PPG Industries, Inc.

Lake Charles, Louisiana

ENSR

Enforceable Commitment Volume I: General Distribution

ENSR Consulting and Engineering

Submitted January 1992
Revised May 1992

Document Number 5510-016-114

SL 025815

PPG Industries, Inc.
Chemicals Post Office Box 1000 Lake Charles, Louisiana 70602 USA

May 20, 1992

Mr. Stanley Meiburg
Director,
Air, Pesticides and Toxics Division (6T)
United States Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Re: Enforceable Commitment for PPG Industries, Inc.
Lake Charles, Louisiana Complex

Dear Mr. Meiburg:

PPG has addressed the concerns listed in your letter dated February 28, 1992, which was in response to the Enforceable Commitment Document (ECD) filed by PPG Industries, Inc., Lake Charles, Louisiana on January 20, 1992. PPG revised the ECD filed in January 1992 in response to recommendations made by Mr. Dave Beck of EPA OAQPS during a conference call made on April 7, 1992 involving PPG, ENSR, LDEQ, EPA Region 6 and EPA OAQPS (RTP).

PPG would like to thank Ms. Tanya Murray for sending ENSR the final copy of the Procedures for Establishing Emissions for Early Reduction Compliance Extensions, Volume I -- Synthetic Organic Chemical Manufacturing Ethylene Oxide Sterilization, and Chromium Electroplating, (EPA-450/3-91-012a) for the calculations of the air emissions. PPG has used forms from that document in the updated ECD. PPG's reply to the concerns listed in your letter are as follows:

Request #1. **One of the requirements of the Early Reduction application is evidence that the base year emissions are verifiable and representative wh n compared to other years. Your Table 3-1 compares years 1985 through 1990 based on the production rate to show that the base year 1987 is representative. Please explain the correlation between emission and production numbers especially in view of the fact that some of the emissions came from the wastewater treatment unit which was significantly improved in July of 1987 by replacing surge pond and API separator (p. J-7).**

SL 025816

Response: A correlation of production rates and emission rates is presented below for each source type contained in the Enforceable Commitment.

Storage Tanks - are used at the site to store raw materials, intermediates, and final products prior to use or transport offsite. The emissions from these units are primarily attributable to working losses, which is a function of tank turnovers. As production increases the use of raw material and products increases the number of tank turnovers and working losses.

Loading and Unloading Emissions - by the same reasoning presented above, the more raw material used and final products shipped from the site the more materials which must be loaded and unloaded from barges and railcars. Consequently, these emissions are directly related to production.

Wastewater Emissions - Increased production increases the amount of water used at the site for cleaning and process activities. Under past practices the amount of wastewater generated at a site was directly tied to the amount of water used which was tied to production rate. Current practices have changed the water use patterns and more water is recycled, but this did not occur in the base year.

Process Vents - Increasing the production rate of a unit means that more raw material are processed. Increased throughput effects all components of the unit including emissions.

From this simple review, it is clear that an increase in production would lead to an increase in emissions. However, PPG did not select the peak production year as the base year, but rather opted for the only pre-control year available, 1987.

The Early Reduction regulation requires PPG to provide evidence that the base year emissions are not "Artificially or Substantially" greater than emissions in other years. The meaning of the phase "Artificially or Substantially" is given as follows:

"Artificially or Substantially greater emissions means abnormally high emissions such as could be caused by equipment malfunctions, accidents, unusually high production or operating rates compared to historical rates, or other unusual circumstances."

In response to the above requirement, PPG has used production rates to demonstrate that 1987 is not an unusually high production year for the reasons stated above.

Request # 2. **For the surge pond taken out of service on June 28, 1987, PPG has claimed unweighted HAP emissions of 543 tons for the first half f 1987. This figure is based on mass balance calculations provided in the application. However LDEQ files include data submitted by Mr. Andy Plauché of PPG in 1986 which claimed annual emissions from the surge pond of 492 tons which would prorate to 246 tons half a year. Please explain the discrepancy.**

Response: The surge pond emissions were first estimated in 1979 to be 356 tons/year by material balance calculations. The flow rate through the pond was 500 gpm and the inlet and outlet organic concentrations of the water were 429 ppm and 104 ppm. The surge pond emissions were estimated in 1982 to be 492 tons based on an extrapolation of 1979 analytical material balance data and an increase in the flow rate to 835 gpm. The flow rate to the pond increased from 1979 to 1982 due to the startup of the new vinyl chloride plant No. 2 and new process pads that were installed in the plant. Mr. Plauché reported in a letter to Mr. Gus Bodungen of the Louisiana Department of Environmental Quality (May 23, 1986) that the waste treatment unit surge pond emissions were 492 tons using the 1982 emissions as the basis for the estimate. This letter informed the LDEQ that PPG was going to eliminate the surge pond and API separator emissions.

The surge pond was taken out of service on June 28, 1987 and the estimated unweighted HAP emissions of 543 tons for the first half of 1987 reported in the enforceable commitment report were based on material balance data from 1986-1988 as referenced in the enforceable commitment. The flow rate to the surge pond in 1987 was 792.5 gpm with an inlet organic concentration of 1057 ppm and an estimated outlet organic concentration of 425 ppm. The organics concentration in the water to the pond from 1979 to 1987 increased due to reducing the number of pure water streams entering the process sewers.

Request # 3. **For the API separator taken out of service June of 1987, PPG claimed unweighted HAP emissions of 119 tons for the first half of 1987. This figure is also inconsistent with emissions data previously submitted to LDEQ by PPG, which claimed 30 tons per year emissions for the API separator. Please explain the discrepancy.**

The above noted discrepancies affect about 50% of the Waste Treatment Unit baseline emissions. Waste Treatment Unit emissions represent about 55% of the total Early Reduction Source.

Response: The emissions for the API separator for 1987 were based on Dr. Shen's model as referenced in the enforceable commitment. The estimated emissions of 119.4 tons for the first 6 months of 1987 were based on an API separator outlet concentration of 1054 ppm. In the Shen model, the vapors released to the atmosphere are directly proportional to the concentration of organics in the separator. Initial PPG estimates in 1979 of the organic emissions to the air from the API separator were 107 tons/year based on solar radiation calculations. The organic concentration of the wastewater stream leaving the API separator in 1979 was 597 ppm.

Mr. Plauché reported a 30 tons/year emission reduction in 1986 to the LDEQ based on the fact that the separator was partly covered with a wooden cover. The wooden cover was badly deteriorated and was removed prior to the shutdown of the separator in 1987. The estimated losses in 1987 are higher than the original estimate of 107 tons/year because the organics in the separator were nearly double the values in 1979.

Request # 4. **The submittal states that the PPG defines the source as "Activities directly associated with the production of SOCMI chemicals that occur within the contiguous property boundary, excluding all hazardous air pollutant (HAP) emissions from equipment leaks." Based on your definition of source, are all emission points of all HAPs accounted for in your submittal?**

Response: All emission points of all HAPs are not included in the PPG source definition. PPG defines the "source" for the Lake Charles facility as follows:

- Activities within the contiguous property boundary which will be subject to regulation under the Hazardous Organic NESHAP(HON), directly associated with the handling of raw materials, the handling, production or transport of intermediate and final products, and wastes of SOCMI chemicals, excluding all hazardous air pollutants (HAP) emissions from equipment leaks and non-SOCMI production units in operation at the facility. These activities are strictly limited to the those SOCMI chemical production units which are in operation prior to proposal of the HON. Included under this definition are all points of emissions associated with the following list of activities:

  - Raw Materials Transport and Storage
  - Intermediate Product Storage and Handling
  - Final Product Storage and Handling
  - Waste Handling

  The specific SOCMI production units present on-site at the time of this filing includes:

  - Chlorine
  - Ethyl Chloride (EC)/Hydrogen Chloride (HCl)
  - Ethylene Dichloride (EDC)
  - Perchloroethylene/Trichloroethylene (PER/TRI)
  - Shipping/Loading Operations
  - Tri-Ethane II● (Methyl Chloroform, MC)
  - Vinyl Chloride (VCM-II)
  - Vinylidene Chloride (VDCM)
  - Waste Treatment Unit (WTU)

  Not included under this definition are activities and HAP emissions associated with:

  - On-site Power Generation
  - Caustics Processing
  - Silicas Plant

This definition meets the regulatory requirements outlined under Section 63.73 (a)(1) as it addresses:

- A portion of an entire contiguous facility under common ownership or control,
- Activities defined by a standard under Section 112 (d) of the Act.

Request # 5. **In Table 2-1, Emission Point Description, where plural of "vents," "tanks," "trucks," etc. is used, please indicate the numbers of vents, tanks, trucks, etc.**

Additionally, in place of * where no EIQ number exists, please assign your own identifying number.

Response: Review of EIQs shown in Table 2-1 identified 17 sources that include more than one emission source that is routed through a single vent location. Table 1 shows the vents that include multiple emission sources.

The number of trucks was not used to calculate emissions from vacuum trucks. The calculation was based on an estimate of the number of hours that loading of organics and contaminated water into trucks occurred because the loading operation resulted in the release of emissions. An emission factor in lb/hr had been developed based on test data collected from the vacuum truck vent. The calculation of vacuum truck emissions is found on pages J-30 and J-31 of the EC document.

Shipping and loading emissions from ships, barges, tank trucks, railcars, and drums were not calculated by unit. The emissions were calculated using the following equation:

$$E = \frac{5.65 \times 10^{-6}\, S\, P\, M\, G}{T}$$

where,
- G = Annual volume of liquid loaded (gal/yr)
- M = Molecular weight of the HAP (lb/lb-mole)
- P = True vapor pressure of the HAP loaded (psia)
- T = Temperature of liquid loaded, °R or (°F + 460)
- S = Saturation Factor

The equation used to determine an emission factor as shown above is from Volume I of Procedures for Establishing Emissions for Early Reduction Compliance Extensions (EPA-450/3-91-012a).

The annual volume of each HAP loaded into drums, ships, barges, railcars, and tank trucks is shown on the emissions calculation form in Section F of the Enforceable Commitment, page F-15 through F-57. The total volume loaded is also shown in the attached Table 2.

Ethyl Chloride (EC) loading emissions from railcars and tank trucks were calculated separately from the other shipping and loading emissions. Detailed data on the loading procedure had been compiled by PPG and was used to calculate emissions from EC loading. The emission calculations are presented on pages F-11 to F-12 of the document.

In response to the second part of question 5, the asterisk used in the table was footnoted by saying all fugitive emissions from the PPG facility are reported under EIQ 349. Table 2-1 has been revised and a unique EIQ number has been assigned to all emission sources, including fugitive emissions from drums (EIQ 394), tank trucks (EIQ 393), railcars (EIQ 392), barges (EIQ 391), and ships (EIQ 390).

Request # 6. The base year submittal requires that supporting basis for each emission number of each emission point include:

(a) For test results submitted as the supporting basis, a description of the test protocol followed, any problems encountered during the testing, and a discussion of the validity of the method for measuring the subject emissions; and

(b) For calculations based on emission factors, material balance, or engineering principles and submitted as the supporting basis, a step-by-step description of the calculations, including assumptions used, and a brief rationale for the validity of the calculation method used.

We find that PPG's submittal is inadequate in this regard for several emission points. As an example, C-13, the following information is needed:

(1) What is the "source"?
(2) How was the process flow obtained?
(3) How was the method of concentration calculated? If not an EPA method, give a brief justification and provide supporting calculations.
(4) What was the "HAP" stream concentration? "Attachment I" does not provide "C".
(5) What are the numbers that go in the brackets to obtain 91.153 Mg/yr of uncontrolled emissions?
(6) What are the numbers that go in the brackets to obtain 5.239 Mg/yr of HAP emissions?
(7) What is the basis for the numbers submitted in Attachment III?
(8) To facilitate review, please substitute real names and HAP amounts instead of "See Attachment....".

Please review all calculations with these comments in mind and make corrections as necessary.

Response: PPG initiated a conference call on April 7, 1992 with EPA Region 6, EPA OAQPS, the LDEQ, and ENSR, during which appropriate responses to the items in Question 6 were discussed. EPA and LDEQ concurred that a single set of calculation forms could be used for process vents that emitted multiple HAPs. The "sample" calculation form needed to be completely filled out. A separate worksheet could be used to show the results of calculations for the other HAPs emitted from the vent. Based on the recommendations of EPA and LDEQ during the call, PPG has revised the emission calculation forms as follows:

Item (1) - What is the "source"?.

The PPG facility is comprised of several distinct production units (e.g., ethyl chloride) and common activity units (e.g., waste treatment unit). Since the definition of source discussed in Question 4 includes only those activities subject to regulation under HON, PPG elected to define source on each process vent calculation form as the HON "subunit" in which the emission point is located. For example, EIQ 363, the PER/TRI BLM Tank No. 2, is located in PER/TRI HON subunit.

Item (2) - How was the process flow obtained?

For the example cited on page C-13 of the January 1992 document, the flow rate was calculated using process design specification data. In several cases, specific process knowledge and SOPs were used to calculate flow data.

Item (3) - How was the method of concentration calculated? If not an EPA method, give a brief justification and provide supporting calculations.

For the page C-13 example, the emission rate was calculated based on the mass balance of materials.

Item (4) - What was the "HAP" stream concentration? "Attachment I" does not provide "C".

Attachment I was originally intended to show the results of emission calculations from all HAPs emitted from a process vent. The attachment, however did not always show all input data included on the sample calculation form. Attachment I has been revised for all process vents to include all the variables used in the process vent emission calculation equation.

Item (5) - What are the numbers that go in the brackets to obtain 91.153 Mg/yr of uncontrolled emissions?

