tanks are summarized in Table 3-3.

A review of the survey data base indicated that approximately 22 percent of the fixed-roof tanks are connected to a control device that controls emissions at an average efficiency of 95 percent. While a variety of specific types of rim and fitting seals are in use on floating roof tanks, the typical internal floating roof tank has been found to use a combination of seals that control emissions at an efficiency of 96.6 percent with respect to a fixed-roof tank. This efficiency is roughly equivalent to the use of a vapor-mounted primary seal with a rim-mounted secondary seal. Similarly, external floating roof tanks are found to have an average control efficiency of 85.0 percent at OLD facilities (compared to a fixed-roof tank). This efficiency is roughly equivalent to use of a mechanical shoe primary seal with a rim-mounted secondary seal. These assumptions were used in calculating overall baseline emissions from the three types of storage tanks.

Data on a small number of pressurized tanks were received in the EPA survey, but emissions from these tanks were presumed to be minimal and no correlations were identified to estimate any vapor losses from these tanks. Therefore, they are not included in the baseline emissions.

TABLE 3-3. MODEL PLANT STORAGE TANKS

SIC Code	Model Plant	Number of Model Plants in Data Base[a]	Number of Tanks by Type				Total Storage Tank Throughput (10^3 gal/yr)	Model Plant Storage Capacity (10^3 gal)	Turnovers/yr[b]
			FXRT	IFRT	EFRT	Total (Range)			
28	28-1	62	4	0	0	4 (1-6)	19, 799	1,920	10
	28-2	34	10	2	0	12 (7-20)	58,473	5,660	
	28-3	22	29	3	0	32 (>20)	157,080	15,210	
29	29-1	18	2	1	0	3 (1-3)	66,5467	2,710	25
	29-2	10	2	1	4	7 (4-9)	586,163	23,872	
	29-3	9	4	4	4	12 (>9)	757,244	30,828	
42	42-1	9	3	3	1	7 (1-10)	103,416	21,848	5
	42-2	12	6	8	1	15 (11-25)	185,333	39,184	
	42-3	14	20	20	2	42 (>25)	474,470	100,178	
46	46-1	26	5	0	0	5 (1-10)	140,612	14,072	10
	46-2	9	0	0	13	13 (>10)	975,460	97,818	
51	51-1	8	4	0	0	4 (1-5)	314	35	9
	51-2	6	0	7	3	10 (>5)	348,395	37,055	

[a]Number of each model plant represented by actual facilities in the EPA survey data base. Only 160 of the 239 reporting facilities in these SIC codes provided data usable for developing the model plants.
[b]Quotient of total throughput divided by total storage capacity. Values have been rounded.

Liquid Transfer (Transfer Racks)

Calculation of emissions from liquid transfer activities was performed for the tank truck and railcar (cargo tank) loadings reported in the surveys. Since no transfer racks were reported at non-terminal pipeline stations handling crude oil (SIC 46), no transfer emissions calculations were performed for this segment. The model plants developed for the remaining four segments are a function of the total transfer rack throughput. The survey responses indicated that only 80, or one-third, of the reporting facilities conducted transfers of organic liquids into tank trucks or railcars. Table 3-4 summarizes the transfer rack model plant information.

The emissions estimation methodology is the same for tank trucks and railcars; therefore, the tank truck and railcar throughputs are combined in the calculations. The data base indicates that approximately 75 percent of the liquid is loaded using bottom or submerged loading, while the remaining 25 percent is loaded by the splash fill method. It also shows that control devices are in use for approximately 60 percent of the tank truck and railcar loading throughput at OLD facilities. The principal reported control devices include flares (20 percent), thermal oxidizers (20 percent), carbon adsorbers (20 percent), scrubbers (20 percent), and condensers (10 percent). Other controls included returning collected vapors to a process or a fuel gas system. While control device efficiencies were reported for many devices in the survey, a large number of these estimates were based on engineering judgment and none was accompanied by test data or a description of test methods. However, the same assumption as used for controlled fixed-roof tanks, that the average control efficiency of the devices in use is 95 percent, appears to be reasonable for the control devices used to control transfer racks and was used in the transfer rack emissions calculations.

Container Filling

The survey data base was reviewed to determine the annual liquid volumes loaded into non-cargo tank containers at individual OLD operations facilities. Containers are divided into small (1 gallon or less), medium (>1 gallon, less than 55 gallons), and large (55 gallons or larger). Container filling was reported at 26 separate facilities. Table 3-5 summarizes the data for container filling. The data base indicates that approximately 28 percent of the OLD container filling is performed using submerged loading, while the remaining 72 percent is done by splash fill. Control devices or vapor balancing are in use for about 24 percent of the liquid loaded (flares, thermal oxidizers, and carbon adsorbers). A uniform control efficiency of 95 percent was applied to the controlled emissions, as was done for storage tanks and loading racks.

Equipment Components

HAP emissions occur due to leaks in equipment components used in the piping that transfers organic liquids. The survey data base contains data on equipment populations that are specific to OLD activities. Table 3-6 lists the number of each component type assigned to the model plants, based on calculated averages from the surveyed facilities.

TABLE 3-4. MODEL PLANTS -- ORGANIC LIQUID TRANSFER INTO TANK TRUCKS AND RAILCARS

Industry Segment (SIC Code)	Model Plant	Throughput for all Model Plants (10^3 gal/yr)[a]	Number of Model Plants in Data Base[b]	Throughput for each Model Plant (10^3 gal/yr)
28	28-1	87,360	14	6,240
	28-2	229,904	14	16,422
	28-3	617,612	18	34,312
Totals		**934,876**	**46**	
29	29-1	30,148	5	6,030
	29-2	265,515	4	66,379
	29-3	343,055	4	85,764
Totals		**638,718**	**13**	
42	42-1	83,674	4	20,918
	42-2	168,900	6	28,150
	42-3	383,910	7	54,844
Totals		**636,484**	**17**	
46	46-1	c	c	c
	46-2	c	c	c
Totals			**0**	
51	51-1	47	2	23.5
	51-2	51,814	2	25,907
Totals		**51,861**	**4**	
Grand Totals		**2,261,939**	**80**	

[a]For facilities in the EPA survey data base.
[b]Less than the model plant populations shown in Table 3-3 because all facilities do not conduct organic liquid transfers into tank trucks or railcars.
[c]Data indicate that transfer racks typically are not used at facilities in SIC code 46.

TABLE 3-5. CONTAINER FILLING DATA

Size of Container Filled[a]	No. of Facilities Reporting[b]	Total Volume Loaded (gal/yr)	Loading Method (%)[c]		Percentage of Facilities Using Control[d]
			SUB/BTM	SPL	
Small	1	515,000	0	100	0%
Medium	7	4,535,100	4	96	14%
Large	24	19,513,200	34	66	25%

[a]Small = 1 gallon or less.
Medium = > 1 gal, < 55 gal.
Large = 55-gallon drum or larger container.
[b]Some facilities reported under more than one size range. A total of 26 different facilities reported.
[c]SUB/BTM = submerged or bottom fill.
SPL = splash fill.
[d]Control includes either a control device or vapor balancing.

Wastewater and Semi-Aqueous Waste

The EPA's OLD survey requested information on the quantities, HAP contents, and emission controls for wastewater and semi-aqueous waste generated by OLD activities. Many facilities responded that wastewater and waste generated by OLD type activities are minimal (or even non-existent), or they provided limited or ambiguous information on their waste.
Therefore, no analysis of the available data could be performed that would allow HAP emissions from these sources to be quantified. As a result, they are not accounted for in the baseline calculations. Those emissions that are not covered under other MACT rules (such as the HON) appear to be a very small percentage of total HAP emitted from OLD operations.

MODEL PLANT BASELINE EMISSIONS

Storage Tanks

Total organic emissions from storage tanks at the model plants were calculated using the general approach outlined in previous EPA guidance. (5) The primary tool used was TANKS3.1 software, which is based on the equations presented in Section 7 of the EPA's document AP-42. As discussed in the *Model Plants* memo (Memo No. 2 in this TSD), average liquid vapor pressures were estimated for each tank type within each industry segment. The average emission control levels discussed earlier for each tank type were assumed in the emissions calculations.

TABLE 3-6. MODEL PLANT EQUIPMENT COUNTS

SIC Code	Model Plant	No. of Equipment Components at Each Model Plant			
		Pumps[a]	Connectors	Valves	Sampling Connection Systems
28	28-1	10	500	200	5
	28-2	10	500	200	5
	28-3	50	2,000	500	15
29	29-1	10	500	200	5
	29-2	10	500	200	5
	29-3	10	500	200	5
42	42-1	10	500	200	5
	42-2	10	500	200	5
	42-3	50	2,000	500	15
46	46-1	10	500	200	5
	46-2	10	500	200	5
51	51-1	10	500	200	5
	51-2	10	500	200	5

[a]Each pump has two seals (emission points).

Finally, the average HAP-to-organics ratios determined for each industry segment were applied to the organic emissions estimates in order to calculate baseline HAP emissions. Table 3-7 presents the calculation results for storage tanks.

Liquid Transfer (Transfer Racks)

Volatile organic emissions from the loading of tank trucks and railcars at transfer racks are estimated using the expression in the EPA's document AP-42 (6):

$$L_L = (12.46)[(M)(P)(S)/(T)]$$

TABLE 3-7. BASELINE STORAGE TANK EMISSIONS FOR INDIVIDUAL MODEL PLANTS

Model Plant	Total Organic Compound Emissions (tons/yr)[a, b]				HAP Emissions (tons/yr)[b,d]
	FXRT[c]	IFRT	EFRT	Totals	
28-1	62.5	0	0	62.5	40.0
28-2	156.3	2.2	0	158.5	101.5
28-3	453.3	3.3	0	456.6	292.2
29-1	23.7	3.5	0	27.2	8.7
29-2	23.7	3.5	170.1	197.3	63.1
29-3	47.3	14.1	170.1	231.6	74.1
42-1	30.5	7.5	84.9	122.8	90.9
42-2	61.0	19.9	84.9	165.7	122.6
42-3	203.2	49.7	169.8	422.6	312.8
46-1	226.5	0	0	226.5	13.6
46-2	0	0	161.0	161.0	9.7
51-1	1.0	0	0	1.0	0.9
51-2	0	16.1	90.1	106.2	90.2

[a]Values apply to the total of all tanks of each type at each model plant.
[b]Values are rounded.
[c]Data indicate that approximately 22 percent of fixed-roof tanks are controlled with a control system efficiency of 95 percent; these emission values represent a composite of controlled and uncontrolled FXRT.
[d]Basis: Organic emissions totals are multiplied by the HAP-to-organics ratios discussed under *Distributed Liquids*.

where:
L_L = emissions due to loading loss (lb/1,000 gal. of liquid transferred)
M = molecular weight of vapors (lb/lb-mole)
P = true vapor pressure of liquid (psia)
S = a saturation factor that depends on the loading method
T = temperature of liquid, ER (EF + 460).

Parameter values similar to those selected for the storage tank calculations were used: constant values of 78.1 lb/lb-mole and 60 EF were selected for M and T, respectively, while a separate average vapor pressure was calculated for each industry segment ("all tanks" values in Table 3-2). The average saturation factor was calculated on the basis that splash filling (S = 1.45) constitutes approximately 25 percent of the loadings, while submerged loading (S = 0.60) makes up the remaining 75 percent. This calculation yielded S = 0.80 as the overall saturation factor applicable to all of the tank truck and railcar loadings. Table 3-8 summarizes the results of the emission calculations for liquid transfer operations at the model plants that have these operations.

TABLE 3-8. BASELINE TRANSFER RACK EMISSIONS FOR INDIVIDUAL MODEL PLANTS[a]

Model Plant	Liquid Annual Average True Vapor Pressure (psia)	Total Organic Compound Emissions (tons/yr)	HAP Emissions (tons/yr)[c]
28-1 28-2 28-3	3.06	10.7 28.1 58.7	6.8 18.0 37.6
29-1 29-2 29-3	3.18	10.7 118.1 152.6	3.4 37.8 48.8
42-1 42-2 42-3	2.84	33.3 44.7 87.2	24.6 33.1 64.5
46-1[b] 46-2[b]	-- --	– –	– --
51-1 51-2	2.36	0.04 34.2	0.03 29.1

[a]Assumes M = 78.1 lb/lb-mole, T = 60EF, and S = 0.80 in the AP-42 emissions equation. Emissions are shown for a composite of controlled (60%) and uncontrolled (40%) racks. Controlled racks are presumed to have an average control system efficiency of 95 percent.

[b]No tank truck or railcar transfer racks are indicated in the data base for SIC code 46 facilities.

[c]Assumes the same HAP-to-organics ratios used in Table 3-7.

As an example of the transfer rack calculation for Model Plant 28-1:

$$L_L = \frac{(12.46)(78.1)(3.06)(6{,}240{,}000 \text{ gal/yr})(0.64 \text{ HAP ratio})}{(1{,}000)(520)} = 22{,}869 \text{ lb/yr.}$$

This term is then multiplied by the following expression, which includes the saturation factors and relative prevalence of controlled and uncontrolled transfer rack model plants, as well as the control efficiency for the controlled operations:

$$[(1.45)(0.40 \text{ uncontrolled}) + (0.60)(0.60 \text{ controlled})(1-0.95)] = 0.598.$$

The resulting weighted emissions estimate for Model Plant 28-1 is then:

$$(22{,}869 \text{ lb/yr})(0.598)(1 \text{ ton}/2{,}000 \text{ lb}) = 6.84 \text{ tpy HAP.}$$

Container Filling

No calculation methods were identified that are tailored to estimate the emissions from the filling of small, medium, or large containers. Filling drums and other containers is a similar process to the refueling of fuel tanks in vehicles, the main difference being that containers are usually empty and clean prior to filling. EPA project team personnel conducting site visits to facilities where container filling was performed routinely observed the use of service station type nozzles in dispensing liquids to containers. The transfer rack loss equation was first used to estimate emissions from container filling, but the results appeared to be unreliable and extremely high. The equation used to calculate emissions from vehicle refueling appears to provide the most reliable means for estimating emissions from container filling.

The emissions due to the filling of containers at OLD facilities are calculated using the vehicle refueling equation presented in Section 5.2 of AP-42. The equation is:

$$E_R = 2.2046[(0.0884)(T_D) + (0.485)(RVP) - (0.0949)(dT) - 5.909]$$

where:	E_R	=	total organic emissions (lb/1,000 gal transferred)
	T_D	=	temperature of dispensed fuel/liquid (deg. F)
	RVP	=	Reid vapor pressure
	dT	=	temperature difference between fuel in vehicle tank and dispensed fuel/liquid (deg. F)

Similar to the calculations for storage tanks and transfer racks, constant values for the equation parameters were selected. Thus, the temperature of the dispensed liquid/fuel was assumed to be 60 EF, and the Reid vapor pressure was based on benzene at 100 EF, or 3.227 psia. Since there is no temperature difference between the fuel/liquid in the container and the dispensed fuel/liquid (i.e., the container is empty prior to filling), a very small, non-zero value (0.001) was selected for this parameter. Table 3-9 summarizes the emission calculations for the filling of containers.

Equipment Components

Vapor leakage emissions from equipment components are calculated for the model plants using two sets of emission factors. For OLD facilities with no formal leak detection and repair (LDAR) program in place (estimated from survey responses to be about 65 percent), we used the average *uncontrolled* SOCMI emission factors from the EPA Protocol Document. (7) For the remaining 35 percent of facilities with an LDAR program in place, we used the *controlled* equipment emission factors found in that document. These factors are expressed in units of lbs of organic emissions/hour/component. It is assumed that these components operate (and have the potential to emit HAP) 12 hours per day (4,380 hr/year). HAP emissions are estimated using the average HAP-to-organics ratios determined for each industry segment, as discussed in a previous section. The emissions calculation results for each model plant are presented in Table 3-10.