As mentioned, a sample calculation form has been completed for a HAP emitted from that vent. The data on the sample calculation sheet shown in Attachment I can be directly input to the brackets of the equation to determine emissions.

Item (6) - What are the numbers that go in the brackets to obtain 5.239 Mg/yr of HAP emissions?

Please see the answer to Question 5.

Item (7) - What is the basis for the numbers submitted in Attachment III?

The use of Attachments II and III has been eliminated. The HCl and EC emissions for EIQ 304 presented on page C-13 of the January 1992 report was calculated based on mass balance.

Item (8) - To facilitate review, please substitute real names and HAP amounts instead of "See Attachment....".

All HAPs emitted from a process vent are listed below the source entry line or, if only a single HAP is emitted, on the HAP entry line on the process vent form. The total for the specific HAP, and the total emissions for all HAPs is included on the process vent form and in Attachment I.

Request # 7. **In example on B-16, where EPA Test Methods were used, please describe any problems encountered during testing. If none, state so. This applies to all instances where this was omitted.**

Response: On each of the process vent forms, an answer has been provided as requested. As an example, on page B-16 the answer supplied was "none identified."

Request # 8. **HAP emissions based on "Emergency" situations cannot be included in the base year emissions. See D-13. This applies to all instances where "Emergency" emissions were used.**

Response: The "emergency" mode occurs when emissions that would normally vent to a specific location are diverted through an alternate vent. The "emergency" vent emissions occur when process conditions or equipment reach a preset action level as defined in the process safety design, and emissions are vented to a scrubber. These releases were redefined as "non-routine" releases in the revised EC document. The actions that cause "non-routine" releases do not result in operating unit shutdown.

Emissions resulting in incinerator and process unit shutdowns (pumps, compressors, reactors, etc.) are not included in the base year emission calculations. These releases are reported under CERCLA and SARA release reporting requirements.

Request # 9. **The emission reductions from scrubber for EDC Process Unit (EIQ 300 and 301 Table D-2) when compared to 1987 base year data do n t tally with the 99.99% control shown in the report.**

Response: The values reported for 1994 are the non-routine emissions. EIQ 300 and 301 have three scenarios (non-routine, startup and shutdown) and in 1987 had a scrubber for emission control. These vents are to be incinerated in 1994 at an efficiency of 99.99%. However, only the startup and shutdown scenarios will be incinerated leaving the non-routine emissions to be vented through the scrubber.

In general, when a vent having the three scenarios of non-routine, startup and shutdown is to be incinerated, only its startup and shutdown scenarios will be incinerated. The non-routine emissions will not be incinerated. In addition to EIQ 300 and 301, EIQ 302C is controlled in this manner. Therefore, the 1994 emissions reported for EIQ 302C also reflect the non-routine emissions from that vent. Detailed calculations are included as an attachment to this letter.

Request # 10. **The emission reductions from Higher Efficiency Scrubber for Chlorine Manufacturing Unit (EIQ 101 Table B-2) when compared to 1987 base year data do not tally with the 99.99% control shown in the report.**

Response: The reported emissions are correct, however, the control efficiencies shown on Tables B-1 and B-2 are reported incorrectly. The controlled chlorine emissions in 1987 were the following:

Uncontrolled emissions equaled 4.652 Mg/yr (see page B-17). The control efficiency in 1994 will be 99.9%. The emissions in 1994 will therefore be:

$$4.652 \times (1 - 0.999) = 0.005 \text{ Mg/yr}$$

Request # 11. **For all the HAPS listed, please include CAS numbers.**

Response: Table 3 lists all the CAS numbers for each of the HAPs reported in the Enforceable Commitment document.

Request # 12. **For LDEQ to verify permitted emissions for the 1987 base year, please submit a list of permits issued, their numbers, date of issuance and a new to old EIQ number cross reference.**

Response: A list of permits and a new to old EIQ reference are shown in Table 4.

PPG looks forward to participating in EPA's Early Reduction Program. Should there be any further questions, please feel free to contact me at (318) 491-4823.

Very truly yours,

David C. Angell

Dave Angell
Works Director
Environmental Assurance

DA/mm:5510-016-114/5510L016.002

Attachments

cc: Chris Roberie, Acting Division Administrator
Air Quality Compliance Division
Louisiana Dept. of Environmental Quality, Baton Rouge

David Beck, OAQPS
Emissions Standards Division (MD-13)
Research Triangle Park, NC

TABLE 1
EIQ DESCRIPTIONS

EIQ No.	Unit	Vent Description	Tank Description
310	TE-II	DCE Tank Vents	No. 1 DCE Storage Tank No. 2 DCE Storage Tank
312	EDC	LP-EDC Process Tanks	EDC Bottom Storage Tank No. 2 EDC Bottom Storage Tank No. 4
313	EDC	No. 1 North Dock EDC Tank	No. 1 Dock EDC Tank No. 2 Dock EDC Tank
315	TE-II	EDC Crude and Storage	No. 1 OHC Product Tank No. 2 OHC Product Tank No. 1 OHC Crude Storage Tank No. 2 OHC Crude Storage Tank
324	TE-II	MC Process Storage	No. 1 DOL/SBL Tank No. 2 DOL/SBL Tank DOL/DOX SBL Tank S-1 Tank S-2 Tank S-3 Tank S-4 Tank No. 1 Day Tank No. 2 Day Tank No. 3 Day Tank No. 4 NRE Tank
325	PER/TRI	MC Dock Storage	No. 1 Triethane Dock Storage Tank No. 2 Triethane Dock Storage Tank No. 3 Triethane Dock Storage Tank
327	PER/TRI	Per Dock Storage	No. 1 Per Dock Tank No. 2 Per Dock Tank No. 3 Per Dock Tank
328	PER/TRI	Per Process Storage	DG 3 Per 232 Batch Tank DG 4 Per 232 Batch Tank No. 1 DG Per Stab. Tank No. 2 DG Per Stab. Tank Per 232 Shipping Tank No. 1 Per Stab. Tank No. 2 Per Stab. Tank
330	PER/TRI	Tri Dock Storage	TRI-Dock Storage Tank No. 1 TRI-Dock Storage Tank No. 2 TRI-Dock Storage Tank No. 3
331	PER/TRI	Tri Process Storage	No. 1 HP Stab. Tank No. 2 HP Stab. Tank No. 1 TRI Stab. Tank No. 2 TRI Stab. Tank

SL 025828

TABLE 1 (Cont'd)
EIQ DESCRIPTIONS

EIQ No.	Unit	Vent Description	Tank Description
333	WTU	Per/Tri Feed Tanks	Area Bottoms Tank No. 1 Area Bottoms Tank No. 2
338	EC	HCl Tails Tower Scrubber	No. 1 HCl Acid Tank No. 2 HCl Acid Tank Weak No. 1 HCl Acid Tank Weak No. 2 HCl Acid Tank
344A	WTU	Bottoms Plant Tank	Bottoms Plant Feed Tank No. 1 Bottoms Plant Product Tank No. 1 Bottoms Plant Product Tank No. 2 Bottoms Plant Product Tank No. 3 Sludge Box
348B	WTU	Incinerator Tanks Scrubber	WTU Surge Tank No. 1 WTU Surge Tank No. 2 WTU Settling Tank No. 1 WTU Settling Tank No. 2
360	PER/TRI	Per/Tri Still Line Tank	No. 1 Still Line Feed Tank No. 2 Still Line Feed Tank No. 1 Aux Line Feed Tank No. 2 Aux Line Feed Tank No. 3 Aux Line Feed Tank No. 4 Aux Line Feed Tank No. 5 Aux Line Feed Tank No. 6 Aux Line Feed Tank No. 7 Aux Line Feed Tank No. 8 Aux Line Feed Tank No. 9 Aux Line Feed Tank No. 10 Aux Line Feed Tank Heavies Still Feed Tank No. 1 Per/Tri Bottoms Tank No. 2 Per/Tri Bottoms Tank TCE Storage Tank Per/Tri Bottoms Tank No. 1 Per/Tri Bottoms Tank No. 2 Dowtherm "A" Make-up Tank Dowtherm Recycle H_2O Recovery
369	Chlorine	No. 1 HCl Acid Storage Tank Scrubber	No. 1 HCl Storage Tank No. 2 HCl Storage Tank
375	WTU	HCl Acid Formate Destruction	HCl Acid Tank (Sodium Formate Destruction) Combination of Sewers HCl Acid Tank Weak HCl Acid Tank

SL 025829

SL 025830

TABLE 2
CHEMICAL PRODUCTION RATES

Name		Annual Volume Loaded				
		Drums gal/yr	Tank Truck gal/yr	Tank Cars gal/yr	Barges gal/yr	Ships gal/yr
Chloroethane (Ethyl Chloride)	EC	0.0	1434393.0	5452482.0	0.0	0.0
1,2-Dichloroethane	EDC	2677.0	706883.0	187686.0	12219254.0	1777361.0
Methylene Chloride	$MeCl_2$	1629.0	145810.0	0.0	0.0	0.0
Perchloroethylene	PER	10556.0	618706.0	2117044.0	2125293.0	1994353.0
Trichloroethylene	TRI	58763.0	796673.0	1683653.0	583519.0	1328619.0
Methyl Chloroform	MC	237734.7	1872179.9	3520965.6	2897367.7	6297957.2

TABLE 3
LIST OF HAP CHEMICALS

CAS No.	HAPs	Acronym
56-23-5	Carbon Tetrachloride	CCl4
67-66-3	Chloroform	CHCl3
67-72-1	Hexachloroethane	HEXA
71-55-6	Methyl Chloroform	MC
74-87-3	Methyl Chloride	MECl
75-00-3	Ethyl Chloride (Chloroethane)	EC
75-01-4	Vinyl Chloride	VC
75-09-2	Methylene Chloride	MECl2
75-34-3	1,1-Dichloroethane	DCE
75-35-4	Vinylidine Chloride	VDC
79-00-5	1,1,2-Trichloroethane	TCE
79-01-6	Trichlorethylene	TRI
79-34-5	1,1,2,2-Tetrachloroethane	SYM
79-46-9	2-Nitropropane	NTE
87-68-3	Hexachlorobutadiene	HCBD
92-52-4	Biphenyl	BIPHEN
106-46-7	1,4-Dichlorobenzene	1,4 DICH
106-88-7	1,2 Epoxy Butane (Butylene Oxide)	BLM
107-06-2	Ethylene Dichloride (1,2 Dichloroethane)	EDC
108-88-3	Toluene	TOL
108-90-7	Chlorobenzene	C6H5Cl
118-74-1	Hexachlorobenzene	HCB
123-91-1	1,4 Dioxane	DOX
127-18-4	Perchloroethylene	PER
7439-97-6	Mercury	Hg
7647-01-0	Hydrogen Chloride	HCl
7782-50-5	Chlorine	Cl2

TABLE 4
LIST OF EXISTING AIR QUALITY PERMITS AND EIQ CROSS-REFERENCE NUMBERS

New EIQ	Old EIQ	Permit No.	Permit Date
100	56	G.f.	---
101	57	G.f.	---
102	58	G.f.	---
103	89	G.f.	---
105	7-73	290	2/74
106	3-80	1430T	9/80
107	4-80	1430T	9/80
109	2-80	1430T	9/80
128	---	None	---
130	---	None	Exemption 11/91
300	20	2105	12/91
301	22	2105	12/91
302	---	2105	12/91
302A	24	923T	4/78, consolidated into EIQ 302, Permit No. 2105, 12/91
302C	---	923T	4/78, consolidated into EIQ 302, Permit No. 2105, 12/91
302D	---	None	consolidated into EIQ 302, Permit No. 2105, 12/91
303	26	G.f.	---
304	36	G.f.	---
305	4-74	442	4/75, revised 7/78
306	3-76	698	2/77
307A	3-78A	897	2/78
307B	3-78B	897	2/78
308	33	923T	4/78
309	1-86	1929	5/86
310	2-74	442	4/75, revised under 1154T, 5/79
311A	68	G.f.	---

TABLE 4 (Cont'd)
LIST OF EXISTING AIR QUALITY PERMITS AND
EIQ CROSS-REFERENCE NUMBERS

New EIQ	Old EIQ	Permit No.	Permit Date
311B	--	None	---
312	69	1305T	12/79, revised 11/80
313	70	G.f.	---
314	1-74	1305T	12/79, revised 11/80
315	2-76	698	2/77
316	72-1	G.f.	---
317	72-6	G.f.	---
318	72-7	G.f.	---
319	72-8	G.f.	---
320	72-9	G.f.	---
321	72-10	G.f.	---
322	72-11	G.f.	---
323	72-12	G.f.	---
324	3-74	442	4/75, revised 7/78, revised 4/79, revised in permit 1154T 5/79
325	5-74	442	4/75, revised 7/78, revised in permit 1154T 5/79
326	108	G.f.	---
327	74	G.f.	---
328	75	G.f.	---
329	109	G.f.	---
330	76	G.f.	---
331	77	G.f.	---
332	80	G.f.	---
333	81	G.f.	---
334	110	G.f.	---
335	87	G.f.	---
336	2-82	1658T	12/81
337	32	G.f.	---

TABLE 4 (Cont'd)
LIST OF EXISTING AIR QUALITY PERMITS AND
EIQ CROSS-REFERENCE NUMBERS

New EIQ	Old EIQ	Permit No.	Permit Date
338	38	G.f.	---
339	78	G.f.	---
340	90	G.f.	---
341	11-78	None assigned	2/79
342	79	G.f.	---
343	1-80	1476T	11/80
344A	83	G.f.	---
344B	83	2040	12/90
345	1-75	2040	12/90
346	1-77	2040	12/90
347	1-78	897	2/78
348A	3-83	2040	12/90
348B	--	G.f.	---
353	--	G.f.	---
355	--	None	---
356	--	None	---
357	--	None	---
358	--	None	---
359	--	None	---
360	--	None	---
361	--	None	---
362	--	None	---
363	--	None	---
365	--	None	---
369	--	None	---
370	--	None	---
371	--	None	---
373	--	None	---
374	--	None	---
375		None	---

SL 025834

TABLE 4 (Cont'd)
LIST OF EXISTING AIR QUALITY PERMITS AND
EIQ CROSS-REFERENCE NUMBERS

New EIQ	Old EIQ	Permit No.	Permit Dat
376	--	None	---
377	--	None	---
380	--	None	---
381	--	None	---
382	--	None	---
383	--	None	---
384	--	None	---
385	--	None	---
386	--	None	---
387	--	None	---
388	--	None	---
389	--	None	---
390	--	None	---
391	--	None	---
392	--	None	---
393	--	None	---
394	--	None	---

G.f. - Grandfather permit status.