TABLE 3-9. CONTAINER FILLING EMISSIONS FROM SURVEYED FACILITIES[a]

Size of Container[b]	Total Volume Loaded (gal/yr)[c]	Total Organic Compound Emissions (tons/yr)[d]	HAP Emissions (tons/yr)[d]
Small	515,000	0.5	0.4
Medium	4,535,100	4.8	3
Large	19,513,200	20.5	13.1
Totals	24,563,300	25.7	16.5

[a]Assumes T_D = 60 EF, RVP = 3.227 psia, and dT = 0.001 in the AP-42 emissions equation.
[b]Container sizes were described in the notes to Table 3-5.
[c]These volumes apply to the facilities that responded to the EPA survey.
[d]Values have been rounded.

TABLE 3-10. EQUIPMENT COMPONENT LEAKAGE EMISSIONS FOR INDIVIDUAL MODEL PLANTS

Model Plant	Component Type	No. of Components	Emission factor (lb/hr/component)[a]	Emissions (tons/yr)[b]	
				Total Organic Compounds	HAP
28-1	Pump[c]	10	0.0318	1.39	0.89
	Connector	500	0.0035	3.83	2.45
	Valve	200	0.0066	2.89	1.85
	Sampling Connection	5	0.0215	0.24	0.15
	Totals	**715**		**8.35**	**5.35**
28-2	Pump[c]	10	0.0318	1.39	10.89
	Connector	500	0.0035	3.83	2.45
	Valve	200	0.0066	2.89	1.85
	Sampling Connection	5	0.0215	0.24	0.15
	Totals	**715**		**8.35**	**5.35**

TABLE 3-10. (Continued)

Model Plant	Component Type	No. of Components	Emission factor (lb/hr/component)[a]	Emissions (tons/yr)[b]	
				Total Organic Compounds	HAP
28-3	Pump [c]	50	0.0318	6.96	4.46
	Connector	2,000	0.0035	15.33	9.81
	Valve	500	0.0066	7.23	4.63
	Sampling Connection	15	0.0215	0.71	0.45
	Totals	**2,565**		**30.23**	**19.35**
29-1	Pump [c]	10	0.0318	1.39	0.44
	Connector	500	0.0035	3.83	1.23
	Valve	200	0.0066	2.89	0.92
	Sampling Connection	5	0.0215	0.24	0.08
	Totals	**715**		**8.35**	**2.67**
29-2	Pump [c]	10	0.0318	1.39	0.44
	Connector	500	0.0035	3.83	1.23
	Valve	200	0.0066	2.89	0.92
	Sampling Connection	5	0.0215	0.24	0.08
	Totals	**715**		**8.35**	**2.67**
29-3	Pump [c]	10	0.0318	1.39	0.44
	Connector	500	0.0035	3.83	1.23
	Valve	200	0.0066	2.89	0.92
	Sampling Connection	5	0.0215	0.24	0.08
	Totals	**715**		**8.35**	**2.67**

TABLE 3-10. (Continued)

Model Plant	Component Type	No. of Components	Emission factor (lb/hr/component)[a]	Emissions (tons/yr)[b]	
				Total Organic Compounds	HAP
42-1	Pump[c]	10	0.0318	1.39	1.03
	Connector	500	0.0035	3.83	2.84
	Valve	200	0.0066	2.89	2.14
	Sampling Connection	5	0.0215	0.24	0.17
	Totals	**715**		**8.35**	**6.18**
42-2	Pump[c]	10	0.0318	1.39	1.03
	Connector	500	0.0035	3.83	2.84
	Valve	200	0.0066	2.89	2.14
	Sampling Connection	5	0.0215	0.24	0.17
	Totals	**715**		**8.35**	**6.18**
42-3	Pump[c]	50	0.0318	6.96	5.15
	Connector	2,000	0.0035	15.33	11.34
	Valve	500	0.0066	7.23	5.35
	Sampling Connection	15	0.0215	0.71	0.52
	Totals	**2,565**		**30.23**	**22.37**
46-1	Pump[c]	10	0.0318	1.39	0.08
	Connector	500	0.0035	3.83	0.23
	Valve	200	0.0066	2.89	0.17
	Sampling Connection	5	0.0215	0.24	0.01
	Totals	**715**		**8.35**	**0.50**

TABLE 3-10. (Concluded)

Model Plant	Component Type	No. of Components	Emission factor (lb/hr/component)[a]	Emissions (tons/yr)[b]	
				Total Organic Compounds	HAP
46-2	Pump [c]	10	0.0318	1.39	0.08
	Connector	500	0.0035	3.83	0.23
	Valve	200	0.0066	2.89	0.17
	Sampling Connection	5	0.0215	0.24	0.01
	Totals	**715**		**8.35**	**0.50**
51-1	Pump [c]	10	0.0318	1.39	1.18
	Connector	500	0.0035	3.83	3.26
	Valve	200	0.0066	2.89	2.46
	Sampling Connection	5	0.0215	0.24	0.20
	Totals	**715**		**8.35**	**7.10**
51-2	Pump [c]	10	0.0318	1.39	1.18
	Connector	500	0.0035	3.83	3.26
	Valve	200	0.0066	2.89	2.46
	Sampling Connection	5	0.0215	0.24	0.20
	Totals	**715**		**8.35**	**7.10**

[a]Composite emission factor based on a combination of facilities with and without a current Federal LDAR program (see text).
[b]Calculations assume that components are emitting HAP one-half of the time, or approximately 4,380 hours per year. Values may not add up exactly to totals due to rounding.
[c]Pump factors are for each pump seal. Each pump has two seals.

Total Model Plant Emissions

The total organic and HAP baseline emissions for each model plant are presented in Table 3-11. This baseline is the sum of the emissions shown in Tables 3-7, 3-8, and 3-10.

TABLE 3-11. TOTAL BASELINE EMISSIONS FOR INDIVIDUAL MODEL PLANTS

Model Plant	Total Organic Compound Emissions (tons/yr)				HAP Emissions (tons/yr)			
	Storage Tanks	Transfer Racks	Equipment Leaks	**Totals**	Storage Tanks	Transfer Racks	Equipment Leaks	**Totals**
28-1	62.5	10.7	8.4	**81.6**	40.0	6.8	5.4	**52.2**
28-2	158.5	28.1	8.4	**195.0**	101.5	18.0	5.4	**124.9**
28-3	456.6	58.7	30.2	**545.5**	292.2	37.6	19.4	**349.2**
29-1	27.2	10.7	8.4	**46.3**	8.7	3.4	2.7	**14.8**
29-2	197.3	118.1	8.4	**323.8**	63.1	37.8	2.7	**103.6**
29-3	231.6	152.6	8.4	**392.6**	74.1	48.8	2.7	**125.6**
42-1	122.8	33.3	8.4	**164.5**	90.9	24.6	6.2	**121.7**
42-2	165.7	44.7	8.4	**218.8**	122.6	33.1	6.2	**161.9**
42-3	422.6	87.2	30.2	**540.0**	312.8	64.5	22.4	**399.7**
46-1	226.5	--[a]	8.4	**234.9**	13.6	--[a]	0.5	**14.1**
46-2	161.0	--[a]	8.4	**169.4**	9.7	--[a]	0.5	**10.2**
51-1	1.0	0.04	8.4	**9.4**	0.9	0.03	7.1	**8.0**
51-2	106.2	34.2	8.4	**148.8**	90.2	29.1	7.1	**126.4**

[a]The EPA survey indicates that there are no tank truck/railcar transfer racks at facilities with SIC code 46.

Container filling emissions are not included in these totals due to the difficulty of assigning these activities to individual model plants. However, these emissions are included in the total baseline discussed in the following sections.

BASELINE FOR SURVEYED FACILITIES

The total baseline HAP emissions for all of the facilities that responded to the EPA's OLD survey are estimated by multiplying the emissions calculated for each model plant times the number of facilities fitting each model plant's parameters that are contained in the survey data base (as shown in Table 3-4). Since the model plant approach was used rather than actual emissions data for each individual facility, this estimate may be higher or lower than the sum of emission inventories for these facilities. For each facility (except SIC 46 facilities, which do not have transfer rack or container filling emissions), the baseline is the sum of the emissions calculated for storage tanks, liquid transfers (tank truck and railcar loadings), container filling (for some facilities), and leaks from equipment components. Since some plants are controlled through the use of control devices on transfer racks (60 percent), and some use a Federal leak detection and repair program for equipment leaks (35 percent), composite plants representing the weighted average control level were used in the calculations. Some model plants also include large container filling operations. There may be other miscellaneous sources at some OLD plants (especially from the handling of HAP-containing waste and wastewater), but these emissions cannot be readily quantified. The total baseline HAP emissions from OLD activities for the facilities in the survey data base are estimated to be 25,288 tons per year. Note that the surveyed facilities constitute only a fraction of all the OLD activities nationwide. Table 3-12 summarizes the baseline results for surveyed facilities by emission source.

NATIONWIDE BASELINE EMISSIONS

The next step in calculating baseline emissions for all OLD activities nationwide was to make an estimate of the total number of major source facilities with OLD activities. For consistency with data in the survey data base, this information was collected on the basis of industry segment, or SIC code. The ratio of total nationwide facilities to surveyed facilities in each segment, multiplied by the baseline emissions calculated for the surveyed facilities in those segments (Table 3-12), is used to provide the estimate of nationwide baseline emissions. The following subsections summarize the information that was used to determine these ratios.

SIC 28

The EPA fact sheet describing the final Hazardous Organic NESHAP (HON) (8) was consulted on the EPA's TTN website. This information states that "about 370 facilities in roughly 35 states are affected by the requirements in this rule." We have assumed that collocated, non-MACT covered OLD activities are carried out at all of these plant sites, and that all of the sites are potential major sources. On this basis, there are 370 OLD facilities nationwide with a primary SIC code of 28.

TABLE 3-12. TOTAL BASELINE HAP EMISSIONS FOR SURVEYED FACILITIES[a]

SIC Code	Baseline HAP Emissions (tons/yr)				
	Storage Tanks	Transfer Racks	Container Filling[b]	Equipment Leaks	**Totals**
28	12,359	1,024	16.5	945	**14,345**
29	1,455	363	--[b]	100	**1,918**
42	6,669	749	--[b]	444	**7,861**
46	441	--[c]	--[b,c]	18	**458**
51	548	58	--[b]	99	**706**
Totals	**21,472**	**2,194**	**16.5**	**1,606**	**25,288**

[a]HAP emissions calculated for 239 OLD facilities, using model plants developed from all facilities that submitted a response to the EPA's 1998 survey. Transfer rack emissions are for 80 of these facilities (see Table 3.4).
[b]Container filling emissions are included in the total emissions for SIC code 28, since most of these activities occur in this industry segment.
[c]There are no transfer rack or container filling emissions at facilities with SIC code 46.

SIC 29

Industry data show that the number of operating petroleum refineries varies from year to year. Due to fluctuating demand for their products, refineries may be idled and reactivated on a sporadic basis. A guideline document prepared in association with the Refinery MACT rule listed a total of 165 refineries based on 1994 data. (9) Another industry publication quoted Energy Information Administration figures indicating that there were 172 operable refineries on January 1, 1994, versus 187 the preceding year. (10) A PES memo (11) concluded that in 1996 there was a population of 173 operating refineries nationwide.

An analysis of the refineries that responded to the EPA survey showed that about 64 percent of the responding facilities conduct OLD operations within this source category. For calculating the baseline for this industry segment, we have assumed that 64 percent of the 173 refineries throughout the country, or 111 refineries, are major sources of HAP emissions that conduct non-MACT covered OLD activities.

SIC 42

Many of the larger companies that own or operate stand-alone, for-hire liquid storage terminals are members of the Independent Liquid Terminals Association (ILTA). It was assumed that the ILTA membership directory (12) would list essentially all of the larger emitting terminals. These listings showed that there are approximately 283 member facilities that handle HAP liquids. Based on the level of activity (equipment and throughputs) at these facilities, we assumed that about one-third of them, or 94 facilities, would be large enough to be a potential major source.

SIC 46

The EPA fact sheet for the final Gasoline Distribution MACT rule (13) was consulted on the EPA's TTN website. This information stated that approximately 20 pipeline breakout stations will be affected by that rule. No specific data on the nationwide population of non-gasoline (crude oil) pipeline stations were available for this analysis. However, since the data base contains 35 facilities it was assumed that this number represents all of the major source OLD facilities in this industry segment.

Crude Oil Transferred at SIC 46 Facilities

Crude oil is an organic liquid that is stored and transferred in large quantities in the United States. The National Petroleum News estimates that the 1994 average crude oil supply was 6,464,000 barrels/day of domestic and 7,282,000 barrels/day of imported crude. In total, this amounts to approximately 210 billion gallons of crude oil that is stored and transferred in the U.S. on an annual basis (10). The 1998 EPA OLD survey collected data on approximately 39 billion gallons of crude oil, or approximately 19 percent of the 1994 total. It is assumed that most of the 210 billion gal/yr of crude oil transferred and stored will be subject to coverage by the Organic Liquids Distribution MACT rule at some point after production and the point of custody transfer and prior to its consumption by refineries.

We have assumed that all of the HAP emissions from SIC 46 facilities are attributable to crude oil. A proportion of the emissions from refineries and for-hire liquid terminals is also attributable to crude oil, as it is both transferred and stored at many of these facilities. Since crude oil is the single largest volume organic liquid transferred and stored in the nation, the emissions attributed to crude oil in SIC code 46 facilities may be an understatement of the actual emissions.

SIC 51

The Gasoline Distribution MACT rule covers bulk gasoline terminals in SIC code 51 as well as pipeline breakout stations. The EPA fact sheet prepared for that rule stated that approximately 240 of these terminals will be affected by the rule. (13) Although many of these terminals store non-gasoline organic liquids, these liquids often have low vapor pressures (such as diesel, heating fuel, or gasoline additives) and may not be regulated as OLD sources. Since the number of OLD sources in this industry is difficult to estimate, it was assumed that the fraction of this industry segment surveyed is similar to the fractions surveyed for SIC codes 28, 29, and 42. Table 3-13 indicates that these three percentages are quite consistent, and average 34.1 percent. Using this percentage, it is estimated that there are approximately 41 SIC 51 facilities nationwide that are major source facilities carrying out OLD activities.

Based on the estimates of the numbers of OLD facilities nationwide, “extrapolation ratios” were determined and are shown in Table 3-13. Using these same ratios, the nationwide population of facilities with transfer racks was determined and is shown in the table. The ratios were used to calculate the nationwide baseline emissions estimate for each industry segment. The total baseline for all segments, as presented in Table 3-14, is 75,776 tons of HAP per year.

The total HAP emissions can be speciated into individual HAP based on the relative occurrence of each HAP in the liquids reported in the OLD data base. Approximately 93 different organic HAP were reported, or about one-half of the complete HAP list. Table 3-15 presents the breakdown of the baseline emissions into the 37 most prevalent HAP. On the basis of the survey data, the HAP shown in this table account for over 99 percent of the total HAP emissions from OLD operations. Table 3-16 summarizes the remaining 56 HAP that were reported as being emitted from OLD activities.

TABLE 3-13. EXTRAPOLATION OF BASELINE EMISSIONS FROM SURVEYED FACILITIES TO ALL O.L.D. FACILITIES NATIONWIDE

SIC Code	Total No. of Facilities in Data Base[a]	No. of Major Source OLD Facilities Nationwide[a]	% of Facilities Surveyed	Extrapolation Ratio[b]	No. of Data Base Facilities with Transfer Racks	No. of Nationwide Facilities with Transfer Racks[c]
28	118	370	31.9	3.1	46	143
29	37	111	33.3	3.0	13	39
42	35	94	37.2	2.7	17	46
46	35	35	100.0	1.0	--	--
51	14	41	34.1	2.9	4	12
Totals	**239**	**651**	**--**	**--**	**80**	**240**

[a]Includes the facilities with organic liquid transfer racks.
[b]Ratio of the estimated nationwide facility population to the number of facilities in the OLD data base. Ratios are rounded.
[c]Equal to data base facility populations multiplied by the respective extrapolation ratio.

TABLE 3-14. NATIONWIDE BASELINE HAP EMISSIONS FOR O.L.D. INDUSTRY

SIC Code	Nationwide Baseline HAP Emissions (tons/yr)				
	Storage Tanks	Transfer Racks	Container Filling	Equipment Leaks	**Totals**
28	38,914	4,730	48	3,002	**46,694**
29	4,365	1,346	1	300	**6,012**
42	17,959	1,434	1	1,210	**20,604**
46	440	--[a]	--[a]	18	**458**
51	1,556	146	1	305	**2,008**
Totals	**63,233**	**7,656**	**51**	**4,836**	**75,776**

[a]There are no transfer rack or container filling emissions at facilities with SIC code 46.

TABLE 3-15. NATIONWIDE O.L.D. BASELINE HAP EMISSIONS, BY INDIVIDUAL HAP

HAP Name	OLD Occurrence, percent of total HAP	Emissions (tons/yr)
Methanol	16.9	12,805
Aniline	12.2	9,245
Benzene	10.4	7,880
Vinyl chloride	8.3	6,290
Methyl tert-butyl ether (MTBE)	7.6	5,760
p-Xylene	7.0	5,305
Toluene	4.7	3,560
Hexane	4.6	3,485
Xylenes (mixed isomers)	4.3	3,260
Styrene	3.8	2,880
Nitrobenzene	3.7	2,805
Vinyl acetate	3.6	2,730
o-Xylene	2.6	1,970
Naphthalene	1.5	1,135
Propylene oxide	1.5	1,135
Ethyl benzene	1.4	1,060
Ethylene oxide	1.3	985
Cumene	0.9	680
2,2,4-Trimethylpentane	0.7	530
Ethylene glycol	0.5	380
Ethylene dichloride	0.3	225
Methyl methacrylate	0.3	225
1,3-Butadiene	0.3	225
Methyl ethyl ketone (MEK)	0.2	150
Formaldehyde	0.2	150

TABLE 3-15. (Concluded)

HAP Name	OLD Occurrence, percent of total HAP	Emissions (tons/yr)
Phenol	0.1	76
Tetrachloroethylene	0.08	61
Methylene chloride	0.07	53
Acetaldehyde	0.05	38
Epichlorohydrin	0.05	38
Acrylic acid	0.03	23
Ethyl acrylate	0.03	23
Acrylonitrile	0.02	15
Chloroform	0.02	15
Glycol ethers	0.02	15
Trichloroethylene	0.01	8
Ethylidene dichloride	0.002	2
Total		**75,222**

[a]The 37 HAP shown in this table represent over 99 percent (75,222 out of 75,776) of the baseline emissions. Individual emission totals for the remaining 56 HAP cannot be quantified, but are considered to contribute less than 1 percent of the total HAP emissions.

TABLE 3-16. ADDITIONAL HAP IDENTIFIED IN ORGANIC LIQUIDS[a]

HAP Name	
1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane
1,1-Dimethyl hydrazine	1,2,4-Trichlorobenzene
1,2-Epoxybutane	1,3-Dichloropropene
1,4-Dioxane (1,4-Diethyleneoxide)	2,4-D salts and esters
2,4-Toluene diisocyanate	4,4'-Methylenedianiline
Acetonitrile	Acetophenone
Acrolein	Acrylamide
Allyl chloride	Biphenyl
Carbon tetrachloride	Chlorine
Chloroacetic acid	Chlorobenzene
Chloroprene	Cresols/cresylic acid
Dibenzofurans	Dibutylphthalate
Diethanolamine	Diethyl sulfate
Dimethyl formamide	Ethyl chloride (Chloroethane)
Ethylene dibromide	Hexachloroethane
Hydrazine	Hydrochloric acid
Hydrogen fluoride	Hydroquinone
Isophorone	Maleic anhydride
m-Cresol	Methyl chloride
Methyl chloroform	Methyl hydrazine
Methyl isobutyl ketone (MIBK)	Methylene diphenyl diisocyanate
m-Xylene	N,N-Diethyl aniline
o-Cresol	o-Toluidine
p-Cresol	Phthalic anhydride
Polycyclic organic matter	Propionaldehyde

TABLE 3-16. (Concluded)

HAP Name	
Propylene dichloride	Quinoline
Styrene oxide	Titanium tetrachloride
Triethylamine	Vinylidene chloride

[a]The HAP in this table were identified in responses to the EPA survey, but data were not sufficient to quantify their annual emission rates in the OLD industry.

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12. Independent Liquid Terminals Association. 1997 Directory. Washington, DC. 1997.

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MEMO NO. 6

Environmental and Cost Impacts of the Proposed OLD NESHAP

MEMO NO. 6

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INTRODUCTION

This memorandum presents the methodology for and results of the calculation of environmental and cost impacts of the application of maximum achievable control technology (MACT) to emission sources in the organic liquids distribution (non-gasoline), or “OLD”, industry. Environmental impacts consist of air pollution emission reductions (primarily of hazardous air pollutants (HAP) and total organic compounds (TOC)), and impacts on the water pollution, solid waste, energy consumption, and other aspects of the operation of OLD facilities. The capital and annual cost impacts of installing controls on the HAP emission sources at OLD operations, including costs for keeping records and sending reports under the OLD NESHAP, are presented both on a facility basis and as nationwide impacts.

The following section briefly describes the OLD industry and its principal HAP emission sources. Then the methodology for calculating emissions is briefly explained, followed by a summary of baseline emissions, emissions with MACT control in place, and emission reductions. Other environmental impacts of the MACT controls are then discussed. Finally, the costing methodology is explained for each emission source, with capital and annual costs presented for individual facilities and for the entire OLD industry.

Spreadsheets used for determining the environmental and cost impacts and for developing many of the tables in this memo are presented in a separate memo, which can be found in the EPA docket for this project. (1)

ENVIRONMENTAL IMPACTS

OLD Industry and Emission Sources

Most of the types of facilities at which organic liquids are distributed have been studied as part of previous MACT rule development projects. These facilities primarily include chemical manufacturing plants (SOCMI facilities), petroleum refineries, storage and marketing terminals, and crude oil pipeline stations. In addition, there may be other manufacturing facilities that are involved in liquid distribution. Generally speaking, these facility types have the following emission sources in common:

1. Organic liquid storage tanks;
2. Liquid transfer activities involving tank trucks and railcars (transfer racks);
3. Leaks from equipment components (pumps, valves, etc.);
4. Container filling operations;
5. Wastewater collection and treatment; and
6. Semi-aqueous waste.

These emission sources have been described in a report prepared previously under this project (2), so these descriptions will not be repeated here. The last three sources, container filling operations, wastewater, and semi-aqueous waste, are difficult to quantify and are assumed to be very small in comparison to the first four sources mentioned. It should be stressed that only activities and equipment that are used in the distribution of organic liquids are considered part of the OLD source category. For the purposes of this standard, liquid movement *into* or *out of* a plant site is considered to be distribution. Thus, a facility that receives bulk organic liquids but does not transfer them back off the site in their original form may still qualify as an OLD operation. An organic liquid distribution operation may be collocated with a manufacturing operation (for example, a solvent manufacturing facility distributing its own products), or they may exist as a stand-alone operation (e.g., for-hire storage and distribution terminals). At production plant sites, the major portion of liquid handling (and HAP emissions) is likely to be associated with non-distribution activities such as chemical process units or other MACT-covered operations. These other non-OLD HAP emissions are not considered part of the emissions baseline or the calculated reductions discussed in this memorandum.

The air pollution impact of applying MACT controls to OLD emission sources is the difference between the current (baseline) OLD emissions and the emissions that will occur after implementation of the NESHAP. The methodology used to calculate both "before" and "after" emission totals is described below.

Emission Calculation Methodology

Baseline Emissions Calculations

The methodology used to calculate HAP emissions from each of the principal emission sources was described in detail in the OLD *Baseline Emissions* memo, which is Memo No. 3 in this TSD. Calculation techniques included the use of the TANKS3.1 program to estimate emissions from storage tanks, the loading loss equation from the EPA's document AP-42 (used to estimate emissions from liquid transfer operations), and accepted SOCMI fugitive emission factors. The baseline emissions results presented in that memo, which apply to the year 1997, are summarized in Table 6-1.

Table 6-1 shows the baseline TOC and HAP emissions from storage tanks, transfer racks, and equipment leaks at each of the 13 model plants developed for the OLD industry. Emissions were calculated on the basis of the model plants that were described in detail in the *Model Plants* memo, which is Memo No. 2 in this TSD. An attempt was made to characterize facilities contained in the 1998 OLD data base, so that most of the actual facilities would be described by one of the model plants. Although the set of model plants represents the total size range of facilities for which data were available, it is not anticipated that any one facility will be exactly mirrored by a model plant.

The nationwide baseline HAP emissions from OLD operations, by SIC code and emission source, are presented in Table 6-2. This table includes an estimate for total HAP emissions from container filling, based on data received from industry in response to the EPA's 1998 survey. The total baseline emissions of HAP are estimated to be 75,776 tons per year. Not shown in this table are the baseline emissions of TOC, which are estimated to total about 129,500 tons per year from OLD operations.

TABLE 6-1. BASELINE EMISSIONS FOR INDIVIDUAL MODEL PLANTS

Model Plant	Total Organic Compound Emissions (tons/yr)				HAP Emissions (tons/yr)			
	Storage Tanks	Transfer Racks[a]	Equipment Leaks[a]	**Totals**	Storage Tanks	Transfer Racks[a]	Equipment Leaks[a]	**Totals**
28-1	62.5	10.7	8.4	**81.6**	40.0	6.8	5.4	**52.2**
28-2	158.5	28.1	8.4	**195.0**	101.5	18.0	5.4	**124.9**
28-3	456.6	58.7	30.2	**545.5**	292.2	37.6	19.4	**349.2**
29-1	27.2	10.7	8.4	**46.3**	8.7	3.4	2.7	**14.8**
29-2	197.3	118.1	8.4	**323.8**	63.1	37.8	2.7	**103.6**
29-3	231.6	152.6	8.4	**392.6**	74.1	48.8	2.7	**125.6**
42-1	122.8	33.3	8.4	**164.5**	90.9	24.6	6.2	**121.7**
42-2	165.7	44.7	8.4	**218.8**	122.6	33.1	6.2	**161.9**
42-3	422.6	87.2	30.2	**540.0**	312.8	64.5	22.4	**399.7**
46-1	226.5	--[a]	8.4	**234.9**	13.6	--[a]	0.5	**14.1**
46-2	161.0	--[a]	8.4	**169.4**	9.7	--[a]	0.5	**10.2**
51-1	1.0	0.04	8.4	**9.4**	0.9	0.03	7.1	**8.0**
51-2	106.2	34.2	8.4	**148.8**	90.2	29.1	7.1	**126.4**

[a]Emissions are for a composite plant reflecting 60 percent controlled transfer racks (with 95 percent system control efficiency), and 35 percent of plants currently having a Federal leak detection and repair program for equipment leaks.

TABLE 6-2. NATIONWIDE O.L.D. BASELINE HAP EMISSIONS

SIC Code	Nationwide Baseline HAP Emissions (tons/yr)				
	Storage Tanks	Transfer Racks	Container Filling[a]	Equipment Leaks	**Totals**
28	38,914	4,730	48	3,002	**46,694**
29	4,365	1,346	1	300	**6,012**
42	17,959	1,434	1	1,210	**20,604**
46	440	--[b]	--[b]	18	**458**
51	1,556	146	1	305	**2,008**
Totals	**63,233**	**7,656**	**51**	**4,836**	**75,776**

[a]Container filling is not included in the proposed OLD NESHAP; therefore, no further impacts analysis was performed for this emission source.
[b]There are no transfer rack or container filling emissions at facilities with SIC code 46.

Emission Reductions

Storage tanks. Emission reductions from OLD storage tanks will result from increasing the control level on tanks that currently have less emission control than the MACT floor level. From the OLD data base, about 33 percent of fixed-roof tanks (FXRT) are 10,000 gallons or larger *and* fall within the tank size/vapor pressure combinations anticipated to be covered by the standards. The data base also shows that approximately 22 percent of FXRT are controlled by a control device (thermal oxidizer, flare, carbon adsorber, etc.) with an estimated overall system control efficiency of 95 percent. Based on these data and the model plant populations, the calculated FXRT totals (using rounded values) are:

Total number of OLD FXRT:	5,383 (A)
Number of FXRT meeting the rule cutoffs:	1,776 (B = 0.33A)
Number of FXRT at the MACT level:	390 (C = 0.22B)
Number of FXRT needing further control:	1,386 (D = B-C)

The most economical control for FXRT consists of installing an internal floating roof containing a vapor-mounted primary seal and a rim-mounted secondary seal. This roof deck and rim seal system has an incremental control efficiency of 96.9 percent relative to an uncontrolled FXRT. Relative efficiencies of the different types of storage tanks and their commonly used floating deck seal combinations are presented in Table 6-3.

TABLE 6-3. STORAGE TANK RIM SEAL RELATIVE CONTROL EFFICIENCIES[a]

Tank #	Tank Type	Primary Seal	Secondary Seal	Survey Code	TOC Emissions (lb/yr)	Relative Control Efficiency
1	FXRT	None	None	FXRT	23,234.5	None
2	IFRT	Vapor-Mounted	Rim-Mounted	VM3	729.6	96.9
3	IFRT	Vapor-Mounted	None	VM1	1,101.2	95.3
4	IFRT	Liquid-Mounted	None	LM1	680.0	97.1
5	IFRT	Liquid-Mounted	Rim-Mounted	LM3	572.7	97.5
6	IFRT	Mechanical Shoe	Shoe-Mounted	(NC)	680.0	97.1
7	IFRT	Mechanical Shoe	Rim-Mounted	MS3	597.4	97.4
8	IFRT	Mechanical Shoe	None	MS1	1,026.9	95.6
9	EFRT	Vapor-Mounted	None	VM1	11,300.9	51.4
10	EFRT	Vapor-Mounted	Rim-Mounted	VM3	4,789.7	79.4
11	EFRT	Vapor-Mounted	Weather Shield	VM2	7,101.2	69.4
12	EFRT	Mechanical Shoe	None	MS1	5,241.8	77.4
13	EFRT	Mechanical Shoe	Shoe-Mounted	(NC)	3,706.7	84.0
14	EFRT	Mechanical Shoe	Weather Shield	MS2	4,230.4	81.8
15	EFRT	Mechanical Shoe	Rim-Mounted	MS3	3,219.0	86.1
16	EFRT	Liquid-Mounted	None	LM1	3,581.6	84.6
17	EFRT	Liquid-Mounted	Rim-Mounted	LM3	3,026.3	87.0
18	EFRT	Liquid-Mounted	Weather Shield	LM2	3,259.0	86.0

[a]The reference tank is a fixed-roof tank with no controls. All tank calculations are based on:

1. Benzene as liquid stored in tanks
2. Tanks having a 705,096 gallon volume
3. 10 turnovers/year per tank.

(NC) = no code was provided in the EPA's 1998 OLD survey for this floating deck rim seal combination.

The baseline roof equipment for internal floating roof tanks (IFRT) consists of a floating deck with a vapor-mounted primary seal and no secondary seal. From the model plant population and the distribution of IFRT seal types in the data base, the calculated IFRT totals (using rounded values) are:

Total number of OLD IFRT:	1,814 (A)
Number of IFRT meeting the rule cutoffs:	1,361 (B = 0.75A)
Number of IFRT at the MACT level:	1,157 (C = 0.85B)
Number of IFRT needing further control:	204 (D = B-C)

Control of IFRT to the MACT level consists of adding a rim-mounted secondary seal to the existing vapor-mounted primary seal. This modification provides an incremental control efficiency increase of 33.8 percent.