RESPONSE TO QUESTION 9

SL 025837

RESPONSE TO QUESTION 9

As explained in the response to Question 9, the reported emissions for EIQ 300 and 301 in 1994 when compared to 1987 base year date do not tally with the 99.99%. Control shown in the report, because the non-routine emissions will not be incinerated in 1994. Detailed calculations are as follows:

	Non-Routine			Start-Up			Shut-Down		
	Emission	Percent Control	Controlled Emission	Emission	Percent Control	Controlled Emission	Emission	Percent Control	Controlled Emission
EIQ 300, 1987;									
EC	0.015	5.0	0.01425	0.002	5.0	0.0019	0.00	5.0	0.00
EDC	0.058	5.0	0.0551	0.087	5.0	0.0826	0.024	5.0	0.023
HCl	0.147	99.0	0.00147	0.003	99.0	0.000	0.00	99.0	0.00
			0.071			0.0845			0.023
EIQ 300, TOTAL EMISSIONS (1987) = 0.1785 Mg/yr									
EIQ 300, 1994;									
EC	0.015	5.0	0.01425	0.002	99.99	0.00	0.00	99.99	0.00
EDC	0.058	5.0	0.0551	0.087	99.99	0.00	0.024	99.99	0.00
HCl	0.147	99.0	0.00147	0.003	99.0	0.00	0.00	99.0	0.00
			0.071			0.00			0.00
EIQ 300, TOTAL EMISSIONS (1994) = 0.071 Mg/yr									

RESPONSE TO QUESTION 9 (CONT'D)

	Non-Routine			Start-Up			Shut-Down		
	Emission	Percent Control	Controlled Emission	Emission	Percent Control	Controlled Emission	Emission	Percent Control	Controlled Emission
EIQ 301, 1987;									
EC	0.157	5.0	0.149	0.014	5.0	0.0133	0.0	5.0	0.0
EDC	0.487	5.0	0.4626	0.562	5.0	0.534	1.17	5.0	1.111
HCl	0.236	99.0	0.00236	0.021	99.0	0.0002	0.0	99.0	0.0
			0.614			0.5495			1.111
EIQ 301, TOTAL EMISSIONS (1987) = 2.273 Mg/yr									
EIQ 301, 1994;									
EC	0.157	5.0	0.149	0.014	99.99	0.0	0.0	99.99	0.0
EDC	0.487	5.0	0.4626	0.562	99.99	0.0001	1.17	99.99	0.0
HCl	0.236	99.0	0.00236	0.021	99.0	0.0	0.0	99.0	0.0
			0.614			0.0001			0.0
EIQ 301, TOTAL EMISSIONS (1994) = 0.614 Mg/yr									

SL 025838

PPG Industries, Inc.

Lake Charles, Louisiana

Enforceable Commitment

Volume I: General Distribution

ENSR Consulting and Engineering

Submitted January 1992

Revised May 1992

Document Number 5510-016-114

SL 025839

CONTENTS

CONTENTS
(Cont'd)

SL 025841

CONTENTS
(Cont'd)

SL 025842

CONTENTS
(Cont'd)

APPENDICES (Cont'd)

LIST OF TABLES

LIST OF TABLES
(Cont'd)

LIST OF FIGURES

The following are enclosed as Volume II: Confidential

LIST OF FIGURES
(Cont'd)

CERTIFICATE OF ENFORCEABLE COMMITMENT

PPG Industries, Inc. (PPG) seeks to participate in and receive the benefits of the Early Reductions Program in accordance with 40 C.F.R.§63, Subpart D. An Enforceable Commitment has been prepared for the PPG Industries, Inc. facility located in Lake Charles, Louisiana. This report presents the details of the Enforceable Commitment required to demonstrate that a 90 percent reduction in Hazardous Air Pollutants (HAPs) will be achieved by January 1994. The base year selected for the facility is 1987. The "source" is defined as all Synthetic Organic Chemical Manufacturing Industry (SOCMI) activities that occur within the contiguous property boundary of the facility. The 90 percent reduction in HAPs scheduled to occur at the Lake Charles plant prior to January 1, 1994 is derived from this SOCMI source.

I certify, as the Works Director, Environmental Assurance, for PPG Industries, Inc., that to the best of my knowledge the base year emissions presented in this report are accurate, and I acknowledge that these emission numbers are being submitted in response to an EPA request under Section 114 of the Clean Air Act. Furthermore, I commit to achieve before January 1, 1994 the stated post-reduction emission levels at the source. This compliance strategy will provide the 90 percent reduction required to qualify for the compliance extension from the Hazardous Organic NESHAP (HON) Section 112(d) standard. I also acknowledge that this commitment is enforceable as specified in 40 C.F.R.§63, Subpart D.

David C. Angell
Name

May 22, 1992
Date

David C. Angell
Name

Works Director, Environmental Assurance
Title

Signed earlier on January 17, 1992 by Richard Rompala, Group Vice President, Chemicals, and submitted to EPA on January 20, 1992.

SL 025847

1.0 INTRODUCTION

This report discusses an emission reductions program that will be implemented at the PPG Industries, Incorporated, Chemical Division, (PPG) facility located at Lake Charles, Louisiana. This program commits PPG to achieve a 90 percent reduction in emissions of volatile organic hazardous air pollutants (HAP) by the January 1, 1994 regulatory deadline. This action will qualify PPG for participation in EPA's Early Reduction Program (ERP) in accordance with Title 40, Part 63, Subpart D of the Code of Federal Regulations. By participating in the early reductions program, PPG expects to be granted a six-year extension in the compliance deadline for Maximum Achievable Control Technology (MACT) requirements contained in applicable Section 112(d) standards.

Participation in the ERP requires a source to achieve a 90 percent reduction in HAP emissions prior to proposal of a specific regulation, or to file an Enforceable Commitment to achieve the reductions by January 1, 1994. The nature of Synthetic Organic Chemical Manufacturing (SOCMI) operations at the PPG Lake Charles facility will not allow a 90 percent reduction to be realized prior to the expected Hazardous Organic NESHAP (HON) proposal date. HON is expected to be the first Section 112(d) standard to be proposed with MACT standards. Therefore, considering PPG's past efforts and future plans, with respect to emission reduction programs, an Enforceable Commitment is hereby submitted.

1.1 Overview

PPG operates a chemical-producing facility in Lake Charles, Louisiana. The facility produces vinyl chloride, ethyl chloride, ethylene dichloride, vinylidene chloride, transdichloroethylene, chlorinated solvents (perchloroethylene, trichloroethylene, methyl chloroform), chlorine, caustic, silica products, and chloropivaloyl chloride. The production of these chemicals at the plant causes a major portion of plant operations to be classified as SOCMI processes.

PPG has in recent years initiated several projects to reduce plant-wide HAP emissions. The projects completed to date have achieved emission reductions by instituting process changes, eliminating sources, and through the use of add-on control technology. Furthermore, the PPG Lake Charles facility is currently participating in the following programs:

- Voluntary program initiated by the Louisiana Department of Environmental Quality (LDEQ) to further reduce HAP emissions;
- Development and implementation of projects to reduce HAP emissions in response to recent LDEQ rules and future New Source Performance Standards (NSPS) regulating vapor emission from marine loading operations; and
- The EPA 33/50 Industrial Toxics Project, a part of the overall Pollution Prevention Strategy initiative.

The 1990 Clean Air Act Amendments (CAAA) call for the regulation of 189 HAP compounds over the next ten years. The CAAA requires EPA to define specific source categories that emit HAP emissions and develop MACT standards for each source category. This EPA regulatory strategy represents a shift in the focus of air toxic regulations from a compound to an emission source base. The first regulation scheduled for promulgation under Section 112 of the revised Clean Air Act is HON, which will address the SOCMI facilities. The HON regulation will affect PPG because the facility meets the following criteria:

- Produce one or more of an estimated 150 organic HAPs included in the CAAA list of 189 HAPs as a:
  - primary product
  - co-product, or
  - by-product.
- Use one or more of an estimated 150 organic HAPs as a reactant.

EPA anticipates proposing HON early in 1992. Since a majority of the emissions from the PPG Lake Charles plant are generated from SOCMI-related activities, HON will have a significant impact on the SOCMI activities. PPG is committed to reducing emissions in a timely, well planned manner. Because of emission reduction commitments initiated well before and since the 1990 CAAA were promulgated, PPG is in a position to participate in the Early Reduction Program.

1.2 Report Organization

This report contains the key components required by the EPA for review of an Enforceable Commitment. The organization of the report is outlined below.

- Definition of "Source" (Section 2.0);
- Selection of Base Year (Section 3.0); and
- Demonstration of 90 percent reduction (Section 4.0 and Appendices).

The Appendices accompanying this report include the following:

- A description of the facility and the process units;
- A discussion of the calculated base-year emissions;
- The proposed strategy to reduce base-year emissions by 90 percent;
- A discussion of the overall emission reductions; and
- The detailed calculations sheets that support the reported base-year emissions.

Each appendix is subdivided into several sections: a summary of emissions from the process unit followed by the detailed calculation forms and worksheets section. In the summary section, a description of the process is given followed by base-year and post-reduction emission estimates. Tables 1 and 2 in each summary section present the emission estimates for the base-year and post-reduction respectively. Table 3 in each summary section provides the summary of emissions for the subunit.

If the process unit contained storage or process tanks that emitted HAPs or separate subsection that discusses storage tank emissions was included in the appendix (Subsection A). This subsection contained a table showing tank emission calculations. A Tank Vent may be a point source for a single tank or a point source for several tanks. In either case, the emissions are calculated separately for each tank emitting through the vent. Total emissions for the Tank Vent is the addition of the emissions from all individual tanks calculated separately. This value is the reported emission estimate under the "HAP Emissions" column on Tables 1 and 2 in the summary section. A list of vapor pressures for pollutants can be found on Table 4-3.

A subsection that showed detailed process vent emission calculations was included in each appendix (Subsection B), calculation procedures for process vents are provided. A process vent may have several operational scenarios (non-routine, startup, or shutdown) and usually emits more than one HAP. For each scenario of each process vent, a sample calculation worksheet is provided which shows how the emissions were calculated for one of the HAPs in the vent. Following the sample calculation worksheet, a summary table (Attachment I) showing all HAPs emitted from that vent is provided. Process vents emitting only one HAP are provided with a calculation worksheet for that HAP only and do not have an Attachment I. Some process vents have non-routine scenarios which had no emissions in the base year (1987). These vents are provided with calculation worksheets showing zero for the emissions. The calculation worksheets for these vents only provide information on what HAPs could potentially be emitted.

2.0 SOURCE DEFINITION

The PPG Lake Charles plant manufactures chlorine, chlorinated organics, caustic, and silica products. Intermediate and final organic chemical products manufactured at the facility qualify the plant as a member of the Synthetic Organic Chemical Manufacturing Industry (SOCMI) group defined in Title 40, Part 60, of the Code of Federal Regulations (CFR). For the Early Reduction Program, an applicant must define the source to which the Enforceable Commitment will be binding, using the guidelines in Subpart D of 40 CFR 63.73. PPG defines the "source" for the Lake Charles facility as follows:

- Activities within the contiguous property boundary which will be subject to regulation under the Hazardous Organic NESHAP (HON), directly associated with the handling of raw materials, the handling, production or transport of intermediate and final products, and wastes of SOCMI chemicals, excluding all hazardous air pollutants (HAP) emissions from equipment leaks and non-SOCMI production units in operation at the facility. These activities are strictly limited to the those SOCMI chemical production units which are in operation prior to proposal of the HON. Included under this definition are all known points of emissions associated with the following list of activities:

    - Raw Materials Transport and Storage
    - Intermediate Product Storage and Handling
    - Final Product Storage and Handling
    - Waste Handling

The specific SOCMI production units present on-site at the time of this filing includes:

- Chlorine
- Ethyl Chloride (EC)/Hydrogen Chloride (HCl)
- Ethylene Dichloride (EDC)

- Perchloroethylene/Trichloroethylene (PER/TRI)
- Shipping/Loading Operations
- Tri-Ethane II● (Methyl Chloroform, MC)
- Vinyl Chloride (VCM-II)
- Vinylidene Chloride (VDCM)
- Waste Treatment Unit (WTU)

Not included under this definition are activities and HAP emissions associated with:

- On-site Power Generation
- Caustics Processing
- Silicas Plant

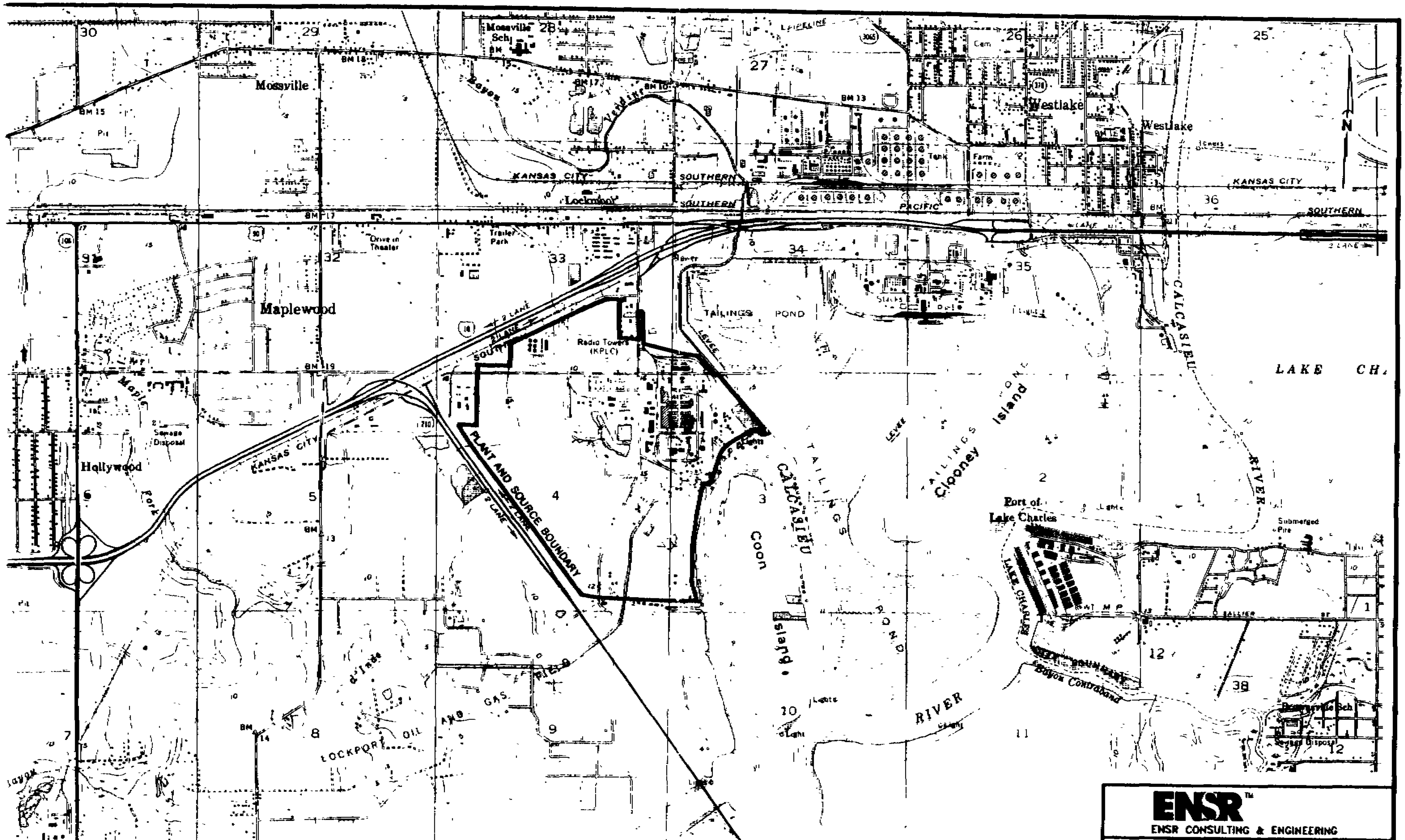
This definition meets the regulatory requirements outlined under Section 63.73(a)(1) as it addresses:

- A portion of an entire contiguous facility under common ownership or control,
- Activities defined by a standards under Section 112(d) of the Act.

The base-year HAP emissions from SOCMI production within the contiguous facility boundary exceeded 25 tpy. Therefore, the plant is classified as a major source under 40 CFR 63.73. Based on the HAP emission reductions scheduled to occur at this source by January 1, 1994, PPG expects that the Lake Charles facility will be granted a six-year extension from any and all Section 112(d) standards applicable to SOCMI activities at the facility.

Figure 2-1 shows the contiguous plant boundary for the PPG Lake Charles facility overlayed on a topographic map.

This section discusses the approach that was used to define HAP emissions from SOCMI activities. Section 2.1 discusses the process unit descriptions used to organize the information



ENSR CONSULTING & ENGINEERING

FIGURE 2-1
PLANT LOCATION
PPG INDUSTRIES, INC.
LAKE CHARLES, LOUISIANA

DRAWN. SJF	DATE 11-8-91	PROJECT NUMBER
APPV'D	REVISED	0-016-160

0 2000 4000
SCALE IN FEET

REFERENCE USGS Quadrangle Map for Westlake and Lake Charles, Louisiana, 1975

SL 025854

presented in the report and appendices. Section 2.2 defines the HAP emissions from the source that are included in the Enforceable Commitment.

2.1 Process Unit Description

The SOCMI chemical production activities at the Lake Charles plant are extensive. PPG has defined several independent areas of the facility, where similar activities are grouped into a single process unit. To prepare the Enforceable Commitment, the list of these process units was used to aid in organizing the information presented in this report. The process units used in this report are as follows:

- Chlorine
- Ethyl Chloride (EC)/Hydrogen Chloride (HCl)
- Ethylene Dichloride (EDC)
- Perchloroethylene/Trichloroethylene (PER/TRI)
- Shipping and Loading (S/L)
- Tri-Ethane® II (Methyl Chloroform, TE-II)
- Vinyl Chloride (VCM-II)
- Vinylidene Chloride (VDCM)
- Waste Treatment Unit (WTU)

Figure 2-2 is a plot plan showing the general location of the process units. Appendix A presents a detailed discussion of the major production activities that occur at the plant.

Chlorine is an important raw material used in the manufacture of chlorinated organics at the PPG Lake Charles facility. Therefore, the production of chlorine by electrolyzing sodium chloride in diaphragm and mercury cells is included in the PPG source definition.

The PPG facility also includes the following process units:

- Caustic,

SL 025856

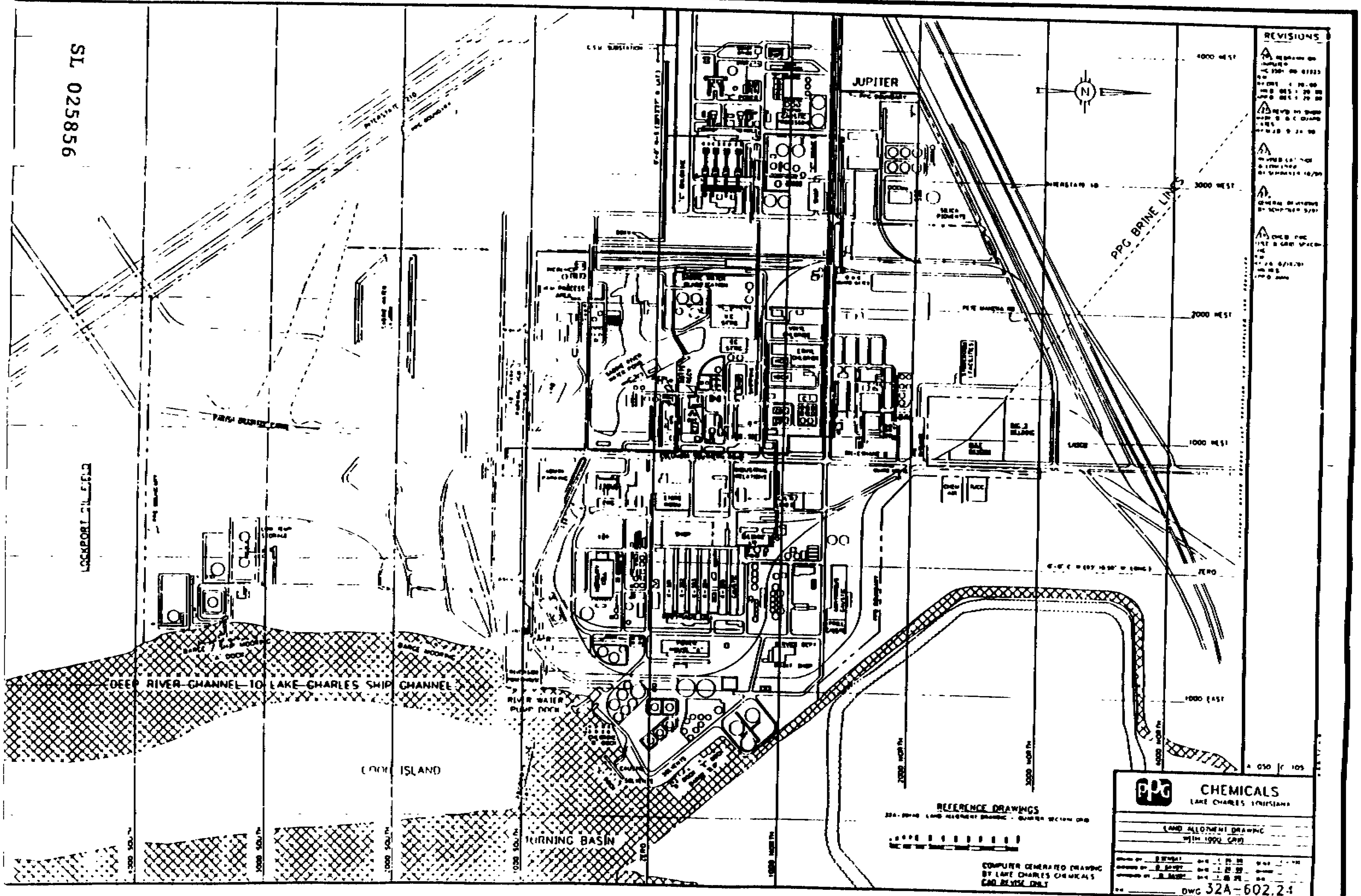


FIGURE 2-2
PLOT PLAN PRODUCTION UNIT LAYOUT

- Silica, and
- Power and Utilities.

Intermediate and final products from the Silica and Caustic units are not SOCMI processes. Power and Utility process systems are not addressed as they do not constitute a SOCMI facility as defined in the proposed Hazardous Organic NESHAP. Therefore, the activities from these units are not included in the definition of source.

2.2 Hazardous Air Pollutant (HAP) Emission Sources

HAP emissions were determined for each of the process units described in Section 2.1. The calculation of emissions was performed for the specific source types listed in the HON. This list includes:

- Process Vents,
- Storage Tanks,
- Transfer Operations (shipping and loading),
- Equipment Leaks, and
- Wastewater Treatment.

The HON will regulate equipment leaks as a source type. However, HAP emissions from equipment leaks from all production units were excluded from the definition of source. The decision to exclude equipment leaks from this Enforceable Commitment was based on uncertainties in establishing base-year emissions and calculating a control efficiency from the reductions associated with the leak detection and repair program at the PPG plant. Further, PPG has an intensive leak detection program in place that either currently meets MACT requirements or will require only minor modification to achieve compliance.

Table 2-1 lists the HAP emission points by process. Also shown in Table 2-1 is the type of emission source (process vent (P), storage tank (T), chlorine manufacturing building fugitive emissions (B), transfer operations (S/L), and wastewater (WW)). Each emission point is identified by a unique Emission Inventory Questionnaire (EIQ) number. The EIQ identifier is used for reporting emissions to the LDEQ. Generally, EIQ numbers from 100 to 199 are assigned to emission points in the chlorine and caustic production units. EIQ numbers from 300 to 399 are assigned to the production of organic chemicals.

TABLE 2-1

Emission Point Descriptions

EIQ No.	Unit	Description	Type
100	CHLORINE	Mercury Cell H_2 Vent	P
101	CHLORINE	Mercury Cell Cl_2 Neutralizer	P
102	CHLORINE	Fume System Endbox Vent	P
105	CHLORINE	Plant C Absorber	P
106	CHLORINE	Circuit 15 Neut. Tower	P
107	CHLORINE	Circuit 16 Neut. Tower	P
109	CHLORINE	Sulfur Chloride Vent	P
128	WTU	Outfall Sewer Vent Scrubber	P
130	CHLORINE	Sulfur Chloride Fume Scrubber	P
300	EDC	No. 1 LP-EDC Startup Scrubber	P
301	EDC	No. 2 LP-EDC Startup Scrubber	P
302	VDCM	VDCM/Trans Plant SU Scrubber	P
302A	VDCM	No. 3 LP-EDC Scrubber/VDCM Plant Vent	P
302C	VDCM	VDCM/No. 3 LP-EDC Scrubber	P
302D	VDCM	VDCM/Trans Scrubber	P
303	PER/TRI	Per/Tri Startup Scrubber	P
304	EC/HCl	EC Scrubber	P
305	TE-II	MC/DCE Startup Scrubber	P
306	TE-II	No. 2 OHC Startup Scrubber	P
307A	VCM-II	VCM-II Startup Scrubber	P
307B	VCM-II	VCM-II Startup Scrubber	P
308	S/L	VDCM Tank Car Vent	P

SL 025859

TABLE 2-1 (Cont'd)

Emission Point Descriptions

EIQ No.	Unit	Description	Type
309	WTU	CPC Unit Scrubber	P
310	TE-II	DCE Tank Vents	T
311A	WTU	No. 2 DH Still Tank	T
311B	WTU	Per/Tri Acid Steam Stripper System Scrubber	P
312	EDC	LP-EDC Process Tanks	T
313	EDC	No. 1 N. Dock EDC Tank	T
314	EDC	No. 1 EDC Tank	T
315	TE-II	EDC Crude and Storage	T
316	TE-II	MC Process Storage	T
317	TE-II	MC Process Storage	T
318	TE-II	MC Process Storage	T
319	TE-II	MC Process Storage	T
320	TE-II	MC Process Storage	T
321	TE-II	MC Process Storage	T
322	TE-II	MC Process Storage	T
323	TE-II	MC Process Storage	T
324	TE-II	MC Process Storage	T
325	TE-II	MC Dock Storage	T
326	TE-II	TE Shipping Tank	T
327	PER/TRI	Per Dock Storage Tank	T
328	PER/TRI	Per Process Storage	T
329	PER/TRI	Per 208 Shipping Tank	T
330	PER/TRI	Tri Dock Storage	T
331	PER/TRI	Tri Process Storage	T