From a review of the data base, the baseline roof configuration for external floating roof tanks (EFRT) is the same as for IFRT, a vapor-mounted primary seal only. The number of EFRT needing control is determined from the model plant tank population and the reported deck seal types (using rounded values) as follows:

Total number of OLD EFRT:	528 (A)
Number of EFRT meeting the rule cutoffs:	502 (B = 0.95A)
Number of EFRT at the MACT level:	352 (C = 0.70B)
Number of EFRT needing further control:	150 (D = B-C)

Control for EFRT to the MACT level consists of replacing the vapor-mounted primary seal with a liquid-mounted seal and adding a rim-mounted secondary seal to the floating deck. The incremental control efficiency of these conversions is about 73.2 percent.

The storage tank baseline and emission reduction calculations for TOC and HAP are presented in Table 6-4. The total reductions estimated for all OLD tanks are 25,341 tons per year (tpy) of TOC and 14,756 tpy of HAP (14,756/63,233 = 23 percent HAP reduction). It is estimated that, out of the total universe of about 7,725 OLD storage tanks, 1,740 tanks (22.5 percent) would require modifications to meet the requirements of the OLD NESHAP.

Transfer racks. The OLD data base indicates that control devices are being used for approximately 60 percent of the cargo tank (tank truck/railcar) rack loading positions at OLD operations (on the basis of throughput). Based on the types of devices found to be in use, the control efficiency for the devices overall is presumed to average at least 95 percent. Assuming that current efforts to minimize vapor leakage from cargo tanks and the vapor collection system are successful, the efficiency of the control system as a whole is also estimated to be 95 percent. As was shown in Table 6-2, the total baseline HAP emissions from OLD transfer racks are estimated to be 7,656 tons per year.

TABLE 6-4. STORAGE TANK BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 1 OF 2): CALCULATION OF BASELINE[a]

Model Plant	Tank Type	TOC Emissions per Tank (lb/yr)	Number of Tanks at each Model Plant	TOC Emissions from all Tanks (lb/yr)	Total Number of Facilities	Nationwide Baseline TOC Emissions (tons/yr)	Overall Liquid HAP %	Nationwide Baseline HAP Emissions (tons/yr)
28-1	FXRT	31,263	4	125,052	195	12,193	0.64	7,803
28-2	FXRT	31,263	10	312,630	105	16,413	0.64	10,504
	IFRT	2,215	2	4,430		233	0.64	149
28-3	FXRT	31,263	29	906,627	70	31,732	0.64	20,308
	IFRT	2,215	3	6,645		233	0.64	149
Totals					**370**	**60,803**		**38,914**
29-1	FXRT	23,653	2	47,306	54	1,277	0.32	409
	IFRT	7,052	1	7,052		190	0.32	61
29-2	FXRT	23,653	2	47,306	30	710	0.32	227
	IFRT	7,052	1	7,052		106	0.32	34
	EFRT	85,072	4	340,288		5,104	0.32	1,633
29-3	FXRT	23,653	4	94,612	27	1,277	0.32	409
	IFRT	7,052	4	28,208		381	0.32	122
	EFRT	85,072	4	340,288		4,594	0.32	1,470
Totals					**111**	**13,639**		**4,365**
42-1	FXRT	20,319	3	60,957	25	762	0.74	564
	IFRT	4,967	3	14,901		186	0.74	138
	EFRT	169,790	1	169,790		2,122	0.74	1,571
42-2	FXRT	20,319	6	121,914	31	1,890	0.74	1,398
	IFRT	4,967	8	39,736		616	0.74	456
	EFRT	169,790	1	169,790		2,632	0.74	1,947

TABLE 6-4. STORAGE TANK BASELINE CALCULATION[a] (Continued)

Model Plant	Tank Type	TOC Emissions per Tank (lb/yr)	Number of Tanks at each Model Plant	TOC Emissions from all Tanks (lb/yr)	Total Number of Facilities	Nationwide Baseline TOC Emissions (tons/yr)	Overall Liquid HAP %	Baseline HAP Emissions (tons/yr)
42-3	FXRT	20,319	20	406,380	38	7,721	0.74	5,714
	IFRT	4,967	20	99,340		1,887	0.74	1,397
	EFRT	169,790	2	339,580		6,452	0.74	4,774
Totals					**94**	**24,269**		**17,959**
46-1	FXRT	90,593	5	452,965	26	5,889	0.06	353
46-2	EFRT	24,774	13	322,062	9	1,449	0.06	87
Totals					**35**	**7,338**		**440**
51-1	FXRT	522	4	2,088	24	25	0.85	21
51-2	IFRT	4,588	7	32,116	17	273	0.85	232
	EFRT	60,082	3	180,246		1,532	0.85	1,302
Totals					**41**	**1,830**		**1,556**
Grand Totals					**651**	**107,879**		**63,233**

TABLE 6-4. STORAGE TANK BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 2 OF 2): CALCULATION OF EMISSION REDUCTIONS[a]

Model Plant	Tank Type	TOC Emissions per Tank after Conversion (lb/yr)	TOC Emission Reduction per Converted Tank (lb/yr)	HAP Emission Reduction per Converted Tank (lb/yr)	Total Number of Tanks	Number of Tanks Meeting Cutoffs[b]	Number of these Tanks Controlled to MACT Floor	Number of Tanks Requiring Conversion	Total TOC Emission Reduction (tons/yr)	Total HAP Emission Reduction (tons/yr)
28-1	FXRT	1,992	29,271	18,733	780	257	56	201	2,948	1,886
28-2	FXRT	1,992	29,271	18,733	1,050	347	77	270	3,944	2,524
	IFRT	1,499	716	458	210	158	134	24	8	5
28-3	FXRT	1,992	29,271	18,733	2,030	670	147	523	7,653	4,898
	IFRT	1,499	716	458	210	158	134	24	8	5
Totals					**4,280**	**1,589**	**548**	**1,041**	**14,562**	**9,319**
29-1	FXRT	928	22,725	7,272	108	36	8	28	314	100
	IFRT	5,353	1,699	544	54	41	34	6	5	2
29-2	FXRT	928	22,725	7,272	60	20	5	15	168	54
	IFRT	5,353	1,699	544	30	23	19	3	3	1
	EFRT	11,576	73,496	23,519	120	114	80	34	1,257	402

TABLE 6-4. STORAGE TANK EMISSION REDUCTIONS[a] (Continued)

Model Plant	Tank Type	TOC Emissions per Tank after Conversion (lb/yr)	TOC Emission Reduction per Converted Tank (lb/yr)	HAP Emission Reduction per Converted Tank (lb/yr)	Total Number of Tanks	Number of Tanks Meeting Cutoffs[b]	Number of these Tanks Controlled to MACT Floor	Number of Tanks Requiring Conversion	Total TOC Emission Reduction (tons/yr)	Total HAP Emission Reduction (tons/yr)
29-3	FXRT	928	22,725	7,272	108	36	8	28	314	100
	IFRT	5,353	1,699	544	108	81	69	12	10	3
	EFRT	11,576	73,496	23,519	108	103	72	31	1,131	362
Totals					**696**	**452**	**295**	**157**	**3,203**	**1,025**
42-1	FXRT	1,952	18,367	13,592	75	25	6	19	172	127
	IFRT	3,342	1,625	1,203	75	56	48	8	7	5
	EFRT	18,360	151,430	112,058	25	24	17	7	539	399
42-2	FXRT	1,952	18,367	13,592	186	61	13	48	444	329
	IFRT	3,342	1,625	1,203	248	186	158	28	23	17
	EFRT	18,360	151,430	112,058	31	29	21	9	669	495
42-3	FXRT	1,952	18,367	13,592	760	251	55	196	1,798	1,331
	IFRT	3,342	1,625	1,203	760	570	485	86	69	51
	EFRT	18,360	151,430	112,058	76	72	51	22	1,640	1,214
Totals					**2,236**	**1,275**	**852**	**422**	**5,362**	**3,968**

TABLE 6-4. STORAGE TANK EMISSION REDUCTIONS[a] (Concluded)

Model Plant	Tank Type	TOC Emissions per Tank after Conversion (lb/yr)	TOC Emission Reduction per Converted Tank (lb/yr)	HAP Emission Reduction per Converted Tank (lb/yr)	Total Number of Tanks	Number of Tanks Meeting Cutoffs[b]	Number of these Tanks Controlled to MACT Floor	Number of Tanks Requiring Conversion	Total TOC Emission Reduction (tons/yr)	Total HAP Emission Reduction (tons/yr)
46-1	FXRT	1,614	88,979	5,339	130	43	10	33	1,464	88
46-2	EFRT	3,332	21,442	1,287	117	111	78	33	357	21
Totals					**247**	**154**	**88**	**66**	**1,821**	**109**
51-1	FXRT	16	506	430	96	32	7	25	6	5
51-2	IFRT	3,100	1,488	1,265	119	89	76	13	10	8
	EFRT	8,109	51,973	44,177	51	48	34	15	378	321
Totals					**266**	**169**	**117**	**53**	**394**	**335**
Grand Totals					**7,725**	**3,638**	**1,900**	**1,739**	**25,341**	**14,756**

[a]Values are taken from spreadsheets and, due to automatic rounding in some calculations, may not sum exactly to the totals shown.

[b]Based on survey data, the number of tanks satisfying the affected tank criteria in the proposed rule related to tank capacity and vapor pressure of the stored organic liquid.

Emission reductions will result from the installation of a control device on transfer racks that are currently uncontrolled. This conversion is expected to result in an estimated overall efficiency for the control system at all affected transfer racks of 95 percent.

Table 6-5 summarizes the baseline emissions and MACT emission reductions estimated for OLD transfer racks. Reductions of total organic compounds are 12,667 tpy and HAP reductions are 7,046 tpy, which is about a 92 percent reduction in transfer rack emissions resulting from the standards. Attachment 1 to this memo is a spreadsheet showing the assumptions made in deriving these estimates.

Container filling. As presented and discussed in this memo and in the Baseline Emissions memo, baseline HAP emissions from the filling of containers at OLD operations are estimated to be about 51 tpy. Based on the OLD survey results, it is assumed that essentially all of these emissions come from filling containers with volumes of 55 gallons and greater. Container filling is not included as a regulated activity in the OLD rule proposal; therefore, it is not further addressed in this memo.

Equipment leaks. Baseline emissions and emission reductions for equipment components were calculated for pumps, connectors (flanges and other), valves, and sampling connections. Table 6-6 presents the results of these calculations. Emission factors were a composite of controlled (Federal LDAR program in effect) and uncontrolled (no LDAR program) SOCMI factors, determined using the prevalence of LDAR programs for OLD operations as shown in the data base. Equipment counts for each model plant were the best averages calculated from the wide ranges reported by OLD facilities. Baseline HAP emissions from OLD equipment were calculated to be 4,836 tons per year, while HAP reductions are estimated at 2,326 tpy (48 percent reduction).

Overall reductions. Table 6-7 presents the total HAP baseline emissions and emission reductions by emission source. The total HAP baseline is estimated at 75,725 tpy, while the total HAP emission reduction expected under this NESHAP is 24,128 tpy of HAP (31.9 percent reduction). The reduction of total organic compound emissions from OLD sources is projected to be 41,819 tpy due to implementation of the NESHAP.

Other Environmental Impacts

Controlling OLD-type air emission sources may result in collateral environmental impacts to other media, such as water or land. Noise pollution is also a potential issue. For example, scrubber effluent may affect water quality, and contaminated carbon from carbon absorbers may create solid waste that needs to be disposed of in a hazardous waste landfill. Flares and other control devices that are situated near residential areas may create a noise pollution issue for the public. Generally, these types of environmental concerns become important when sensitive site-specific receptors exist or when the incremental emission reduction potential of one control option is only marginally greater than the next most effective option. Of particular concern are potential pollutant releases to land and water which result from the controlling of air emissions from OLD emission sources.

TABLE 6-5. TRANSFER RACK BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 1 OF 2): CALCULATION OF BASELINE[a]

Model Plant	Liquid Throughput per Model Plant (gal/yr)	Liquid Molecular Weight (lb/lb-mole)	True Vapor Pressure (psia)	Liquid Temperature deg F (deg C)	Uncontrolled Rack Saturation Factor	TOC Emissions per Uncontrolled Facility (tons/yr)	Number of Plants Without a Control System	Nationwide Uncontrolled TOC Emissions (tons/yr)
28-1	6,240,000	78.1	3.06	60 (15.6)	1.45	25.9	26	673.6
28-2	16,421,700					68.2	26	1,772.6
28-3	34,311,800					142.5	34	4,843.4
Totals							**86**	**7,289.6**
29-1	6,029,600	78.1	3.18	60 (15.6)	1.45	26.0	7	182.1
29-2	66,378,800					286.4	6	1,718.3
29-3	85,763,800					370.0	6	2,220.2
Totals							**19**	**4,120.6**
42-1	20,918,500	78.1	2.84	60 (15.6)	1.45	80.6	3	241.8
42-2	28,150,000					108.5	5	542.3
42-3	54,844,300					211.3	5	1,056.6
Totals							**13**	**1,840.8**
51-1	23,500	78.1	2.36	60 (15.6)	1.45	0.1	3	0.2
51-2	25,907,000					83.0	2	165.9
Totals							5	166.1
Grand Totals							**123**	**13,417**

TABLE 6-5. TRANSFER RACK BASELINE EMISSIONS[a] (Continued)

Model Plant	Controlled Rack Saturation Factor	System Control Efficiency	TOC Emissions per Controlled Facility (tons/year)	Number of Plants With a Control System	Nationwide Controlled TOC Emissions (tons/year)	Nationwide Baseline TOC Emissions (tons/year)	Overall Liquid HAP Percentage (%)	Nationwide Baseline HAP Emissions (tons/year)
28-1	0.60	0.95	0.5	17	9.1	682.7	64	436.9
28-2			1.4	17	24.0	1,796.6		1,149.8
28-3			2.9	23	67.8	4,911.2		3,143.1
Totals				**57**	**100.9**	**7,390.4**		**4,729.9**
29-1	0.60	0.95	0.5	8	4.3	186.4	32	59.7
29-2			5.9	6	35.6	1,753.9		561.2
29-3			7.7	6	45.9	2,266.1		725.2
Totals				**20**	**85.8**	**4,206.4**		**1,346.1**
42-1	0.60	0.95	1.7	8	13.3	255.2	74	188.8
42-2			2.2	12	26.9	569.3		421.3
42-3			4.4	13	56.8	1,113.5		824.0
Totals				**33**	**97.1**	**1,937.9**		**1,434.0**
51-1	0.60	0.95	0.0	4	0.0	0.2	85	0.2
51-2			1.7	3	5.1	171.1		145.4
Totals				**7**	**5.2**	**171.3**		**145.6**
Grand Totals				**117**	**288.9**	**13,706.0**		**7,655.6**

TABLE 6-5. TRANSFER RACK BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 2 OF 2): CALCULATION OF EMISSION REDUCTIONS[a]

Model Plant	Number of Facilities Installing a Rack Control System	TOC Emissions Reduction per Model Plant (tons/year)[b]	Nationwide TOC Emissions Reduction (tons/year)[b]	Nationwide HAP Emissions Reduction (tons/year)[b]
28-1	26	24.6	639.9	409.5
28-2	26	64.8	1,684.0	1,077.8
28-3	34	135.3	4,601.2	2,944.8
Totals	**86**		**6,925**	**4,432**
29-1	7	24.7	173.0	55.4
29-2	6	272.1	1,632.4	522.4
29-3	6	351.5	2,109.2	674.9
Totals	**19**		**3,915**	**1,253**
42-1	3	76.6	229.7	170.0
42-2	5	103.0	515.2	381.3
42-3	5	200.8	1,003.8	742.8
Totals	**13**		**1,748.7**	**1,294**
51-1	1	0.1	0.1	0.1
51-2	1	78.8	78.8	67.0
Totals	**2**		**79**	**67**
Grand Totals	**120**		**12,667**	**7,046**

[a]Values are taken from spreadsheets and, due to automatic rounding in some calculations, may not sum exactly to the totals shown.