TABLE 2-1 (Cont'd)

Emission Point Descriptions

EIQ No.	Unit	Description	Type
332	WTU	Bottoms Tank No. 6301	T
333	WTU	Per/Tri Feed Tanks	T
334	PER/TRI	Tri Shipping Tank	T
335	WTU	Puerto Rican Bottoms Tank	T
337	EC/HCl	VCM-I Plant Scrubber	P
338	EC/HCl	HCl Tails Tower Scrubber	P
339	PER/TRI	Per/Tri Still Line Scrubber	P
340	PER/TRI	Per/Tri DH System Vent Scrubber	P
341	PER/TRI	Per/Tri Acid Tank Scrubber	P
342	WTU	WTU Scrubber	P
343	WTU	S. Classifier Scrubber Vent	P
344A	WTU	Bottoms Plant Tank	T
344B	WTU	Bottoms Plant Scrubber	P
345	WTU	No. 1&2 Incinerator Sec. Scrubber	P
346	WTU	No. 3 Incinerator Sec. Scrubber	P
347	WTU	No. 4 Incinerator	P
348A	WTU	Incinerator Scrubber	P
348B	WTU	Incinerator Tanks Scrubber	T
353	TE-II	TCE/Tetra Tank	T
355	TE-II	No. 1 BLM Storage Tank	T
358	TE-II	TBL/MC Tank	T
359	PER/TRI	Per/Tri Product Dryer Regen.	P
360	PER/TRI	Per/Tri Still Line Tank	T
361	VDCM	TCE Tank	T

SL 025861

TABLE 2-1 (Cont'd)

Emission Point Descriptions

EIQ No.	Unit	Description	Type
362	PER/TRI	Per/Tri BLM Tank No. 1	T
363	PER/TRI	Per/Tri BLM Tank No. 2	T
365	CHLORINE	Brine/HCL Neut. Reactor Tank Vent Scrubber	T
369	CHLORINE	No. 1 HCL Acid Storage Tank Scrubber	T
370	CHLORINE	HCL Acid Head Tank Scrubber	T
371	CHLORINE	D.I. Tank Vent	T
373	EC/HCL	North Rubber Lined Acid Tank Scrubber	T
374	EC/HCL	South Rubber Lined Acid Tank Scrubber	T
375	WTU	HCL Acid Formate Destruction Unit	T
376	PER/TRI	Dowtherm "A" Makeup Tank	T
377	PER/TRI	Dowtherm Recycle H_2O Recovery Tank	T
380	WTU	North Dock G.W. Collection Tank	T
381	WTU	S. Terminal G.W. Collection Tank	T
382	WTU	West Vacuum Tank Vent	P
383	WTU	East Vacuum Tank Vent	P
384	WTU	G.W. Pumps Vent	P
385	WTU	North Classifier	WW
386	WTU	Lift Stations	WW
387	WTU	Surge Pond	WW
388	WTU	Vacuum Trucks	WW

SL 025862

TABLE 2-1 (Cont'd)

Emission Point Descriptions

EIQ No.	Unit	Description	Type
389	WTU	API Separator	WW
390	S/L	Ships	SL
391	S/L	Barges	SL
392	S/L	Railcar	SL
393	S/L	Tank Trucks	SL
394	S/L	Drums	SL

P - Process Vent
T - Storage Tank
WW - Fugitive emissions from wastewater
SL - Fugitive emissions from shipping and loading operations
Su - Startup mode operation
GW - Groundwater
Scr. - Scrubber
Sec. - Secondary
Neut. - Neutralization

3.0 BASE-YEAR SELECTION

Demonstrating compliance with the emission reduction requirements of the Early Reduction Program necessitates establishing the total base-year HAP emissions for the source. As required by EPA, "base-year emissions must represent actual and verifiable emissions for calendar year 1987 or later." Selection of a base year must ensure HAP emissions are not artificially or substantially higher than would occur under normal operations.

PPG has selected 1987 as the year for which the baseline emissions were calculated. The selection of 1987 is based on the following:

- Emissions in 1987 were not unusually high when compared to preceding and subsequent years and, therefore, are a reasonable representation of normal operations;

- Significant process modifications occurred in wastewater treatment methods in 1987 resulting in a significant reduction in HAP emissions; and

- PPG instituted a program of emissions reductions at the facility beginning in 1987 which included process changes, application of vent recovery, and incineration of process vents, also resulting in significant reductions in HAP emissions.

Table 3-1 shows the production data for the chemicals manufactured and shipped from the PPG facility for the years 1985 to 1990. In fact, none of the major chemicals were produced at their maximum rates during 1987. Trichloroethylene and vinylidene chloride emissions peaked in 1985 and 1986, respectively. The peak production of the other chemicals except chloropivaloyl chloride occurred after 1987.

TABLE 3-1

Production Rate (TPY)

Chemical	1985	1986	1987	1988	1989	1990
Chlorine	916,415	1,032,949	1,149,972	1,157,817	1,185,665	1,189,842
Ethylene Dichloride	515,386	634,767	729,419	727,674	853,922	893,881
Ethyl Chloride	22,934	28,854	24,894	30,235	42,990	60,232
Methyl Chloroform (Tri-Ethane® II)	74,452	82,821	83,710	79,602	81,251	89,927
Perchloroethylene	36,946	38,048	46,551	53,412	48,461	41,552
Trichloroethylene	28,008	21,441	25,254	26,241	27,464	24,245
Vinyl Chloride	254,502	298,416	344,661	343,652	356,335	369,064
Vinylidene Chloride	11,066	12,412	9,564	7,366	7,207	10,295
Transdichloroethylene	0	0	0	0	732	238
Chloropivaloyl Chloride	0	414	2194	1606	1571	805

- Peak Production Year
Shaded production totals are the highest production rate for each compound.

4.0 EARLY REDUCTION DEMONSTRATION

This section discusses the results of the base and post-reduction emission calculations. A detailed presentation of the emission calculation for each of the PPG process units is included in Appendices B through J. Also discussed in this section is the proposed strategy to achieve the 90 percent reduction required by the early reduction program.

4.1 Emissions Summary

Using representative stack sampling data and process specific information, emissions were calculated for the 1987 base year. Table 4-1 shows the unweighted and weighted base-year HAP emissions by process unit. The total unweighted base-year HAP emissions were 1634.192 Mg/yr compared to the total weighted HAP emissions of 2327.094 Mg/yr. The chemicals vinyl chloride, vinylidene chloride (1,1-dichloroethylene), and 1,1,2-2-tetrachloroethane were included in the list of high risk pollutants, and therefore, the base and post-reduction year emissions were multiplied by the factor 10 to determine the weighted HAP emissions.

Unweighted post-reduction emissions were determined from the base-year emissions and the percent additional control to be applied by PPG prior to January 1, 1994. This resulted in a predicted post-reduction total of 105.962 Mg/yr. Post-reduction weighted HAP emissions were calculated in the same manner noted above giving a total of 151.880 Mg/yr.

A 93.516 percent reduction in unweighted HAP emissions from SOCMI-related production at the PPG Lake Charles facility was calculated from the 1987 base-year emissions. For weighted HAP emissions, a 93.473 percent reduction was calculated. These reductions, which exceed 90 percent, qualify the PPG facility for participation in the early reduction program.

TABLE 4-1

Early Reductions Emission Summary

Process Unit	Unweighted HAP Emissions (Mg/Yr)		Weighted HAP Emissions (Mg/Yr)	
	Base Year	Post-Reduction	Base Year	Post-Reduction
Chlorine	0.192	0.056	0.192	0.056
Ethyl Chloride (EC)/ Hydrogen Chloride (HCl)	4.286	0.141	5.462	1.316
Ethylene Dichloride (EDC)	6.784	0.868	9.051	0.870
Perchloroethylene/ Trichloroethylene (PER/TRI)	206.784	25.535	366.552	52.705
Shipping and Loading (S/L)	164.402	9.637	164.402	9.637
Tri-Ethane®II (TE-II)	46.266	30.536	48.187	32.457
Vinyl Chloride (VCM-II)	11.690	9.434	15.923	9.435
Vinylidene Chloride (VDCM)	41.260	0.001	274.779	0.009
Waste Treatment Unit (WTU)	1152.528	29.754	1442.546	45.395
Total	1634.192	105.962	2327.094	151.880
Total Reduction		1528.231		2175.214
Percent Reduction		93.516		93.473

4.2 Emission Reduction Strategy

Table 4-2 presents the strategy that will be used to reduce the 1987 base-year emissions by the required 90 percent. The control device and the percent reduction in base-year emissions is shown.

In the chlorine process unit, most EIQ sources were controlled to levels of 90 percent or greater in 1987. Additional control will be placed on EIQ 101. Otherwise, no further controls will be applied at this production unit.

The majority of the emissions reductions in the wastewater treatment area was achieved by replacing the surge pond and API separator with surge tanks and clarifiers. A net reduction in unweighted HAP emissions of 1122.774 Mg/yr and weighted HAP emissions of 1397.151 resulted from these changes.

Another significant source of emissions to be controlled by January 1, 1994 is the transfer operations emissions from loading drums, tank trucks, railcars, barges, and ships. HAP emissions from tank trucks and railcars will be collected and routed to an existing incinerator. Refrigerated condensers (98 percent control) followed by carbon adsorption (98 percent control) will be used to reduce barge and ship loading emissions of ethylene dichloride. A total HAP emissions reduction of 154.765 Mg/yr is calculated for transfer operations.

The process vent and storage tank emissions will be reduced significantly using incineration and refrigerated condensers. In cases where incineration will be applied, non-routine emissions, have been estimated and are included in the emission totals. Non-routine emissions occur infrequently and are not expected to exceed 10 to 20 hours per year based on existing operating data. Further, projects are currently underway at the Lake Charles facility to improve the reliability of the existing incinerator systems, which will reduce the amount of non-routine emissions.

TABLE 4-2

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device 1987	Control Device 1994	1994 % Control
100	CHLORINE	Mercury Cell H_2 Vent	Vapor Rec	Vapor Rec	98.00
101	CHLORINE	Mercury Cell Cl_2 Neutralizer	Scrubber	Upgraded Scrubber	99.90
102	CHLORINE	Fume System Endbox Vent	Vapor Rec	Vapor Rec	99.00
105	CHLORINE	Plant C Absorber	Scrubber	Scrubber	99.90
106	CHLORINE	Circuit 15 Neutralizer Tower	Scrubber	Scrubber	99.90
107	CHLORINE	Circuit 16 Neutralizer Tower	Scrubber	Scrubber	99.90
109	CHLORINE	Sulfur Chloride Vent	Vapor Rec	Vapor Rec	99.90
128	WTU	Outfall Sewer Vent Scrubber	None	Scrubber	99.80
130	CHLORINE	Sulfur Chloride Fume Scrubber	Did Not Exist	Scrubber	100
300(NR)	EDC	No. 1 LP-EDC Startup Scrubber	Scrubber	Scrubber	5/99*
300(SU)	EDC	No. 1 LP-EDC Startup Scrubber	Scrubber	Incinerator	99.99
300(SD)	EDC	No. 1 LP-EDC Startup Scrubber	Scrubber	Incinerator	99.99
301(NR)	EDC	No. 2 LP-EDC Startup Scrubber	Scrubber	Scrubber	5/99*
301(SU)	EDC	No. 2 LP-EDC Startup Scrubber	Scrubber	Incinerator	99.99
301(SD)	EDC	No. 2 LP-EDC Startup Scrubber	Scrubber	Incinerator	99.99
302	VDCM	VDCM/Trans Plant SU. Scrubber	Did Not Exist	Incinerator	99.99
302A	VDCM	No. 3 LP-EDC Scrubber/VDCM Plant Vent	Scrubber	Deleted	100
302C(NR)	VDCM	VDCM/No. 3 LP-EDC Scrubber	Scrubber	EIQ 302	—
302C(SU)	VDCM	VDCM/No. 3 LP-EDC Scrubber	Scrubber	EIQ 302	—
302D	VDCM	VDCM/Trans Scrubber	Did Not Exist	EIQ 302	—
303(NR)	PER/TRI	Per/Tri Startup Scrubber	Scrubber	Scrubber	5/99*

TABLE 4-2 (Cont'd)