[b]Reductions occur at the currently uncontrolled facilities that install a control device on their transfer racks in response to the OLD NESHAP.

TABLE 6-6. EQUIPMENT LEAKS BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 1 OF 2): BACKGROUND INFORMATION[a]

Model Plant	Component Type	Number of Components	Time in which Emissions Occur (hr/yr per component)	Total Number of Facilities	Number of Facilities with No LDAR Program	Number of Facilities with an LDAR Program
28-1	Pumps	10	4,380	195	128	67
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 28-1		**715**				
28-2	Pumps	10	4,380	105	69	36
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 28-2		**715**				
28-3	Pumps	50	4,380	70	47	23
	Connectors	2,000				
	Valves	500				
	Sampling Connections	15				
Total for 28-3		**2,565**				

TABLE 6-6. EQUIPMENT LEAKS BACKGROUND INFORMATION[a] (Continued)

Model Plant	Component Type	Number of Components	Time in which Emissions Occur (hr/yr per component)	Total Number of Facilities	Number of Facilities with No LDAR Program	Number of Facilities with an LDAR Program
29-1	Pumps	10	4,380	54	35	19
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 29-1		**715**				
29-2	Pumps	10	4,380	30	20	10
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 29-2		**715**				
29-3	Pumps	10	4,380	27	18	9
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 29-3		**715**				

TABLE 6-6. EQUIPMENT LEAKS BACKGROUND INFORMATION[a] (Continued)

Model Plant	Component Type	Number of Components	Time in which Emissions Occur (hr/yr per component)	Total Number of Facilities	Number of Facilities with No LDAR Program	Number of Facilities with an LDAR Program
42-1	Pumps	10	4,380	25	16	9
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 42-1		**845**				
42-2	Pumps	10	4,380	31	21	10
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 42-2		**715**				
42-3	Pumps	50	4,380	38	25	13
	Connectors	2,000				
	Valves	500				
	Sampling Connections	15				
Total for 42-3		**2,565**				

TABLE 6-6. EQUIPMENT LEAKS BACKGROUND INFORMATION[a] (Continued)

Model Plant	Component Type	Number of Components	Time in which Emissions Occur (hr/yr per component)	Total Number of Facilities	Number of Facilities with No LDAR Program	Number of Facilities with an LDAR Program
46-1	Pumps	10	4,380	26	17	9
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 46-1		**715**	4,380	9	6	3
46-2	Pumps	10				
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 46-2		**715**				
51-1	Pumps	10	4,380	24	17	7
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 51-1		**715**				

TABLE 6-6. EQUIPMENT LEAKS BACKGROUND INFORMATION[a] (Continued)

Model Plant	Component Type	Number of Components	Time in which Emissions Occur (hr/yr per component)	Total Number of Facilities	Number of Facilities with No LDAR Program	Number of Facilities with an LDAR Program
51-2	Pumps	10	4,380	17	12	5
	Connectors	500				
	Valves	200				
	Sampling Connections	5				
Total for 51-2		**715**				
Grand Totals				**651**	**431**	**220**

TABLE 6-6. EQUIPMENT LEAK BASELINE EMISSIONS AND EMISSION REDUCTIONS (PART 2 OF 2): BASELINE AND REDUCTION CALCULATIONS[a]

Model Plant	Nationwide Controlled TOC Emissions (tpy)[b]	Nationwide Uncontrolled TOC Emissions (tpy)[c]	Nationwide Baseline TOC Emissions (tpy)[d]	Overall Liquid HAP Percentage	Nationwide Baseline HAP Emissions (tpy)[d]	Nationwide TOC Emission Reduction (tpy)[e]	Nationwide HAP Emission Reduction (tpy)
28-1	291	1,354	1,644	64	1,052	799	511
28-2	156	730	886	64	567	431	276
28-3	373	1,788	2,161	64	1,383	1,025	656
Totals	**820**	**3,872**	**4,691**		**3,002**	**2,255**	**1,443**
29-1	82	370	453	32	145	218	70
29-2	43	212	255	32	82	125	40
29-3	39	190	229	32	73	112	36
Totals	**164**	**772**	**937**		**299**	**455**	**146**
42-1	39	169	208	74	154	100	74
42-2	43	222	265	74	196	131	97
42-3	211	951	1,162	74	860	545	403
Totals	**293**	**1,342**	**1,635**		**1,206**	**776**	**574**
46-1	39	180	219	6	13	106	6
46-2	13	63	76	6	5	37	2
Totals	**52**	**243**	**295**		**18**	**143**	**8**

TABLE 6-6. EQUIPMENT LEAK BASELINE AND REDUCTION CALCULATIONS[a] (Concluded)

Model Plant	Nationwide Controlled TOC Emissions (tpy)[b]	Nationwide Uncontrolled TOC Emissions (tpy)[c]	Nationwide Baseline TOC Emissions (tpy)[d]	Overall Liquid HAP Percentage	Nationwide Baseline HAP Emissions (tpy)[d]	Nationwide TOC Emission Reduction (tpy)[e]	Nationwide HAP Emission Reduction (tpy)
51-1	30	180	210	85	179	106	90
51-2	22	127	149	85	126	75	64
Totals	**52**	**307**	**359**		**305**	**181**	**154**
Grand Totals	**1,382**	**6,536**	**7,918**	**Avg. ▪ 60**	**4,836**	**3,811**	**2,326**

[a]Values are taken from spreadsheets and, due to automatic rounding in some calculations, may not sum exactly to the totals shown. The emission factors used in the baseline calculations are shown in Table 3-10 of Memo No. 3.

[b]Total organic compound emissions from OLD operations that have a formal, instrument-based LDAR program.

[c]Total organic compound emissions from OLD operations without a formal, instrument-based LDAR program.

[d]Sum of controlled and uncontrolled equipment leak emissions.

[e]Difference between currently uncontrolled equipment emissions and the emissions at plants with a newly imposed LDAR program.

TABLE 6-7. SUMMARY OF HAP EMISSION REDUCTIONS BY EMISSION SOURCE

Emission Source	HAP Emissions (tpy)[a]			Percent Reduction
	Baseline	After Rule	Reduction	
Storage Tanks	63,233	48,477	14,756	23.4
Transfer Racks	7,656	610	7,046	92.0
Equipment	4,836	2,510	2,326	48.0
Totals	**75,725**	**51,597**	**24,128**	**31.9**

[a]Container filling is not included as a component of the baseline or the emission reductions because it is not being proposed for regulation by this NESHAP.

Impacts on Water

Organic liquid distribution operations may generate solid waste, semi-aqueous waste, and wastewater. Wastewater may be generated from OLD-type operations due to tank and line cleanings, spills, scrubber effluents, liquid blending and packaging activities, stormwater drainage, deballasting tank ships, and other sources. In most cases, all wastewater is treated before it is discharged into the surface waters (rivers, bays, estuaries, etc.). In some cases, wastewater treatment is performed either on the OLD site or, as is usually the case with stand-alone terminals, the water can be collected and disposed of by a contracting firm. Wastewater may also enter groundwater via surface waste contamination, but a detailed analysis of this is beyond the scope of this memo.

The EPA's 1998 industry survey requested information pertaining to wastewater generation sources and rates from OLD-type operations. Only very limited information was received in the survey responses. The survey had as its threshold a wastewater generation rate of 500,000 gallons per year, and only a few facilities reported OLD wastewater generation rates in excess of this limit. Information from the survey and from site visits to OLD operations indicates that wastewater generation rates from OLD operations are minimal, and have no significant impact on the environment. Furthermore, existing State and Federal rules (ex., NPDES permits) should sufficiently cover wastewater treatment and disposal. We also believe that air emissions resulting from wastewater generated by OLD operations are minimal due to low HAP concentrations and low water flow rates. The implementation of this rule should not increase wastewater generation rates, and it is anticipated that it will not have an impact on any sources of groundwater.

Impacts on Land

OLD-type operations may create some solid wastes which would have to be landfilled or otherwise disposed of to prevent impacts to the environment. Solid waste generated by OLD operations may include contaminated soil from spills, oily rags, solids from tank bottom cleanings, or oil/water separator cleanings. These wastes are usually stored in closed containers, and then shipped off site for treatment and disposal according to applicable solid and hazardous waste rules. It is anticipated that the implementation of this rule may lead to a temporary increase in solid waste generation as tank roof seals are replaced and fixed-roof tanks are equipped with floating roofs.

The OLD industry survey requested information on semi-aqueous waste generation rates and sources. Not enough information was received to warrant the regulation of semi-aqueous waste(s). As solid wastes are already regulated by existing State and Federal regulations, and these most likely encompass semi-aqueous waste, it is believed that these waste types will not have an impact on the environment due to OLD operations. Furthermore, we do not believe that the implementation of this NESHAP will have a long-term impact on the generation of solid or semi-aqueous waste.

Noise Impacts

It is not anticipated that the implementation of this NESHAP will significantly increase noise pollution. Most OLD-type facilities are located in industrial areas that already experience significant amounts of noise from other sources. Temporary noise pollution may be generated during the conversion of tanks and during other construction projects related to the implementation of this rule. More permanent impacts on noise pollution may result from the operation of control devices such as flares or scrubbers. Noise coming from flares has been tested, and has been found to be moderate (less than 70 decibels at 7 meters).

Air Impacts

The standards associated with this NESHAP are aimed at regulating hazardous air pollutants. In regulating HAP, total organic compounds (which consist primarily of volatile organic compounds, or VOC, under the EPA's VOC definition) will also be controlled, thereby resulting in a reduction of emissions of these compounds to the environment. Flares and/or thermal oxidizers (or most of other control devices) will also produce air pollutant emissions (such as carbon monoxide and nitrogen oxides), but we believe that the benefits of controlling the HAP from the emission sources offsets any pollution generated from properly functioning control devices. A further discussion regarding the impacts of VOC on health and safety is presented in the health and safety impacts section below.

Energy Impacts

The implementation of the proposed NESHAP may result in a minor increase in energy consumption for affected facilities. Energy consumption may increase due to the increased need for pumps, blowers, and automatic valves and dampers. Energy in the form of electricity and supplemental fuels may display this slight increase. Some of the vapors that result from organic liquid storage, transfer, and distribution may also serve as fuel for combustion devices, which may partially offset increases in energy consumption. It is anticipated that the energy requirements for the control devices mandated by this NESHAP will comprise only a very small fraction of the energy required to operate an OLD-type facility. It is therefore anticipated that there will be no significant increases in energy consumption attributable to this NESHAP.

Health and Safety Impacts

Hazardous air pollutants have been found to contribute to a variety of illnesses. The range of potential effects on human health associated with exposure to organic HAP include: cancer, aplastic anemia, pulmonary structural changes, dyspnea, upper respiratory tract irritation with cough, conjunctivitis, and various neurotoxic effects. We have calculated that the implementation of this MACT standard will result in a decrease of 24,128 tpy of HAP emissions to the atmosphere; therefore, it has the potential for providing both cancer and noncancer health benefits.

Reductions in VOC (calculated to be 41,819 tpy), which will occur as a consequence of controlling HAP, will also result in improved public health. Many VOC react photochemically with nitrogen oxides to form tropospheric ozone. It has been shown that exposure to ozone can result in various adverse health impacts such as alterations in lung capacity; eye, nose and throat irritation; and aggravation of existing respiratory disease. Some animal studies have shown increased susceptibility to respiratory infection and lung structure damage.

Natural Resources Impacts

By reducing HAP and VOC emissions, damage to natural vegetative and animal communities and ecosystems should be reduced. Studies have found that tropospheric ozone may lead to damage to commercial timber species and economic losses for commercially available crops such as soybeans and cotton. Studies have also shown that exposure to ozone can disrupt carbohydrate production in plants. The reduction in carbohydrate production and allocation can lead to reduced root growth, reduced biomass or yield, reduced plant vigor, and diminished ability to successfully compete with more tolerant species. As animals depend on vegetation for sustenance, impacts to vegetation will invariably impact animal welfare. This should be especially evident with herbivorous animals which depend upon vegetation as their primary source of nutrition.

COST IMPACTS

The EPA's 1996 OAQPS Control Cost Manual (3) was consulted in order to determine costs associated with implementing the standards of the OLD NESHAP. Other documents used in the analysis are cited in individual sections for each emission source. Cost estimates were developed for storage tanks, transfer racks, equipment leak detection and repair programs, and the proposed recordkeeping and reporting requirements.

Storage Tanks

Three current configurations of storage tanks would be affected by the OLD NESHAP: fixed-roof, internal floating roof, and external floating roof tanks. The proposed rule allows fixed-roof tanks to be converted to an internal floating roof tank, or their vapors may be routed to a control device such as a flare or a carbon adsorber. Existing internal or external floating roof tanks may require an upgrade to their primary deck seal, installation of a secondary seal on the floating deck, and/or installation of controls (such as gaskets or flexible fabric seals) on roof deck fittings.

Costs associated with retrofitting fixed-roof tanks, and of installing and upgrading seals on internal and external floating roof tanks, were calculated using figures taken from various sources. These included the 1993 Storage Tank CTG (4), the 1994 Gasoline Distribution MACT proposal BID (5), and guidance issued by the Office of Management and Budget (OMB). (6) The primary references were the OLD data base and the Storage Tank CTG.

Unit costs of the needed storage tank conversions are presented in Tables 6-8 through 6-10. Tables 6-11 through 6-13 present per-facility storage tank conversion costs, while Tables 6-14 and 6-15 present total capital and annual costs, respectively, for all of the tanks requiring conversions.

Transfer Racks

Number of Facilities Incurring Control Costs

Liquid transfer racks are used at many of the facilities that will be impacted by the OLD NESHAP, because many have the capability to load liquids into tank trucks or railcars. The data base indicated that approximately 80 of the surveyed facilities contained potentially affected transfer operations. An estimate was then made (see Table 2-13 in Memo No. 3 in the TSD) that there are about 240 OLD facilities nationwide with similar transfer racks. By examining the data base, an estimate was made of the approximate percentage of facilities in each SIC code that currently are using a control system on part or all of their transfer operations (assumed to achieve 95 percent control efficiency). The percentages of already controlled racks are: SIC 28 - 40%, SIC 29 - 50%, SIC 42 - 70%, and SIC 51 - 50%. These percentages were applied to the nationwide facility populations to calculate the number of facilities already controlled, as well as the number that therefore is likely to require control in response to a MACT requirement. Due to the existing control systems at refineries (SIC 29), we assumed that these facilities would have existing control capacity available for their transfer racks. Therefore, they would not incur any additional control costs in controlling transfer rack operations. Table 6-16 shows the estimates for transfer rack control, as well as the relative size of control system (selected for this analysis as a flare) that would be necessary.

TABLE 6-8. COSTS OF INSTALLING AN IFR IN AN EXISTING FIXED-ROOF TANK (1997 DOLLARS)[a]

Cost Element	Industry Segment (SIC Code)				
	28	29	42	46	51
Capital Costs - Tank Prep./Installation					
Cleaning, degassing, & waste disposal	11,770	11,770	14,980	18,190	2,140
Installed internal floating roof[b]	38,078	34,495	59,735	101,660	26,209
Controlled deck fittings	215	215	215	215	215
Total capital cost	50,063	46,480	74,930	120,065	28,564
Annualized Costs ($/yr)					
Maintenance (5%)	2,503	2,324	3,747	6,003	1,428
Taxes, insurance, G & A (4%)[c]	1,532	1,388	2,398	4,075	1,057
Inspections (1%)	501	465	749	1,201	286
Annual capital charges (CRF = 0.1424, based on 10 yrs. @ 7%)	7,129	6,619	10,670	17,097	4,068
Total annualized cost ($/yr)	11,665	10,796	17,564	28,376	6,839
Product recovery credit[d]	13,287	3,094	6,150	2,853	172
Net annualized cost ($/yr)	(1,622)[e]	7,702	11,414	25,523	6,667

[a]Assumptions based on analyses in the Storage Tank CTG, the Gasoline Distribution MACT proposal BID, and 1992 OMB guidance.