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device 1987	Control Device 1994	1994 % Control
303(SU)	PER/TRI	Per/Tri Startup Scrubber	Scrubber	Incinerator	99.99
304(NR)	EC/HCL	EC Scrubber	Scrubber	Scrubber	5/99*
304(SU)	EC/HCL	EC Scrubber	Scrubber	Incinerator	99.99
305(NR)	TE-II	MC/DCE Startup Scrubber	Scrubber	Scrubber	5/99*
305(SU)	TE-II	MC/DCE Startup Scrubber	Scrubber	Scrubber	5/99*
306(NR)	TE-II	No. 2 OHC Startup Scrubber	Scrubber	Scrubber	5/99*
306(SU)	TE-II	No. 2 OHC Startup Scrubber	Scrubber	Scrubber	5/99*
306(SD)	TE-II	No. 2 OHC Startup Scrubber	Scrubber	Scrubber	5/99*
307A(NR)	VCM-II	VCM-II Startup Scrubber	Scrubber	Incinerator	99.99
307A(SU)	VCM-II	VCM-II Startup Scrubber	Scrubber	Incinerator	99.99
307B(NR)	VCM-II	VCM-II Startup Scrubber	Scrubber	Scrubber	5/99*
307B(SD)	VCM-II	VCM-II Startup Scrubber	Scrubber	Scrubber	5/99*
308	S/L	VDCM Tank Car Vent	None	Incinerator	99.99
309(NR)	WTU	CPC Unit Scrubber	Scrubber	Scrubber	5/99*
310	TE-II	DCE Tank Vents	Ref. Cond.	Ref. Cond.	88.10
311A	WTU	No. 2 DH Still Tank	Scrubber	Scrubber	5/99*
311B	WTU	Per/Tri Acid Steam Stripper System	Did Not Exist	Scrubber	5/99*
312	EDC	LP-EDC Process Tanks	Scrubber	Incinerator	99.99
313	EDC	No. 1 North Dock EDC Tank	Ref. Cond.	Ref. Cond.	99.00
314	EDC	No. 1 EDC Tank	Scrubber	Incinerator	99.99
315	TE-II	EDC Crude and Storage	Ref. Cond.	Ref. Cond.	88.00

TABLE 4-2 (Cont'd)

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device		1994 % Control
			1987	1994	
316	TE-II	MC Process Storage	None	Incinerator	99.99
317	TE-II	MC Process Storage	None	Incinerator	99.99
318	TE-II	MC Process Storage	None	Incinerator	99.99
319	TE-II	MC Process Storage	None	Incinerator	99.99
320	TE-II	MC Process Storage	None	Incinerator	99.99
321	TE-II	MC Process Storage	None	Incinerator	99.99
322	TE-II	MC Process Storage	None	Incinerator	99.99
323	TE-II	MC Process Storage	None	Incinerator	99.99
324	TE-II	MC Process Storage	Ref. Cond.	Ref. Cond.	84.00
325	TE-II	MC Dock Storage	Ref. Cond.	Ref. Cond.	88.40
326	TE-II	TE Shipping Tank	None	Incinerator	99.99
327	PER/TRI	Per Dock Storage Tank	None	None	0.00
328	PER/TRI	Per Process Storage	Ref. Cond.	Ref. Cond.	73.10
329	PER/TRI	Per 208 Shipping Tank	None	Incinerator	99.99
330	PER/TRI	Tri Dock Storage	Ref. Cond.	Ref. Cond.	66.70
331	PER/TRI	Tri Process Storage	Ref. Cond.	Ref. Cond.	69.20
332	WTU	Bottoms Tank No. 6301	Scrubber	Incinerator	99.99
333	WTU	Per/Tri Feed Tanks	Scrubber	Incinerator	99.99
334	PER/TRI	Tri Shipping Tank	None	Incinerator	99.99
335	WTU	Puerto Rican Bottoms Tank	Scrubber	Removed	100.00
337	EC/HCL	VCM-I Plant Scrubber	Incinerator	Incinerator	99.99
338	EC/HCL	HCl Tails Tower Scrubber	Scrubber	Scrubber	5/99*

TABLE 4-2 (Cont'd)

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device 1987	Control Device 1994	1994 % Control
339	PER/TRI	Per/Tri Still Line Scrubber	Scrubber	Incinerator	98.00
340	PER/TRI	Per/Tri DH System Vent Scrubber	Scrubber	Scrubber	5/99*
341	PER/TRI	Per/Tri Acid Tank Scrubber	Scrubber	Incinerator	99.99
342	WTU	WTU Scrubber	Scrubber	Incinerator	99.99
343	WTU	S. Classifier Scrubber Vent	Scrubber	Incinerator	99.99
344A	WTU	Bottoms Plant Tank	Scrubber	Incinerator	99.99
344B	WTU	Bottoms Plant Scrubber	Incinerator	Incinerator	99.99
345	WTU	No. 1&2 Incinerator Secondary Scrubber	Scrubber	Scrubber	5/99*
346	WTU	No. 3 Incinerator Sec. Scrubber	Scrubber	Scrubber	5/99*
347	WTU	No. 4 Incinerator	Scrubber	Scrubber	5/99*
348A	WTU	Incinerator Scrubber	Scrubber	Deleted	100
348B	WTU	Incinerator Tanks Scrubber	Scrubber	Incinerator	99.99
353	TE-II	TCE/Tetra Tank	Scrubber	Scrubber	5.00
355	TE-II	No. 1 BLM Storage Tank	None	None	0.00
358	TE-II	TBL/MC Tank	None	Incinerator	99.99
359	PER/TRI	Per/Tri Product Dryer Regeneration	Scrubber	Cool Water Condenser	99.0
360	PER/TRI	Per/Tri Still Line Tank	Scrubber	Incinerator	99.99
361	VDCM	TCE Tank	Scrubber	Incinerator	99.99
362	PER/TRI	Per/Tri BLM Tank No. 1	None	None	0.0

TABLE 4-2 (Cont'd)

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device 1987	Control Device 1994	1994 % Control
363	PER/TRI	Per/Tri BLM Tank No. 2	None	None	0.0
365	CHLORINE	Brine/HCL Neut. Reactor Tank Vent Scrubber	Scrubber	Scrubber	99.0
369	CHLORINE	No. 1 HCL Acid Storage Tank Scrubber	Scrubber	Scrubber	99.0
370	CHLORINE	HCL Acid Head Tank Scrubber	Scrubber	Scrubber	99.0
371	CHLORINE	D.I. Tank Vent	Scrubber	Scrubber	99.0
373	EC/HCL	North Rubber Lined Acid Tank Scrubber	Scrubber	Scrubber	99.0
374	EC/HCL	South Rubber Lined Acid Tank Scrubber	Scrubber	Scrubber	99.0
375	WTU	HCL Acid Formate Destruction Unit	Scrubber	Scrubber	99.0
376	PER/TRI	Dowtherm "A" Makeup Tank	None	None	0.00
377	PER/TRI	Dowtherm Recycle H_2O Recovery Tank	None	None	0.00
380	WTU	N. Dock G.W. Collection Tank	None	None	0.00
381	WTU	S. Terminal G.W. Collection Tank	None	CB	98.0
382	WTU	West Vacuum Tank Vent	None	None	0.00
383	WTU	East Vacuum Tank Vent	None	None	0.00
384	WTU	Ground Water Pumps Vent	None	None	0.00
385	WTU	North Classifier	None	Replace	99.99
386	WTU	Lift Stations	None/Covered	Covered/CB	90.0
387	WTU	Surge Pond	None	Removed	100
388	WTU	Vacuum Trucks	None	Process Changes	98.0

TABLE 4-2 (Cont'd)

Strategy to Achieve Emissions Reductions

EIQ No.	Process Unit	Description	Control Device		1994 % Control
			1987	1994	
389	WTU	API Separator	None	Not in Service	100
390	S/L	Ships (EDC)	None	Ref. Cond./CB	99.96
		Ships (Other Chemicals)	None	None	0.00
391	S/L	Barges (EDC)	None	Ref. Cond./CB	99.96
		Barges (Other Chemicals)	None	None	0.00
392	S/L	Railcars	None	Incinerator	99.99
393	S/L	Tank Trucks	None	Incinerator	99.99
394	S/L	Drums	None	CB	98.0

Scr - Scrubber
Sec - Secondary
Ref. Cond. - Refrigerated Condenser
Vapor Rec - Vapor Recovery
Cool Wat - Cooling Tower Water
S/L - Shipping and loading fugitive emissions
NR - Non-Routine Operation
Su - Startup mode operation
SD - Shutdown Mode Operation
CB - Carbon adsorption
* - Scrubber has 5% efficiency for hydrocarbon and 99% efficiency for HCL

TABLE 4-3

Vapor Pressure of Pollutants

Chemical Name	Abbreviation	Vap. Press. @ 70F (psia)
Chloroform	$CHCl_3$	3.154
Trichloroethylene	Tri	1.45
Carbon Tetrachloride	CCl_4	1.767
1,2-Dichloroethane	EDC	1.33
1,1-Dichloroethane	DCE	3.67
1,1,2-Dichloroethane	Unsym	0.215
1,2-Dichloroethylene	CIS	3.33
Perchloroethlyene	Per	0.27
Ethyl Chloride	EC	20.37
Vinylidene Dichloride	VDCM	9.656
1,1,2-Trichloroethylene	TCE	0.38
Methyl Chloroform	MC	2.02
Vinyl Chloride	VC	51.35
1,1,2,2-sym-Tetrachloroethane	SYM	0.1
Methyl Chloride	MeCl	73.96
Pentachloroethane	Penta	0.069
Hexachloro 1,3-Butadiene	HCBD	0.002
Tert Butylalcohol	TBL	0.63
Hexachloroethane	HEXA	0.0083
Chlorobenzene	C6H5Cl	0.18
Heavy Chloride	Hvy-Chlori	0.046
1,4-Dioxane	DOX	0.55

Vapor Pressure of Pollutants

Chemical Name	Abbreviation	Vap. Press. @ 70F (psia)
Dioxolane	DOL	1.37
2-Nitropropane	NTE	0.2
Nitromethane	NRE	0.56
Sec-Butyl alcohol	SBL	0.17
1,2-Butylene Oxide	BLM	2.83
Hexachlorobenzene	HCB	0.03
Bromomethane	Bromo	0.07
Toluene	TLE	0.48
Trans 1,2-Dichloroethylene	trans	5.21
Dimethoxy methane	DME	6.38
Butyl Tertiary Ether	BTE	1.93
Penta Chloro Butadiene	PCBD	0.286
Methylene Chloride	MeCl2	7.74
n-Propanol	NPL	0.3
Biphenyl	Biphenyl	0.052
Hydrogen Chloride (Aqueous)	HCl	(6% HCl) 0.000147* (20% HCl) 0.003965* (30% HCl) 0.205*

* These are partial pressures at 70°F.

5.0 GLOSSARY OF ABBREVIATIONS

Adsorption	Adsorp
American Petroleum Institute	API
Best Available Technology	BAT
Carbon Bed Adsorption	CB
Carbon Tetrachloride	CCl_4
Chlorine	Cl_2
Chloroform	$CHCl_3$
Chloropivaloyl Chloride	CPC
Clean Air Act Amendments	CAAA
Code of Federal Regulations	CFR
Condenser	Cond
Dehydration	DH
1,1-Dichloroethane	DCE
Early Reduction Program	ERP
Emissions Inventory Questionnaire	EIQ
Ethyl Chloride	EC
Ethylene Dichloride (1,2-Dichloroethane)	EDC
Fugitive Emissions	F
Groundwater	G.W.
Hazardous Air Pollutant	HAP
Hazardous Organic NESHAP	HON
Hexachloro-1, 3-Butadiene	HCBD
Hexachloroethane	HEXA
Hydrogen Chloride	HCl
Liquid Phase	LP
Louisiana Department of Environmental Quality	LDEQ
Maximum Achievable Control Technology	MACT
Mercury	Hg
Methyl Chloride	MECl
Methyl Chloroform	MC
Methylene Chloride	$MECl_2$
Million Grams Per Year (Megagrams Per Year)	Mg/Yr
National Emission Standard for Hazardous Air Pollutant	NESHAP
Neutralizing	Neut
New Source Performance Standards	NSPS

2-Nitropropane	NTE
Non-Routine	NR
Oxygen	O_2
Oxyhydrochlorination	OHC
Perchloroethylene (Tetrachloroethylene)	PER
Plant	Plt
Pivaloyl Chloride	PC
Process Vent	P
Railcar	RC
Refrigerated	Ref
Refrigerated Vent Recovery	RVR
Scrubber	SCR
Secondary	Sec
Shipping and Loading	S/L
Shutdown	SD
Startup	SU
Storage Tank	T
Synthetic Organic Chemical Manufacturing Industries	SOCMI
Tank Truck	TT
Thermal Conductivity Detector	TCD
1,1,2,2-tetrachloroethane	SYM (TETRA)
Tons Per Year	tpy
Transfer Operations	S/L
Tri-Ethane® II Process Unit	TE-II
1,1,2-trichloroethane	TCE
Trichloroethylene	TRI
United States Environmental Protection Agency	EPA
Vinyl Chloride	VC
Vinyl Chloride Process Unit	VCM II
Vinylidene Chloride	VDC
Vinylidene Chloride Process Unit	VDCM
Waste Treatment Unit	WTU
Wastewater	WW
Water	H_2O

APPENDIX A
FACILITY DESCRIPTION

APPENDIX A

FACILITY DESCRIPTION

A.1 Facility Identifying Information

Company Name:	PPG Industries, Inc.
Address:	Columbia Southern Road P.O. Box 1000
City/State/Zip:	Lake Charles, LA 70602
Corporate Official:	Richard Rompala
Title:	Group Vice President, Chemicals
Telephone Number:	(412) 434-2515 (Business)
Address:	PPG Industries, Inc. One PPG Place
City/State/Zip:	Pittsburgh, PA 15272
Local Responsible Official:	Dave Angell
Title:	Works Director, Environmental Assurance
Telephone Number:	(318) 491-4823 (Business)
Address:	P.O. Box 1000
City/State/Zip:	Lake Charles, LA 70602
Local Plant Contact:	Lamar White
Title:	Manager, Derivatives
Telephone Number:	(318) 491-4712 (Business)
Local Plant Contact:	Jim Wyche
Title:	Environmental Manager
Telephone Number:	(318) 491-4830 (Business)

Source:

- Activities within the contiguous property boundary which will be subject to regulation under the Hazardous Organic NESHAP (HON), directly associated with the handling of raw materials, the handling, production or transport of intermediate and final products, and wastes of SOCMI chemicals, excluding all hazardous air pollutants (HAP) emissions from equipment leaks and non-SOCMI production units in operation at the facility. These activities are strictly limited to the those SOCMI chemical production units which are in operation prior to proposal of the HON. Included under this definition are all known points of emissions associated with the following list of activities:

    - Raw Materials Transport and Storage
    - Intermediate Product Storage and Handling
    - Final Product Storage and Handling
    - Waste Handling

The specific SOCMI production units present on-site at the time of this filing includes:

- Chlorine
- Ethyl Chlorine (EC)/Hydrogen Chloride (HCl)
- Ethylene Dichloride (EDC)
- Perchloroethylene/Trichloroethylene (PER/TRI)
- Shipping/Loading Operations
- Tri-Ethane II● (Methyl Chloroform, MC)
- Vinyl Chloride (VCM-II)
- Vinylidene Chloride (VDCM)
- Waste Treatment Unit (WTU)

Not included under this definition are activities and HAP emissions associated with:

- On-site Power Generation
- Caustics Processing
- Silicas Plant

This definition meets the regulatory requirements outlined under Section 63.73(a)(1) as it addresses:

- A portion of an entire contiguous facility under common ownership or control,
- Activities defined by a standards under Section 112(d) of the Act.