[b]Assumes installation of an IFR with a vapor-mounted primary seal and rim-mounted secondary seal.

[c]Not applicable to degassing, cleaning, and waste disposal costs.

[d]Based on the difference between baseline emissions and controlled emissions for model FXRT's. Organic chemicals are $1,370/ton, petroleum products are $320/ton, and crude oil is $65/ton.

0 [e]Parentheses indicate a net cost savings.

TABLE 6-9. COSTS OF INSTALLING A RIM-MOUNTED SECONDARY SEAL ON AN EXISTING INTERNAL FLOATING ROOF TANK (1997 DOLLARS)[a]

Cost Element	Industry Segment (SIC Code)				
	28	29	42	46[b]	51
Capital Costs - Controls Installation					
Installed internal floating roof[c]	3,672	11,490	8,429	0	9,514
Controlled deck fittings	642	642	642	0	642
Total capital cost	4,314	12,132	9,071	0	10,156
Annualized Costs ($/yr)					
Maintenance (5%)	216	607	454	0	508
Taxes, insurance, G & A (4%)	173	485	363	0	406
Inspections (1%)	43	121	91	0	102
Annual capital charges (CRF = 0.1424, based on 10 yrs. @ 7%)	614	1,728	1,292	0	1,446
Total annualized cost ($/yr)	1,046	2,941	2,200	0	2,462
Product recovery credit[d]	324	321	525	--	352
Net annualized cost ($/yr)	722	2,620	1,675	--	2,110

[a]Assumptions based on the same analyses referenced in Table 6-8, footnote a.

[b]No IFRT's are assumed to be in use at OLD facilities in SIC code 46.

[c]Assumes installation of a rim-mounted secondary seal in conjunction with an existing vapor-mounted primary seal.

[d]Assumptions are as shown in Table 6-8, footnote d.

TABLE 6-10. COSTS OF REPLACING DECK SEALS ON AN EXISTING EXTERNAL FLOATING ROOF TANK (1997 DOLLARS)[a]

Cost Element	Industry Segment (SIC Code)				
	28[b]	29	42	46	51
Capital Costs - Controls Installation					
Installed deck seals [c]	0	29,622	40,590	35,357	29,622
Controlled deck fittings	0	642	642	642	642
Total capital cost	0	30,264	41,232	35,999	30,264
Annualized Costs ($/yr)					
Maintenance (5%)	0	1,513	2,062	1,800	1,513
Taxes, insurance, G & A (4%)	0	1,211	1,649	1,440	1,211
Inspections (1%)	0	303	412	360	303
Annual capital charges (CRF = 0.1424, based on 10 yrs. @ 7%)	0	4,310	5,871	5,126	4,310
Total annualized cost ($/yr)	0	7,337	9,994	8,726	7,337
Product recovery credit [d]	--	1,353	5,275	94	2,535
Net annualized cost ($/yr)	--	5,984	4,719	8,632	4,802

[a]Assumptions based on the same analyses referenced in Table 6-8, footnote a.

[b]No EFRT's are assumed to be in use at OLD facilities in SIC code 28.

[c]Assumes replacement of a vapor-mounted primary seal with a liquid-mounted seal and installation of a rim-mounted secondary seal.

[d]Assumptions are as shown in Table 6-8, footnote d.

TABLE 6-11. PER-FACILITY AND INDUSTRY CAPITAL AND ANNUAL COSTS FOR STORAGE TANK CONVERSIONS: INSTALL FLOATING ROOF IN FIXED-ROOF TANK (FXRT)

Model Plant	Number of Facilities Making FXRT Conversions[a]	FXRT Conversions Needed per Facility	Capital Cost to Convert one FXRT (1997 $)[b]	Net Annualized Cost per FXRT Conversion ($/yr)[b]	Capital Cost per Facility (1997 $)	Annual Cost per Facility (1997 $)	Total Capital Cost ($/yr)	Total Net Annualized Cost ($/yr)
28-1	50	4	50,063	-1,622	200,252	-6,488	10,051,249	-325,652
28-2	27	10	50,063	-1,622	500,630	-16,220	13,530,527	-438,378
28-3	18	29	50,063	-1,622	1,451,827	-47,038	26,159,019	-847,531
29-1	14	2	46,480	7,702	92,960	15,404	1,292,107	214,109
29-2	8	2	46,480	7,702	92,960	15,404	717,837	118,950
29-3	7	4	46,480	7,702	185,920	30,808	1,292,107	214,109
42-1	6	3	74,930	11,414	224,790	34,242	1,446,524	220,347
42-2	8	6	74,930	11,414	449,580	68,484	3,587,379	546,461
42-3	10	20	74,930	11,414	1,498,600	228,280	14,658,106	2,232,852
46-1	7	5	120,065	25,523	600,325	127,615	4,017,615	854,051
46-2	0	0	0	0	0	0	0	0
51-1	6	4	28,564	6,667	114,256	26,668	705,828	164,744
51-2	0	0	0	0	0	0	0	0
Totals	**161**						**77,458,297**	**2,954,063**

[a]Total number of facilities x percentage of FXRT in reg. cutoffs (33%) x percentage of FXRT below proposed control level (78%). For MP 28-1, no. of facilities = 195 x 0.33 x 0.78 = 50.19 (value used in calculations). Whole number (50) is shown in the table.

[b]Unit costs are from Table 6-8.

TABLE 6-12. PER-FACILITY AND INDUSTRY CAPITAL AND ANNUAL COSTS FOR STORAGE TANK CONVERSIONS: INTERNAL FLOATING ROOF TANKS (IFRT)

Model Plant	Number of Facilities Making IFRT Conversions[a]	IFRT Conversions Needed per Facility	Capital Cost to Convert One IFRT (1997 $)[b]	Net Annualized Cost per IFRT Conversion ($/yr)[b]	Capital Cost per Facility (1997 $)	Annual Cost per Facility (1997 $)	Total Capital Cost ($/yr)	Total Net Annualized Cost ($/yr)
28-1	0	0	0	0	0	0	0	0
28-2	12	2	4,314	722	8,628	1,444	101,918	17,057
28-3	8	3	4,314	722	12,942	2,166	101,918	17,057
29-1	6	1	12,132	2,620	12,132	2,620	73,702	15,917
29-2	3	1	12,132	2,620	12,132	2,620	40,946	8,843
29-3	3	4	12,132	2,620	48,528	10,480	147,404	31,833
42-1	3	3	9,071	1,675	27,213	5,025	76,537	14,133
42-2	4	8	9,071	1,675	72,568	13,400	253,081	46,733
42-3	4	20	9,071	1,675	181,420	33,500	775,571	143,213
46-1	0	0	0	0	0	0	0	0
46-2	0	0	0	0	0	0	0	0
51-1	0	0	0	0	0	0	0	0
51-2	2	7	10,156	2,110	71,092	14,770	135,963	28,248
Totals	**45**						**1,707,039**	**323,032**

[a]Total number of facilities x percentage of IFRT in reg. cutoffs (75%) x percentage of IFRT below proposed control level (15%). For MP 28-2, no. of facilities = 105 x 0.75 x 0.15 = 11.81 (value used in calculations). Whole number (12) is shown in the table.

[b]Unit costs are from Table 6-9.

TABLE 6-13. PER-FACILITY AND INDUSTRY CAPITAL AND ANNUAL COSTS FOR STORAGE TANK CONVERSIONS: EXTERNAL FLOATING ROOF TANKS (EFRT)

Model Plant	Number of Facilities Making EFRT Conversions[a]	EFRT Conversions Needed per Facility	Capital Cost to Convert one EFRT (1997 $)[b]	Net Annualized Cost per EFRT Conversion ($/yr)[b]	Capital Cost per Facility (1997 $)	Annual Cost per Facility (1997 $)	Total Capital Cost (1997 $)	Total Net Annualized Cost ($/yr)
28-1	0	0	0	0	0	0	0	0
28-2	0	0	0	0	0	0	0	0
28-3	0	0	0	0	0	0	0	0
29-1	0	0	0	0	0	0	0	0
29-2	9	4	30,264	5,984	121,056	23,936	1,035,029	204,653
29-3	8	4	30,264	5,984	121,056	23,936	931,526	184,188
42-1	7	1	41,232	4,719	41,232	4,719	293,778	33,623
42-2	9	1	41,232	4,719	41,232	4,719	364,285	41,692
42-3	11	2	41,232	4,719	82,464	9,438	893,085	102,214
46-1	0	0	0	0	0	0	0	0
46-2	3	13	35,999	8,632	467,987	112,216	1,200,387	287,834
51-1	0	0	0	0	0	0	0	0
51-2	5	3	30,264	4,802	90,792	14,406	439,887	69,797
Totals	**50**						**5,157,976**	**924,000**

[a]Total number of facilities x percentage of EFRT in reg. cutoffs (95%) x percentage of EFRT below proposed control level (30%). For MP 29-2, no. of facilities = 30 x 0.95 x 0.30 = 8.55 (value used in calculations). Whole number (9) is shown in the table.

[b]Unit costs are from Table 6-10.

TABLE 6-14. CAPITAL COSTS TO CONTROL ALL FXRT, IFRT, AND EFRT NATIONWIDE (1997 $)[a]

Model Plant	Capital Costs for FXRT ($)	Capital Costs for IFRT ($)	Capital Costs for EFRT ($)	Total Capital Costs for All Tank Types ($)
28-1	10,051,249	0	0	10,051,249
28-2	13,530,527	101,918	0	13,632,445
28-3	26,159,019	101,918	0	26,260,937
Totals	**49,740,795**	**203,837**	**0**	**49,944,632**
29-1	1,292,107	73,702	0	1,365,809
29-2	717,837	40,946	1,035,029	1,793,812
29-3	1,292,107	147,404	931,526	2,371,037
Totals	**3,302,051**	**262,051**	**1,966,555**	**5,530,657**
42-1	1,446,524	76,537	293,778	1,816,839
42-2	3,587,379	253,081	364,285	4,204,745
42-3	14,658,106	775,571	893,085	16,326,762
Totals	**19,692,009**	**1,105,188**	**1,551,148**	**22,348,345**
46-1	4,017,615	0	0	4,017,615
46-2	0	0	1,200,387	1,200,387
Totals	**4,017,615**	**0**	**1,200,387**	**5,218,002**
51-1	705,828	0	0	705,828
51-2	0	135,963	439,887	575,850
Totals	**705,828**	**135,963**	**439,887**	**1,281,678**
Grand Totals	**77,458,297**	**1,707,039**	**5,157,976**	**84,323,313**

[a]Values are taken from spreadsheets and, due to automatic rounding in some calculations, may not sum exactly to the totals shown.

TABLE 6-15. NET ANNUALIZED CONTROL COSTS FOR ALL FXRT, IFRT, AND EFRT NATIONWIDE (1997 $/YR)[a]

Model Plant	Annual Costs for FXRT ($/yr)	Annual Costs for IFRT ($/yr)	Annual Costs for EFRT ($/yr)	Total Net Annualized Costs for All Tank Types ($/yr)
28-1	-325,652	0	0	-325,652
28-2	-438,378	17,057	0	-421,321
28-3	-847,531	17,057	0	-830,474
Totals	**-1,611,561**	**34,115**	**0**	**-1,577,447**
29-1	214,109	15,917	0	230,026
29-2	118,950	8,843	204,653	332,446
29-3	214,109	31,833	184,188	430,130
Totals	**547,168**	**56,592**	**388,840**	**992,602**
42-1	220,347	14,133	33,623	268,103
42-2	546,461	46,733	41,692	634,886
42-3	2,232,852	143,213	102,214	2,478,279
Totals	**2,999,660**	**204,078**	**177,529**	**3,381,268**
46-1	854,051	0	0	854,051
46-2	0	0	287,834	287,834
Totals	**854,051**	**0**	**287,834**	**1,141,885**
51-1	164,744	0	0	164,744
51-2	0	28,248	69,797	98,045
Totals	**164,744**	**28,248**	**69,797**	**262,789**
Grand Totals	**2,954,063**	**323,032**	**924,000**	**4,201,097**

[a]Values are taken from spreadsheets and, due to automatic rounding in some calculations, may not sum exactly to the totals shown.

TABLE 6-16. TRANSFER RACK MACT CONTROL REQUIREMENTS

Model Plant[a]	Total Number of Model Plant Facilities Nationwide[b]	Number of Facilities Already Controlled	Number of Facilities Requiring MACT Control	Control Device Required (Size of Flare)
28-1	43	17	26	Small
28-2	43	17	26	Medium
28-3	57	23	34	Large
Totals	**143**	**57**	**86**	**--**
29-1	15	8	7	Small
29-2	12	6	6	Medium
29-3	12	6	6	Medium
Totals	**39**	**20**	**19**	**--**
42-1	11	8	3	Small
42-2	17	12	5	Medium
42-3	18	13	5	Large
Totals	**46**	**33**	**13**	**--**
51-1	7	4	3	Small
51-2	5	3	2	Small
Totals	**12**	**7**	**5**	
Grand Totals	**240**	**117**	**123**	**--**

[a]Model plant facilities in SIC code 46 are not shown because available data indicate that they do not operate transfer racks.

[b]Numbers obtained from OLD Baseline Emissions memo (TSD Memo No. 3), representing facilities with organic liquid transfer operations.

Rationale for Selection and Costing of Transfer Rack Control Equipment

Flares are commonly utilized to control HAP emissions from transfer racks at facilities conducting OLD-type operations. This conclusion is based on a knowledge of the industry as obtained from site visits performed by the EPA/PES project team, and from information in the OLD survey data base. In addition, flares are the lowest cost option, and we assume that facilities will select the lowest cost device that will meet the standard. As a result, costing information was developed for large, medium, and small flares, which would be installed at the various sized plants. The costing algorithms were obtained from the EPA's Control Cost Manual.

Results. Tables 6-17 and 6-18 present the capital and annual costs, respectively, of the individual flare systems. Table 6-19 shows the sizing parameters used to assign one of these systems to each model plant. Table 6-20 presents the capital and annual control costs for each model plant facility and for all affected facilities.

Costing assumptions. Three sizes of flares were costed to accommodate the various sizes of OLD operations represented by the model plants. Based on throughputs and numbers of loading positions, flares were costed as shown in Table 6-19.

TABLE 6-17. CAPITAL COSTS FOR FLARE SYSTEMS ON O.L.D. TRANSFER RACKS

Cost Item	Factor	Estimated Value (1997 $)		
		Small Flare	Medium Flare	Large Flare
Direct Costs				
Flare System	A	29,793	42,814	64,001
Instrumentation, taxes, freight	0.18A	5,363	7,707	11,520
Purchased Equipment	B = 1.18A	35,156	50,521	75,521
Installation	0.57B	20,039	28,797	43,047
Total Direct Costs	1.57B	55,195	79,318	118,568
Indirect Installation Costs				
Indirect	0.35B	12,305	17,682	26,432
Total Capital Investment	1.92B	67,500	97,000	145,000

In the costing analysis performed prior to proposal of the regulation, the algorithms in the Control Cost Manual were used to derive an estimate of total capital investment and total annual cost for the small, medium, and large flares. Subsequent discussions and contacts with vendors of flare control equipment made clear that these initial cost estimates represented open flares, when in fact most transfer racks (approximately 90 percent or more) are controlled using enclosed ground flares. Enclosed flares include a refractory-lined stack and additional instrumentation, making them significantly more expensive than open flare systems. One of the flare manufacturers provided estimated purchase costs for enclosed flare systems. The original total costs were replaced in the cost analysis with these new vendor quotes, assuming a distribution of 90 percent enclosed flares and 10 percent open flares. The Control Cost Manual's algorithms were used to "back-calculate" the other cost items in Table 6-17, as well and all the annual costs in Table 6-18.