Activity Causing HAP Emissions:

Emissions of raw materials, intermediate products, by-products, and final products from process vents, storage tanks, shipping/loading, and waste treatment from the production of chlorinated organics and chlorine.

General Source Description:

The PPG Lake Charles facility is divided into three production areas:

- Plant A - Chlorine and Caustic Production
- Plant B - Chlorinated Organics Production
- Plant C - Chlorine, Caustic, and Silica Production

Several of the emissions vent identifications and the process flow diagrams discussed in the following appendices refer to Plant B, the chlorinated organics production area and Plants A and C, chlorine production.

Products manufactured in Plant B include vinyl chloride, chloropivaloyl chloride, transdichloroethylene, ethyl chloride, vinylidene dichloride, perchloroethylene, trichloroethylene, methyl chloroform, hydrogen chloride, and ethylene dichloride.. In addition to these finished products, several intermediate products are made and internally consumed. Table A-1 presents the primary products, by-products, and intermediates found in the plant and aids in understanding the nomenclature used in the following Appendices. Figure A-1 shows the interrelationships in the production processes.

The primary raw materials required in Plant B are ethylene and chlorine. Ethylene is purchased from the area petrochemical industry and chlorine is supplied from within the Lake Charles facility by Plant A. Because of the importance of chlorine as a raw material, and because chlorine is

TABLE A-1

Common Hydrocarbon Compounds Found in Plant B

Common Name	Abbreviation	Primary End Use
Ethylene	C2H4	Raw Material
Vinyl chloride	VC	Plastics
Vinylidene dichloride	VDC	Plastics
Cis-dichloroethylene	Cis	Intermediate By-Product
Trans-dichloroethylene	Trans	Intermediate By-Product
Trichloroethylene	TRI	Solvent
Perchloroethylene	PER	Solvent
Ethyl chloride	EC	Ethylene Glycol
Ethylene dichloride, (1,2-Dichloroethane)	EDC	Intermediate Product
1,1-Dichloroethane	DCE	Intermediate Product
Methyl chloroform, (1,1,1-trichloroethane)	MC	Solvent
1,1,2-trichloroethane	TCE	Intermediate Product
Unsymmetrical tetrachloroethane 1,1,1,2-tetrachloroethane	Unsym	Intermediate Product
Symmetrical tetrachloroethane 1,1,2,2-tetrachloroethane	Sym	Intermediate Product
Pentachloroethane	Penta	Intermediate Product
Hexachloroethane	Hexa	Undesirable By-Product
Hydrogen chloride	HCl	Muriatic Acid

Figure A-1: Plant B Chlorinated Organics Production Process Flow Diagram
See Volume II - Confidential

manufactured on site, HAP emissions from chlorine production are included in base-year emissions.

For organizational purposes, HAP emissions from the PPG facility are reported by functional unit. The functional units, discussed in detail in the following Appendices are as follows:

- Chlorine;
- Ethyl Chloride (EC)/Hydrogen Chloride (HCl);
- Ethylene Dichloride (EDC);
- Perchloroethylene/Trichloroethylene (Per/Tri);
- Shipping/Loading (S/L);
- Tri-Ethane® II (TE-II);
- Vinyl Chloride (VCM-II);
- Vinylidene Chloride (VDCM); and
- Waste Treatment Unit (WTU).

APPENDIX B
CHLORINE PROCESS UNIT

APPENDIX B

CHLORINE PROCESS UNIT

B.1 Process Description

Sodium chloride is electrolyzed in cells to produce chlorine and sodium hydroxide. The electrolysis is achieved in a series of mercury cells and diaphragm cells. The feed to the chlorine manufacturing processes is brine from salt domes mined at nearby facilities. The products of electrolysis are chlorine, sodium hydroxide, and hydrogen. Chlorine is used internally to manufacture chlorinated organics or is sold in the merchant market. Nearly all the caustic is sold and the hydrogen is burned as fuel or sold. Chlorine is produced in two areas of the PPG plant, designated as Chlorine Plants A and C. These two areas are combined as one production unit; the "Chlorine Manufacturing Unit" (CHLORINE). Figures B-1 and B-2 show the major equipment associated with both types of chlorine production.

The HAP emissions associated with chlorine manufacture are small amounts of Cl_2 gas and mercury vapors.

B.2 1987 Base-Year Emissions

Table B-1 shows the total base-year emissions for the chlorine process unit. The total unweighted HAP emissions were 0.1916 Mg/yr.

Since none of the sources emitted pollutants that are considered high risk pollutants and subject to multiplication by a weighting factor, the total weighted HAP base-year emissions equal the total unweighted HAP base-year emissions.

B.3 Emissions Reduction Strategy

Table B-2 shows the control strategy for the chlorine unit that will be implemented to help achieve a plantwide reduction in emissions for all SOCMI sources at the facility. Only one of the vents (EIQ 101, mercury cell Cl_2 neutralizer) will have additional controls, a higher efficiency scrubber, which will reduce the emissions from that vent to 0.005 Mg/yr.

Figure B-1: Diaphragm - Chlorine and Caustic Production
See Volume II - Confidential

Figure B-2: Mercury - Chlorine and Caustic Production
See Volume II - Confidential

SL 025890

P.4

TABLE B-1

1987 BASE YEAR EMISSIONS
CHLORINE MANUFACTURING

UNIT	EIQ	DESCRIPTION	TYPE	BASE YEAR			
				CONTROL DEVICE		HAP EMISSIONS	
				TYPE	% CONTROL	UNWEIGHTED MG/YR	WEIGHTED MG/YR
CHLORINE	100	Mercury Cell H2 Vent	P	Vapor Rec.	98.00	0.006	0.006
CHLORINE	101	Mercury Cell Cl2 Neutralizer	P	Scrubber	97.00	0.140	0.140
CHLORINE	102	Fume System Endbox Vent.	P	Vapor Rec.	99.00	0.042	0.042
CHLORINE	105	Plant C Absorber	P	Scrubber	99.90	0.002	0.002
CHLORINE	106	Circuit 15 Neut. Tower	P	Scrubber	99.90	0.000	0.000
CHLORINE	107	Circuit 16 Neut. Tower	P	Scrubber	99.90	0.000	0.000
CHLORINE	109	Sulfur Chloride vent	P	Vapor Rec.	99.90	0.002	0.002
CHLORINE	130	Sulfur Chloride Fume Scrubber	P	Did Not Exist	0.00	0.000	0.000
				Subtotal Process Vents		0.1916	0.1916
CHLORINE	365	Brine/HCl Neut. Reactor Tk. Vent Scr.	T	Scrubber	99.00	0.000	0.000
CHLORINE	369	No. 1 HCl Acid Storage Tank Scrubber	T	Scrubber	99.00	0.000	0.000
CHLORINE	370	HCl Acid Head Tank Scrubber	T	Scrubber	99.00	0.000	0.000
CHLORINE	371	D.I. Tank Vent	T	Scrubber	99.00	0.000	0.000
				Subtotal Tank Vents		0.000	0.000
				Total Base Year Emissions		0.192	0.192

FILE: CLBASE

SL 025891

TABLE B-2

EMISSIONS REDUCTIONS STRATEGY AND POST REDUCTION EMISSIONS CHLORINE MANUFACTURING

UNIT	EIQ	DESCRIPTION	TYPE	POST REDUCTION			
						HAP EMISSIONS	
				ADDITIONAL CONTROL	1994 % CONTROL	UNWEIGHTED MG/YR	WEIGHTED MG/YR
CHLORINE	100	Mercury Cell H2 Vent	P	None	98.00	0.006	0.006
CHLORINE	101	Mercury Cell Cl2 Neutralizer	P	Higher Efficiency Scr.	99.90	0.005	0.005
CHLORINE	102	Fume System Endbox Vent.	P	None	99.00	0.042	0.042
CHLORINE	105	Plant C Absorber	P	None	99.90	0.002	0.002
CHLORINE	106	Circuit 15 Neut. Tower	P	None	99.90	0.000	0.000
CHLORINE	107	Circuit 16 Neut. Tower	P	None	99.90	0.000	0.000
CHLORINE	109	Sulfur Chloride vent	P	None	99.90	0.002	0.002
CHLORINE	130	Sulfur Chloride Fume Scrubber	P	Scrubber	100.00	0.000	0.000
				Subtotal Process Vents		0.056	0.056
CHLORINE	365	Brine/HCl Neut. Reactor Tk. Vent Scr.	T	None	99.00	0.000	0.000
CHLORINE	369	No. 1 HCl Acid Storage Tank Scrubber	T	None	99.00	0.000	0.000
CHLORINE	370	HCl Acid Head Tank Scrubber	T	None	99.00	0.000	0.000
CHLORINE	371	D.I. Tank Vent	T	None	99.00	0.000	0.000
				Subtotal Tank Vents		0.000	0.000
				Total Post Reduction Emissions		0.056	0.056

FILE: CLPOST

B.4 Post-Reduction Emissions

Table B-3 shows the total weighted and unweighted HAP emissions for the chlorine process unit.

The total post-reduction emissions of 0.056 Mg/yr represent a 0.136 Mg/yr decrease (70.83% reduction) in base-year emissions.

SL 025893

TABLE B – 3

HAP EMISSIONS SUMMARY
CHLORINE PROCESS UNIT

Type (Units)	Unweighted HAP Emissions			Weighted HAP Emissions		
	Base Year (Mg/yr)	Post Reduction (Mg/yr)	Percent Reduction (%)	Base Year (Mg/yr)	Post Reduction (Mg/yr)	Percent Reduction (%)
P	0.192	0.056	70.83	0.192	0.056	70.83
T	0.000	0.000	0.00	0.000	0.000	0.00
F						
Total	0.192	0.056		0.192	0.056	
Total Percent Reduction (%)		70.83			70.83	

P – Process Vents
T – Tank Vents
F – Fugitive emissions

APPENDIX B-A
CHLORINE PROCESS UNIT
STORAGE TANK CALCULATIONS

SL 025895

Source: HON subunit(s) Chlorine Unit (Cl_2)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE)

HAP: Hydrogen Chloride (HCl) Date: 05/13/92
Year: 1987 Calculator: J. Greer

Tank Designation: EIO 365 Brine/HCl Neutralization Reactor Tank Scrubber (60-1602)
Product: Hydrogen Chloride HCl (20%)

Tank Characteristics

Inside diameter, (ft)	6	= D
Height, (ft)	8	= H_T
Capacity, (gal) = $\pi \frac{D^2h}{4} * 7.48 \frac{gal}{ft^3}$, if not known	1,900	= V
Roof color Yellow		
Shell color Yellow		
Vapor space height, (ft)[a]	4	= H

Ambient Conditions

Average atmospheric pressure (psia) (defaults 14.7 psia)	14.7	= P_A
Average ambient diurnal temperature (°F)[b]	18	= dT
Average annual ambient temperature (°F)	70	= T_A

Bulk Liquid Characteristics

Stored liquid temperature (°F)[c]	70	= T_S
Total throughput per year (gal)	913,997	= A_N
Number of turnovers per year[d]	481.05	= N
Molecular weight of HAP (lb/lb mole)	36.46	= M_v
Mole percent of HAP	11.0	= %
Partial pressure of the HAP at liquid conditions (psia)	0.000435	= P

Adjustment Factors

Paint factor	1.3	= F_P
Small diameter tank factor[e]	0.2824	= C
Turnover factor[f]	0.23	= K_N
Product factor[g]	1.0	= K_C

SL 025896

Source: HON subunit(s) Chlorine Unit (Cl_2)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Baseline Control

Control device Scrubber
HAP control efficiency (%) 99% = eff

Calculations[h]

Breathing Loss (Mg/yr) =

$$L_B = 1.02E\text{-}05\ (M_V)\left[\frac{(P)}{(P_A) - (P)}\right]^{0.68} (D)^{1.73}(H)^{0.51}(dT)^{0.50}(F_P)(C)(K_C)$$

$$= 1.02E\text{-}05\ (36.46)\left[\frac{0.000435}{14.7 - 0.000435}\right]^{0.68} (6)^{1.73}(4)^{0.51}(18)^{0.50}(1.3)(0.2824)(1)$$

$$= \boxed{2.17\text{x}10^{-5}\ \text{Mg/yr}}$$

Working Loss (Mg/yr) = L_W = 1.09E-08 $M_V P\ VNK_N K_C$
= 1.09E-08 (36.46) (0.000435) (1,900) (481.05) (0.23) (1)

$$= \boxed{3.62\text{x}10^{-5}\ \text{Mg/yr}}$$

Total Loss (Mg/yr) =

$$T_L = L_B + L_W = (2.17 \times 10^{-5}) + (3.62 \times 10^{-5})$$
$$= \boxed{5.79\text{x}10^{-5}\ \text{Mg/yr}}$$

If a control device is employed,

HAP Emissions (E_{HAP}) = Total Loss (1 - eff/100)
= 5.79×10^{-5} (1 - 99/100)

$$= \boxed{5.79\text{x}10^{-7}\ \text{Mg/yr}}$$

SL 025897

Source: HON subunit(s) Chlorine Unit (Cl_2)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Calculation (Continued)

Weighted HAP Emissions[i] $= E_{HAP} \quad F_{HR}$
$= (5.79 \times 10^{-5}) \quad (1)$
$= \boxed{5.79\times10^{-7}\ \text{Mg/yr}}$

[a]If vapor space height is unknown for shell, assume H equals one half tank height. If tank has a cone roof, adjust vapor space height by adding 1/3 of height of cone.