TABLE 6-18. ANNUAL COSTS FOR FLARE SYSTEMS ON O.L.D. TRANSFER RACKS

Cost Item	Factor	Estimated Value, $/yr in 1997 dollars		
		Small Flare	Medium Flare	Large Flare
Direct Annual Costs				
Labor Charges	L	22,800	22,800	22,800
Material	M	10,360	10,360	10,360
Purge gas		205	365	575
Pilot gas		2,045	2,045	2,045
Steam		7,160	11,015	14,320
Total Direct		**42,570**	**46,585**	**50,100**
Indirect Annual Costs				
Overhead	0.6 (L+M)	19,900	19,900	19,900
Administration	0.02 x TCI[a]	1,350	1,940	2,900
Property Tax	0.01 x TCI	675	970	1,450
Insurance	0.01 x TCI	675	970	1,450
Capital Recovery	0.1424 x TCI	9,612	13,813	20,648
Total Indirect		**32,212**	**37,593**	**46,348**
Total Annual Cost		**74,962**	**84,178**	**96,448**

[a]TCI = total capital investment (from Table 6-17).

TABLE 6-19. SIZING ASSUMPTIONS USED IN COSTING FLARES

Model Plant[a]	Number of Loading Positions	Maximum Vapor Displacement (cfm)[b]	Size of Flare Costed
28-1	2	130	Small
28-2	4	200	Medium
28-3	5	260	Large
29-1	2	130	Small
29-2	3	200	Medium
29-3	4	200	Medium
42-1	4	130	Small
42-2	9	200	Medium
42-3	15	260	Large
51-1	2	130	Small
51-2	2	130	Small

[a]Model plants in SIC code 46 are not included because data show that they do not operate transfer racks.

[b]Assumes each loading position generates 500 gal/min (65 cfm) of vapors and each model plant generates a maximum of 2,000 gal/min (260 cfm).

TABLE 6-20. TRANSFER RACK CONTROL COSTS BY MODEL PLANT AND NATIONWIDE (1997$)

Model Plant[a]	Capital Investment per Facility ($/yr)	Annual Cost per Facility ($/yr)	Total Capital Investment for Industry ($)	Total Annual Costs for Industry ($/yr)
28-1	67,500	74,962	1,755,000	1,949,012
28-2	97,000	84,178	2,522,000	2,188,628
28-3	145,000	96,448	4,930,000	3,279,232
42-1	67,500	74,962	202,500	224,886
42-2	97,000	84,178	485,000	420,890
42-3	145,000	96,448	725,000	482,240
51-1	67,500	74,962	202,500	224,886
51-2	67,500	74,962	135,000	149,924
Totals			**10,957,000**	**8,919,698**

[a]Model plant facilities in SIC code 29 are not shown because refineries are presumed to have existing control capacity for their transfer racks.
Model plant facilities in SIC code 46 are not shown because data indicate that they do not operate transfer racks.

Equipment Leaks

This section details the costs that OLD facilities would incur in developing and carrying out a leak detection and repair (LDAR) program to control leakage from equipment components. Only 431 (66 percent) of the 651 major source facilities are estimated to need a new program; the remaining 220 facilities are currently performing a formal LDAR program.

Cost estimation techniques for LDAR developed under previous NESHAP were adapted for use in the OLD NESHAP. Information was obtained primarily from a technical memorandum prepared for the Group IV Polymers and Resins NESHAP. The costing information found to be pertinent for the OLD LDAR analysis was extracted from that memo and formed into a single item that was placed in the OLD NESHAP docket. (7)

Costing algorithms were available for two LDAR scenarios: programs performed in-house (by company personnel) and those performed by a contractor (outside specialty firm). It was assumed that 50 percent (about 215) of the facilities would carry out the program in-house, and the remaining 50 percent would hire a contractor. Thus, final costs represent the average of the costs for each type of program.

Costs were calculated for pumps, valves, and sampling connection systems. As discussed in memo no. 2, compressors and pressure relief devices were excluded from consideration based on information that they are not used to any considerable degree in OLD operations. Connectors also have not been costed for LDAR because the proposed NESHAP (in the referenced subpart TT of 40 CFR part 63) does not require monitoring of connectors if leaks found by non-instrument means are eliminated within 5 days. Spreadsheets displaying the individual cost elements of implementing an LDAR program are contained in a separate memo. (1) Estimates of per-facility costs presented in Table 6-21 are taken directly from these spreadsheets, without making any adjustment for product recovery cost credits. This was done due to the variability of the types of organic liquids handled and to produce conservative, worst-case costs.

Capital and Annual Cost Impacts for the Industry

The capital and annual cost impacts of controlling all major source OLD emission sources are summarized in Table 6-22. This table does not include the costs of complying with the testing, recordkeeping, and reporting requirements of the NESHAP. Estimates of these costs are presented in the next subsection.

Recordkeeping and Reporting

The proposed OLD NESHAP specifies recordkeeping and reporting requirements for all affected facilities. There are one-time reports that are required, as well as periodic, ongoing recordkeeping and reporting requirements. The information for the following tables was obtained from the Information Collection Request prepared for the Office of Management and Budget (OMB). For this effort, the costs of complying with the recordkeeping and reporting requirements, and for the Federal Government's processing of the industry reports, were estimated both for affected facilities and for the EPA. The estimated number of facilities affected nationwide and their corresponding SIC/NAICS codes are summarized in Table 6-23.

Tables 6-24 through 6-26 document the computation of individual burdens for each of the applicable recordkeeping and reporting requirements. The individual burdens are expressed under standardized headings that are consistent with the concept of burden under the Paperwork Reduction Act. Where appropriate, we have identified specific tasks and major assumptions, which follow the guidance in the EPA's ICR Handbook. (8)

The average annual burden for OLD operations facilities over the first 3 years of the standards due to these recordkeeping and reporting requirements is estimated at 242,911 person-hours, as indicated in Table 6-25.

For the purposes of the estimates in Table 6-24, a controlled organic liquids distribution facility is one that controls affected transfer operations and storage tanks, and that institutes an equipment LDAR program. Cargo tanks that are presently required to have annual vapor tightness tests are classified as currently tested. The number of facilities estimated to be constructed/reconstructed or modified was based on industry growth projections and knowledge of the industry.

The primary costs associated with complying with the recordkeeping and reporting requirements are associated with labor costs. The unit labor costs used in Tables 6-24 and 6-26 were derived from standard estimates based on the EPA's impact calculations for other standards. The costs to conduct this effort have been calculated on the basis of:

- $40.00 per hour for Technical Labor
- $59.00 per hour for Managerial Labor
- $18.00 per hour for Clerical Labor.

These labor rates include overhead and fringe benefits.

In addition to the labor costs, part of the burden to affected OLD facilities would be the creation of a computer data base system to handle the records and create the reports required for this NESHAP. At an estimated capital cost of $2,500 per system, and assuming that all 651 affected facilities would make this purchase, the total capital cost would be $1,627,500. If this cost is annualized assuming 7 percent interest over a 3-year period, the additional annual cost burden to the industry would be about $960 per year (see Table 6-25).

TABLE 6-21. PER-FACILITY AND NATIONWIDE LDAR PROGRAM COSTS

Model Plant	Capital Cost/Facility ($)			Annual Cost/Facility ($/yr)			Number of Affected Facilities	Nationwide LDAR Costs	
	In-House	Contracted	Average	In-House	Contracted	Average		Capital ($)	Annual ($/yr)
28-1	5,641	9,058	7,350	20,134	25,434	22,785	128	940,800	2,916,480
28-2	5,641	9,058	7,350	20,134	25,434	22,785	69	507,150	1,572,165
28-3	10,089	13,506	11,798	84,515	90,988	87,752	47	554,506	4,124,344
29-1	5,641	9,058	7,350	20,134	25,434	22,785	35	257,250	797,475
29-2	5,641	9,058	7,350	20,134	25,434	22,785	20	147,000	455,700
29-3	5,641	9,058	7,350	20,134	25,434	22,785	18	132,300	410,130
42-1	5,641	9,058	7,350	20,134	25,434	22,785	16	117,600	364,560
42-2	5,641	9,058	7,350	20,134	25,434	22,785	21	154,350	478,485
42-3	10,089	13,056	11,798	84,515	90,988	87,752	25	294,950	2,193,800
46-1	5,641	9,058	7,350	20,134	25,434	22,785	17	124,950	387,345
46-2	5,641	9,058	7,350	20,134	25,434	22,785	6	44,100	136,710
51-1	5,641	9,058	7,350	20,134	25,434	22,785	17	124,950	387,345
51-2	5,641	9,058	7,350	20,134	25,434	22,785	12	88,200	273,420
Totals	--	--	--	--	--	--	**431**	**3,488,106**	**14,497,959**

[a]Average refers to the average cost of the in-house and contracted LDAR programs.

[b]Product recovery credits are not included in the annual cost figure (see text).

TABLE 6-22. SUMMARY OF NATIONWIDE COST IMPACTS[a]

Emission Source Controlled	Capital Cost ($ million)	Annual Cost ($ million/yr)
Upgrade Fixed-Roof Tanks	77.46	2.95
Upgrade Floating Roof Tanks	6.87	1.25
Transfer Racks (Control Device)	10.96	8.92
Equipment Leaks (LDAR)	3.49	14.50
Totals	**98.8**	**27.6**

[a]Does not include the costs for testing, recordkeeping, and reporting.

TABLE 6-23. ESTIMATED NUMBER OF MAJOR SOURCE OLD FACILITIES AND THEIR SIC/NAICS CODES

Industry Segment	SIC Codes	NAICS Codes	Number of Major Source Facilities
Chemical Manufacturing	2821,2865,2869	325211, 325192, 325188	370
Petroleum Refineries	2911	32411	111
Liquid Terminals	4226	49311, 49319	94
Crude Oil Pipeline Stations	4612	48611	35
Petroleum Terminals	5169, 5171	42269, 42271	41
		Total	**651**

Testing costs were estimated for EPA Methods 18, 25, 25A, and 27. The total annual cost for facilities to perform the required tests is estimated to be $1,718,400 per year. It was assumed for this analysis that Method 18 would only be used to determine the percentage of affected HAP (as listed in Table 1 of the proposed rule) in organic liquids. As such, this requires that a sample of the organic liquid be run through a gas chromatograph for analysis, and this is a fairly rapid and inexpensive procedure. Methods 25 and 25A will be the primary means of measuring emissions of HAP from control devices. The cost of Method 25 or 25A testing was provided by the emissions testing staff at PES, Inc. Method 27 is used to verify vapor tightness in cargo tanks. Based on information provided in the background information document for the proposed NSPS for bulk gasoline terminals (9), and on current information from an oil company (10), we estimated the cost of performing a Method 27 test to be $200.

The only Federal costs are those costs associated with the analysis of the information reported by affected facilities. Publication and distribution of the information are part of the Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS), which is operated and maintained by the EPA's Office of Air Quality Planning and Standards. Examination of records to be maintained by the respondents will occur as part of the periodic inspection of sources, which is part of the EPA's overall compliance and enforcement program. Labor rates were assumed to be similar to those of the industry respondents. The average annual cost to the Federal Government during the first 3 years of the standards, as derived in Table 6-26, is estimated to be $1,460,708 per year.

TABLE 6-24. ANNUAL FACILITY LABOR COSTS FOR RECORDKEEPING AND REPORTING

Burden Item	(A) Hours per Technical Occurrence	(B) Number of Occurrences per Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year@ $40/hr	Manag. Hours per Year@ $59/hr	Clerical Hours @ $18/hr	Total Labor Cost per Year ($/yr)
1. Applications	N/A									
2. Surveys and Studies	N/A									
3. Reporting Requirements										
A. Read and Understand Rule Requirements	40	1		40	651	ab	26,040	1,302	2,604	1,165,290
B. Required Activities:										
3.1 Organic Liquids										
(a). Provide true vapor pressure and percentage of Table 1 HAP in all liquids transferred into/out of facility.	10	1		10	651	b	6,510	326	651	291,323
(b). Provide and determine Table 1 HAP percentage in organic liquids using Method 18.	1	15	$500	15	135	i	2,025	101	203	90,619
(c). Provide records of the volume of organic liquids transferred into/out of the facility.	10	1		10	651	b	6,510	326	651	291,323
3.2 Storage Tanks										
(a). Provide a list of all tanks in OLD service including their dimensions, roof type, primary and secondary seals, and fittings.	20	1		20	651	ab	13,020	651	1,302	582,645
(b). Provide results of the required inspections for storage tanks.	15	1		15	651	b	9,765	488	977	436,984

TABLE 6-24. (Continued)

Burden Item	(A) Hours per Technical Occurrence	(B) Number of Occurrencesper Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year@ $40/hr	Manag. Hours per Year@ $59/hr	Clerical Hours @ $18/hr	Total LaborCost per Year ($/yr)
3.3 Transfer Operations										
(a). Provide documentation, by position transferring affected liquids, of the organic liquids transferred, their volumes, their true vapor pressure, and HAP percentages.	20	2		40	240	c	9,600	480	960	429,600
(b). Provide documentation that cargo tanks subject to Method 27 vapor tightness testing loading at affected loading positions have current vapor tightness certification.	15	1	$200	15	240	c	3,600	180	360	161,100
3.4 Equipment Leaks										
(a). Provide a list of all equipment in OLD service.	20	1		20	431	ad	8,620	431	862	385,745
(b). Provide documentation that equipment found leaking using Method 21 was repaired in time provided.	10	4	$2,500	40	431	d	17,240	862	1,724	771,490
3.5 Control Devices										
(a). Provide records of control devices in OLD service and the emission sources which they control.	10	1		10	240	ab	2,400	120	240	107,400
(b). Provide records detailing deviations in the proper operating conditions of the control devices in OLD service.	5	1		5	240	e	1,200	60	120	53,700
(c). Provide records of all performance tests required for the control devices.	24	1		24	123	e	2,952	148	295	132,122

TABLE 6-24. (Continued)

Burden Item	(A) Hours per Technical Occurrence	(B) Number of Occurrences per Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year@ $40/hr	Manag. Hours per Year@ $59/hr	Clerical Hours@ $18/hr	Total Labor Cost per Year ($/yr)
(d). Performance test of control devices, Method 25 or 25A	24	1	$12,000	24	123	e	2,952	148	295	**[1,344,122]**
3.6 Repeat of Performance Test										
Method 18--Measurement of Gaseous Organic Compound Emissions by Gas Chromatography	5	1	$500	5	14	fgh	70	4	7	**[10,133]**
Method 25--Determination of Gaseous Nonmethane TOC as Carbon, or Method 25A--Determination of Gaseous TOC by Flame Ionization Detection	24	1	$12,000	24	14	fgh	336	17	34	**[183,036]**
Method 27--Determination of Vapor Tightness Test for Gasoline Delivery Tanks	2	1	$200	2	75	k	150	8	15	**[21,713]**
C. Create Information	Incl. in 3.B									
D. Gather Information	Incl. in 3.B									
E. Report Preparation										
Intitial Notification Report	16	1		16	651	ab	10,416	521	1,042	466,166
Initial Compliance Report	20	1		20	651	ab	13,020	651	1,302	582,645
Semiannual Compliance Report	40	2		80	651	b	52,080	2,604	5,208	2,330,580
Notification of Performance Test	4	1		4	651	b	2,604	130	260	116,529
Notification of Construction/Reconstruction	4	1		4	20	aj	80	4	8	3,580

TABLE 6-24. (Continued)

Burden Item	(A) Hours perTechnical Occurrence	(B) Number of Occurrencesper Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year@ $40/hr	Manag. Hours per Year@ $59/hr	Clerical Hours @ $18/hr	Total Labor Cost per Year ($/yr)
Notification of anticipated startup	4	1		4	20	aj	80	4	8	3,580
Notification of actual startup	4	1		4	20	aj	80	4	8	3,580
4. Recordkeeping Requirements										
A. Read Instructions	Incl. in 3.A									
B. Plan Activities	Incl. in 3.A									
C. Implement Activities	Incl. in 3.A									
D. Record Information										
4.1 Organic Liquids										
(a). Maintain records of true vapor pressure of organic liquids.	Incl. in 3.1(a)									
(b). Maintain records of Table 1 HAP in organic liquids.	Incl. in 3.1(a)									
(c). Maintain records of the volumes of organic liquids transferred into/out of facility.	Incl. in 3.1(b)									

TABLE 6-24. (Continued)

Burden Item	(A) Hours per Technical Occurrence	(B) Number of Occurrences per Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year @ $40/hr	Manag. Hours per Year @ $59/hr	Clerical Hours per Year @ $18/hr	Total Labor Cost per Year ($/yr)
4.2 Storage Tanks										
(a). Maintain records of all storage tanks in OLD service, their dimensions, roof types, seal types, and fittings.	Incl. in 3.2(a)									
(b). Maintain records of organic liquids and their respective volumes stored in individual storage tanks.	Incl. in 3.2(a)									
(c). Maintain records of storage tank inspections and repairs.	Incl. in 3.2(b)									
4.3 Liquid Transfers										
(a). Maintain records of the organic liquids and their respective volumes transferred at each loading position.	Incl. in 3.2(a)									
(b). Maintain records of cargo tanks and their vapor tightness certification.	Incl. in 3.2(b)									
4.4 Equipment Leaks										
(a). Maintain records of equipment associated with organic liquids distribution.	Incl. in 3.3(a)									
(b). Maintain records of periodic Method 21 inspections, including leaking equipment found and time required to repair leaking equipment.	Incl. in 3.3(b)									

TABLE 6-24. (Concluded)

Burden Item	(A) Hours per Technical Occurrence	(B) Number of Occurrences per Facility per Year	Emissions Testing Cost per Occurrence	(C) Hours per Facility (C=AxB)	Number of Facilities		Technical Hours per Year @ $40/hr	Manag. Hours per Year @ $59/hr	Clerical Hours per Year @ $18/hr	Total Labor Cost per Year ($/yr)
4.5 Control Devices										
(a). Maintain records describing the control devices used to comply with the NESHAP, and what emission sources they control.	Incl. in 3.5(a)									
(b). Maintain records of performance tests.	Incl. in 3.5(b)									
(c). Record startups, shutdowns, and malfunctions.	4	12		48	651	b	31,248	1,562	3,125	1,398,328
E. Personnel Training	N/A									
F. Time for audits	8	2		16	651	b	10,416	521	1,042	466,135
Totals:							**233,014**	**11,651**	**23,30**	**10,270,464**[l]

Key to Table 6-24:

a) One-time activity.
b) Estimate includes all affected facilities.
c) Estimate does not include crude oil pipeline breakout stations.
d) Estimate does not include facilities that already have a formal LDAR program.
e) Only includes facilities implementing a control device for transfer racks as a result of the OLD NESHAP.
f) Estimate includes test plan, test report, and parametric monitoring setup.
g) Assumes that 15 percent of all performance tests fail and need to be repeated.
h) Assumes that this method will only be used to determine the percent HAP in organic liquids.
i) Assumes that only for-hire terminals and bulk gasoline terminals willl require Method 18 testing of organic liquids.
j) Assumes that 3 percent of total facilities will be subject to construction/reconstruction/anticipated startup/actual startup provision.
k) Assumes that ½ percent of the approximately 15,000 tank tucks carrying organic liquids will undergo Method 27 testing on an annual basis.
l) The total of total labor costs (last column) does not include the four annual O&M costs shown in brackets and bold type (sections 3.5(d) and 3.6), which are a separate cost item

Table 6-25.

TABLE 6-25. SUMMARY OF RECORDKEEPING AND REPORTING COSTS

Number of Affected Facilities	Average Annual Hours[a]	Total Capital Cost, $[b]	Annual Labor Costs, $/yr[c]	Annualized Capital Cost, $/yr[d]	Annual O&M Costs, $/yr[e]	Total Annual Costs, $/yr
651	242,911	1,627,500	10,270,464	620,165	1,559,004	12,449,633

[a]Average of all facility burden hours over the first 3 years.

[b]Cost for developing an OLD-specific data base to accommodate records and reports, at $2,500 per facility.

[c]Derived in Table 6-24.

[d]Obtained as Cost of Start-up Capital/PVFA, where PVFA = Present Value Factor = Sum $[1/(1 + k)^t]$, where k = % discount rate (7%) and t = 1 to 3 years.

[e]O&M costs associated with performing the required EPA test methods (sum of the bold, bracketed costs in the last column of Table 6-24).

TABLE 6-26. ANNUAL FEDERAL GOVERNMENT (EPA) BURDEN AND COSTS ASSOCIATED WITH RECORDKEEPING AND REPORTING REQUIREMENTS

Burden Item	Number of Facilities per Year		EPA Hours per Facility	Technical Hours per Year @ $40/hr	Management Hours per Year @ $59/hr	Clerical Hours per Year @ $18/hr	EPA Total Cost per Year ($/yr)
1. Applications	N/A						
2. Surveys and Studies	N/A						
3. Reporting Requirements							
A. Read and Understand Rule Requirements	1		40	40	2	4	1,790
B. Required Activities							
3.1 Organic Liquids							
(a). Review documentation of organic liquids, their vapor pressure, and percentage of Table 1 HAP.	651	b	4	2,604	130	260	116,510
(b). Review documentation of total organic liquid throughput through the facility.	651	b	2	1,302	65	130	58,255
3.2 Storage Tanks							
(a). Review documentation of storage tanks, their roof types, etc.	651	ab	8	5,208	260	521	233,038
(b). Review documentation of the required storage tank inspections.	651	b	4	2,604	130	260	116,510

TABLE 6-26. (Continued)

Burden Item	Number of Facilities per Year		EPA Hours per Facility	Technical Hours per Year @ $40/hr	Management Hours per Year @ $59/hr	Clerical Hours per Year @ $18/hr	EPA Total Cost per Year ($/yr)
3.3 Transfer Operations							
(a). Review documentation of the organic liquids transferred, their volumes, TVP, and HAP percentages.	240	c	4	960	48	96	42,960
(b). Review documentation of vapor tightness testing on cargo tanks.	240	c	4	960	48	96	42,960
3.4 Equipment Leaks							
(a). Review report of equipment LDAR program.	228	ad	8	2,248	112	225	100,578
(b). Review report of equipment leak repairs.	228	d	4	1,124	56	112	50,280
(c). Review Method 21 documentation.	228	d	4	1,124	56	112	50,280
3.5 Control Devices							
(a). Review control devices in OLD service.	240	ab	4	960	48	96	42,960
(b). Review records of deviations.	240	e	4	960	48	96	42,960
(c). Review control device performance test results.	240	e	4	960	48	96	42,960
C. Create Information	N/A						
D. Gather Information	N/A						
E. Report Preparation	N/A						
Review Initial Notification Report	651	ab	4	2,604	130	260	116,510

TABLE 6-26. (Concluded)

Burden Item	Number of Facilities per Year		EPA Hours per Facility	Technical Hours per Year @ $40/hr	Management Hours per Year @ $59/hr	Clerical Hours per Year @ $18/hr	EPA Total Cost per Year ($/yr)
Review Initial Compliance Report	240	ab	4	960	48	96	42,960
Review Semiannual Compliance Report	240	b	2	480	24	48	21,480
Review Notification of Performance Test	240	b	2	480	24	48	21,480
Review Notification of Construction/ Reconstruction	20	aj	2	40	2	4	1,790
Review Notification of Anticipated Startup	20	aj	2	40	2	4	1,790
Review Notification of Actual Startup	20	aj	2	40	2	4	1,790
4. Recordkeeping Requirements							
A. Read Instructions	N/A						
B. Plan Activities	N/A						
C. Implement Activities	N/A						
D. Develop Record System	N/A						
E. Record Information	N/A						
F. Personnel Training	N/A						
G. Time for Auditors	N/A						
H. Litigation	N/A						
Totals:				**25,698**	**1,283**	**2,308**	**1,149,841**

Note: The footnotes for this table are the same as those in Table 6-24.

Summary of Total Annual Costs

The overall annual cost impact of the OLD NESHAP being proposed is the sum of the costs for emission controls on regulated emission sources and the costs that industry will encounter in making the required reports and keeping needed records. Based on the annual cost elements already presented in Tables 6-22 and 6-25, the total annual cost to the affected industry sources is approximately \$40.1 million per year.

Cost Effectiveness of the Rule Proposal

The cost effectiveness (CE) of a NESHAP is the cost of reducing a unit weight of HAP emissions as a result of complying with the standards. It is calculated as the quotient of the net annualized cost (including recordkeeping and reporting costs) and the annual HAP emission reduction resulting from the standards. In English units,

CE = annualized cost [\$/yr] ÷ annual HAP reduction [tons/yr]

= \$/ton of HAP reduced.

As discussed above, the total annual cost to industry has been calculated to be \$40.1 million per year for each year the standards are in effect at all affected facilities. The annual HAP emission reduction for the entire industry has been estimated (see Table 6-7) to be 24,130 tons per year. Therefore, the calculated cost effectiveness (in English units) is:

CE = \$40.1 million/yr ÷ 24,130 tons/yr

= <u>\$1,660 per ton of HAP reduced</u>.

In metric units, the cost effectiveness is:

CE = \$40.1 million/yr ÷ 21,900 Mg/yr

= <u>\$1,830 per Mg of HAP reduced</u>.

REFERENCES

1. Spreadsheets for the Environmental and Cost Impacts of the Proposed Organic Liquids Distribution (Non-Gasoline) NESHAP. Memorandum from G. LaFlam, Pacific Environmental Services, Inc., to Air Docket A-98-13. Air Docket A-98-13, document no. II-B-23. October 3, 2000.

2. Presumptive MACT for Organic Liquids (Non-Gasoline) Distribution Facilities. U.S. EPA, OAQPS, Waste and Chemical Processes Group. Research Triangle Park, NC. June 9, 1998. Docket A-98-13, document no. II-A-1.

3. OAQPS Control Cost Manual, Fifth Edition. EPA-453/B-96-001. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. February 1996.

4. Control of Volatile Organic Compound Emissions from Volatile Organic Liquid Storage in Floating and Fixed Roof Tanks (Storage Tank CTG). EPA-453/D-93-057. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. 1993.

5. Gasoline Distribution Industry (Stage I)--Background Information for Proposed Standards (NESHAP). EPA-453/R-94-002a. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. 1994.

6. Circular A-94, Guidelines and Discount Rates for Benefit Cost Analysis of Federal Programs. U.S. Office of Management and Budget. October 29, 1992.

7. Selected costing information for LDAR programs taken from Memorandum: From Kenneth R. Meardon, To Group IV Polymers and Resins Docket A-92-45, Equipment Leak Analysis for PET Facilities Subject to the Group IV Polymers and Resins NESHAP, October 26, 1998. Air Docket A-98-13, document no. II-B-21.

8. ICR Handbook. U.S. EPA, Office of Policy, Planning, and Evaluation, Regulatory Information Division. Revised February 1999.

9. Bulk Gasoline Terminals--Background Information for Proposed Standards. EPA-450/3-80-038a. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. 1980.

10. E-mail from G. Wilson, Marathon Oil Company, to B. Haneke, Pacific Environmental Services, Inc. Information on Method 27 costs. January 14, 2000.

Attachment 1

OLD Transfer Rack Baseline Emissions and Emission Reductions

Model Plant	Liquid Throughput per Model Plant (gal/yr)	Liquid Molecular Weight (lb/lb-mole)	Liquid True Vapor Pressure (psia)	Liquid Temperature (deg. F)	Uncontrolled Rack Saturation Factor	TOC Emissions per Uncontrolled Model Plant (lb/yr)	Number of Plants Without a Control System	Nationwide TOC Emissions from Uncontrolled Plants (tons/yr)
28-1	6,240,000	78.1	3.06	60	1.45	51,813	26	673.6
28-2	16,421,700	78.1	3.06	60	1.45	136,356	26	1,772.6
28-3	34,311,800	78.1	3.06	60	1.45	284,904	34	4,843.4
Totals							**86**	**7,289.6**
29-1	6,029,600	78.1	3.18	60	1.45	52,029	7	182.1
29-2	66,378,800	78.1	3.18	60	1.45	572,783	6	1,718.3
29-3	85,763,800	78.1	3.18	60	1.45	740,056	6	2,220.2
Totals							**19**	**4,120.6**
42-1	20,918,500	78.1	2.84	60	1.45	161,207	3	241.8
42-2	28,150,000	78.1	2.84	60	1.45	216,935	5	542.3
42-3	54,844,300	78.1	2.84	60	1.45	422,653	5	1,056.6
Totals							**13**	**1,840.8**
51-1	23,500	78.1	2.36	60	1.45	150	3	0.2
51-2	25,907,000	78.1	2.36	60	1.45	165,906	2	165.9
Totals							**5**	**166.1**
Grand Totals							**123**	**13,417.1**

Attachment 1

OLD Transfer Rack Baseline Emissions and Emission Reductions (continued)

Model Plant	Controlled Rack Saturation Factor	System Control Efficiency	TOC Emissions per Controlled Model Plant (lb/yr)	Number of Plants with a Control System	Nationwide TOC Emissions from Controlled Plants (tons/yr)	Nationwide Baseline TOC Emissions (tons/yr)	Overall Liquid HAP Percentage	Nationwide Baseline HAP Emissions (tons/yr)	TOC Emission Reduction per Uncontrolled Model Plant (lb/yr)	Number of Plants Installing a Control System	Nationwide TOC Emission Reduction (tons/yr)	Nationwide HAP Emission Reduction (tons/yr)
28-1	0.60	0.95	1,072	17	9.1	682.7	0.64	436.9	49,222	26	639.9	409.5
28-2	0.60	0.95	2,821	17	24.0	1,796.6	0.64	1,149.8	129,538	26	1,684.0	1,077.8
28-3	0.60	0.95	5,895	23	67.8	4,911.2	0.64	3,143.1	270,659	34	4,601.2	2,944.8
Totals				**57**	**100.9**	**7,390.4**		**4,729.9**		**86**	**6,925.1**	**4,432.1**
29-1	0.60	0.95	1,076	8	4.3	186.4	0.32	59.7	49,428	7	173.0	55.4
29-2	0.60	0.95	11,851	6	35.6	1,753.9	0.32	561.2	544,144	6	1,632.4	522.4
29-3	0.60	0.95	15,312	6	45.9	2,266.1	0.32	725.2	703,054	6	2,109.2	674.9
Totals				**20**	**85.8**	**4,206.4**		**1,346.1**		**19**	**3,914.6**	**1,252.7**
42-1	0.60	0.95	3,335	8	13.3	255.2	0.74	188.8	153,146	3	229.7	170.0
42-2	0.60	0.95	4,488	12	26.9	569.3	0.74	421.3	206,089	5	515.2	381.3
42-3	0.60	0.95	8,745	13	56.8	1,113.5	0.74	824.0	401,520	5	1,003.8	742.8
Totals				**33**	**97.1**	**1,937.9**		**1,434.0**		**13**	**1,748.7**	**1,294.1**
51-1	0.60	0.95	3	4	0.0	0.2	0.85	0.2	143	1	0.1	0.1
51-2	0.60	0.95	3,433	3	5.1	171.1	0.85	145.4	157,611	1	78.8	67.0
Totals				**7**	**5.2**	**171.3**		**145.6**		**2**	**78.9**	**67.0**
Grand Totals				**117**	**288.9**	**13,706.0**		**7,655.6**		**120**	**12,667.3**	**7,045.8**