[b]If average ambient diurnal temperature change is unknown, assume 20°F.

[c]Stored liquid temperature may be approximated from average annual ambient temperature.

[d]$N = \frac{AN}{V}$ where N = number of turnovers per year
AN = total throughput per year (gal)
V = tank capacity (gal)

For D≥ 30ft, C=1; For 6 ≤ D < 30 ft, C = 0.0771D-0.0013D2-0.1334.

[f]For turnovers > 36, $K_N = (180 + N)/(6 * N)$
where K_N = turnover factor (dimensionless)
N = number of turnovers per year
For turnovers ≤ 36, $K_N = 1$

[g]$K_C = 1.0$ for volatile organic liquids

[h]Expression for computing HAP emissions are from "Procedures for Establishing Base Year and Post-Reduction HAP Emissions." The calculation procedure is consistent with AP-42.

[i]For emissions of other HAPs from this EIQ, see summary of calculated emissions from fixed roof storage tanks.

SL 025898

SL 025899

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE CHLORINE PROCESS UNIT (CL2)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
365	60-1602	Brine/ HCL Neut. Reactor Tank Vent Scrubb	H20*	89.00	Yellow	6.00	1900	4.00	70.00	481.05	18.020	0.177	1.30	0.2824	0.23
365	60-1602	Brine/ HCL Neut. Reactor Tank Vent Scrubb	HCL	11.00	Yellow	6.00	1900	4.00	70.00	481.05	36.460	0.000	1.30	0.2824	0.23
369	60-918	#1 HCL Storage Tank	H20*	82.52	Amber	12.00	31300	10.00	70.00	47.43	18.020	0.086	1.30	0.6046	0.80
369	60-918	#1 HCL Storage Tank	HCL	17.48	Amber	12.00	31300	10.00	70.00	47.43	36.460	0.036	1.30	0.6048	0.80
369	60-919	#2 HCL Storage Tank	H20*	82.52	Amber	12.00	31300	10.00	70.00	23.71	18.020	0.086	1.30	0.6046	1.00
369	60-919	#2 HCL Storage Tank	HCL	17.48	Amber	12.00	31300	10.00	70.00	23.71	36.460	0.036	1.30	0.6046	1.00
370	60-927	HCL Acid Head Tank Scrubber	H20*	78.98	Yellow	10.00	6500	6.00	70.00	96.47	18.020	0.083	1.30	0.5076	0.48
370	60-927	HCL Acid Head Tank Scrubber	HCL	19.23	Yellow	10.00	6500	6.00	70.00	96.47	36.460	0.039	1.30	0.5076	0.48
371	60-1526	D.I. Tank (HCL)	H20*	97.46	Brown	20.00	75000	16.00	70.00	0.20	18.020	0.300	1.40	0.8886	1.00
371	60-1526	D.I. Tank (HCL)	HCL	2.54	Brown	20.00	75000	16.00	70.00	0.20	36.460	0.000	1.40	0.8886	1.00

* = NON HAP. Emission is not included as a HAP emission.

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE CHLORINE PROCESS UNIT (CL2)

SL 025900

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
365	60-1602	Brine/HCL Neut. Reactor Tank Vent Scrubber	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
365	60-1602	Brine/HCL Neut. Reactor Tank Vent Scrubber	HCL	0.00002	0.00004	0.00006	Scrubber	99.00	5.79E-07	5.79E-07
369	60-918	#1 HCL Storage Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
369	60-918	#1 HCL Storage Tank	HCL	0.00495	0.01690	0.02184	Scrubber	99.00	2.18E-04	2.18E-04
369	60-919	#2 HCL Storage Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
369	60-919	#2 HCL Storage Tank	HCL	0.00495	0.01057	0.01552	Scrubber	99.00	1.55E-04	1.55E-04
370	60-927	HCL Acid Head Tank Scrubber	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
370	60-927	HCL Acid Head Tank Scrubber	HCL	0.00249	0.00469	0.00718	Scrubber	99.00	7.18E-05	7.18E-05
371	60-1526	D.I. Tank (HCL)	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
371	60-1526	D.I. Tank (HCL)	HCL	0.00001	0.00000	0.00001	Scrubber	99.00	9.83E-08	9.83E-08

* = NON HAPS, mission is not included as a HAP emission

APPENDIX B-B
CHLORINE PROCESS UNIT
PROCESS VENT CALCULATIONS

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Mercury (Hg) Date: April 1992

Year: 1987 Calculator: S.R.

Process Vent Identification: 100

Description: Mercury Cell Hydrogen Vent

Process Conditions/Sampling

Date of flow measurement	1987
Method of flow measurement	EPA Methods 1-4
Date of concentration measurement	1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	EPA Method 101
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	262,194
Production rate during sampling (lbs/hr)	262,194
Average production rate during base year (lbs/hr)	262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	4,892	= Q
HAP concentration (ppmv)	11	= C
Annual hours of operation (hrs)	427	= h
Vent stream discharge temperature (°F)	87	= T
HAP molecular weight (lb/lb-mole)	201	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	Vapor Recovery	
HAP control efficiency (%)	98	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(4,892)(11)(427)(201)(14.7)}{(87) + 460}$$

$$= \boxed{0.315\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025902

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.315 (1 - 98/100)

$$= \boxed{0.006 \text{ Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.007) (1)

$$= \boxed{0.006 \text{ Mg/yr}}$$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025903

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE)

HAP: Chlorine (Cl_2) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 101
Description: Mercury Cell Cl_2 Neutralization Tower

Process Conditions/Sampling

Date of flow measurement ---
Method of flow measurement Process Design Rate
Date of concentration measurement 1987
Method of concentration measurement
(if not an EPA Method give a brief
description and attach protocol) CEM
Describe any problems encountered
during testing None Identified
Production rate during flow determination (lbs/hr) not available
Production rate during sampling (lbs/hr) not available
Average production rate during base year (lbs/hr) 262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	3,528.	= Q
HAP concentration (ppmv)	33	= C
Annual hours of operation (hrs)	8,562	= h
Vent stream discharge temperature (°F)	100	= T
HAP molecular weight (lb/lb-mole)	70	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 97 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(3,528)(33)(8,562)(70)(14.7)}{(100) + 460}$$

$$= \boxed{4.652\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025904

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 4.652 (1 - 97/100)

$$= \boxed{0.14 \text{ Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.14) (1)

$$= \boxed{0.14 \text{ Mg/yr}}$$

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, pr vide justification and supporting calculations:

The flow rate is representative of the maximum design flow rate and the Cl_2 concentration is based on an averaged CEM data.

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025905

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE)

HAP: Mercury (Hg) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 102
Description: Fume System (Endbox Ventilation System)

Process Conditions/Sampling

Date of flow measurement	1986
Method of flow measurement	EPA Methods 1-4
Date of concentration measurement	1986
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	EPA Method 101
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	235,512
Production rate during sampling (lbs/hr)	235,512
Average production rate during base year (lbs/hr)	262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	2,825	= Q
HAP concentration (ppmv)	12	= C
Annual hours of operation (hrs)	8,568	= h
Vent stream discharge temperature (°F)	59	= T
HAP molecular weight (lb/lb-mole)	201	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	Vapor Recovery	
HAP control efficiency (%)	99	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(2,825)(12)(8,568)(201)(14.7)}{(59) + 460}$$

$$= \boxed{4.2\ \text{Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - \text{eff}/100)$$

SL 025906

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 4.2 (1 - 99/100)

$$= \boxed{0.042\ \mathrm{Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.042) (1)

$$= \boxed{0.042\ \mathrm{Mg/yr}}$$

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and xplain:

Flow rate and sampling analysis were done in 1986. Chlorine manufactured in 1986 and 1987 (base year) were very close. No extrapolation was conducted.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M thod 301, provide justification and supporting calculations:

N/A

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025907

Sourc : HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Chlorine　　　　Date: April 1992
Year: 1987　　　　Calculator: S.R.

Process Vent Identification: 105
Description: Plant C Absorber

Process Conditions/Sampling

Date of flow measurement ---
Method of flow measurement Process Design Rate
Date of concentration measurement ---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol) Engineering Judgement
Describe any problems encountered during testing None Identified
Production rate during flow determination (lbs/hr) 262,194
Production rate during sampling (lbs/hr) 262,194
Average production rate during base year (lbs/hr) 262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	48,300	= Q
HAP concentration (ppmv)	1,000	= C
Annual hours of operation (hrs)	10	= h
Vent stream discharge temperature (°F)	70	= T
HAP molecular weight (lb/lb-mole)	70	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 99.9 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(48{,}300)(1{,}000)(10)(70)(14.7)}{(70) + 460}$$

$$= \boxed{2.382\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025908

Sourc : HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 2.382 (1 - 99.9/100)

= $\boxed{0.002 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.002) (1)

= $\boxed{0.002 \text{ Mg/yr}}$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M thod 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025909

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Chlorine Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 106
Description: Circuit 15 Neutralizing Tower

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	235,512
Production rate during sampling (lbs/hr)	235,512
Average production rate during base year (lbs/hr)	262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	3,020	= Q
HAP concentration (ppmv)	345	= C
Annual hours of operation (hrs)	2	= h
Vent stream discharge temperature (°F)	140	= T
HAP molecular weight (lb/lb-mole)	70	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber

HAP control efficiency (%) 99.9 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(3{,}020)(345)(2)(70)(14.7)}{(140) + 460}$$

$$= \boxed{0.009\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025910

Sourc : HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.009 (1 - 99.9/100)

= $\boxed{0.0 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0) (1)

= $\boxed{0.0 \text{ Mg/yr}}$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

Chlorine flow rate at 75 kilo amp. = 41,542 lb/hr

At 45 kilo amp. = $41{,}542 \times \frac{45}{75} = 24{,}925$ lb/hr

Air in Cl_2 on startups ≈ 40% air,

Therefore,

$$24{,}925 \times \frac{\text{lb-mole}}{71 \text{ lb}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{379 \text{ ft}^3}{\text{lb-mole}} \times \frac{0.4 \text{ Air}}{0.6 \text{ } Cl_2} = 1478 \text{ scfm, air}$$

Tower Vent Flow = $1478 \times \frac{630}{520} = 1791$ acfm, air

Mole fraction of H_2O = $\frac{5.99}{14.7} = 0.407$, mole fraction of air = 0.593

Therefore, total vent flow = $\frac{1791}{0.593} = 3020$ acfm

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Chlorine (Cl_2) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 107
Description: Circuit 16 Neutralizing Tower

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	235,512
Production rate during sampling (lbs/hr)	235,512
Average production rate during base year (lbs/hr)	262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	3,020	= Q
HAP concentration (ppmv)	345	= C
Annual hours of operation (hrs)	2	= h
Vent stream discharge temperature (°F)	140	= T
HAP molecular weight (lb/lb-mole)	70	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber

HAP control efficiency (%) 99.9 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(3,020)(345)(2)(70)(14.7)}{(140) + 460}$$

$$= \boxed{0.009 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - \text{eff}/100)$$

SL 025912

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.009 (1 - 99.9/100)

$$= \boxed{0.0\ \text{Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0) (1)

$$= \boxed{0.0\ \text{Mg/yr}}$$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

Chlorine flow rate at 75 kilo amp. = 41,542 lb/hr

At 45 kilo amp. = $41{,}542 \times \frac{45}{75} = 24{,}925$ lb/hr

Air in Cl_2 on startups ≈ 40% air,

Therefore,

$$24{,}925 \times \frac{\text{lb-mole}}{71\ \text{lb}} \times \frac{\text{hr}}{60\ \text{min}} \times \frac{379\ \text{ft}^3}{\text{lb-mole}} \times \frac{0.4\ \text{Air}}{0.6\ Cl_2} = 1478\ \text{scfm, air}$$

Tower Vent Flow = $1478 \times \frac{630}{520} = 1791$ acfm, air

Mole fraction of H_2O = $\frac{5.99}{14.7} = 0.407$, mole fraction of air = 0.593

Therefore, total vent flow = $\frac{1791}{0.593} = 3020$ acfm

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025913

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Chlorine — Date: April 1992
Year: 1987 — Calculator: S.R.

Process Vent Identification: 109
Description: Sulfur Chloride Vent

Process Conditions/Sampling

Date of flow measurement: 1987
Method of flow measurement: Process Flow Meter
Date of concentration measurement: 1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol): Hexane Impinger/IR Spectroscopy
Describe any problems encountered during testing: None Identified
Production rate during flow determination (lbs/hr): 262,194
Production rate during sampling (lbs/hr): 262,194
Average production rate during base year (lbs/hr): 262,194

Stream Characteristics

Average vent stream flow rate (ft^3/min)	740	= Q
HAP concentration (ppmv)	42	= C
Annual hours of operation (hrs)	8,760	= h
Vent stream discharge temperature (°F)	-10	= T
HAP molecular weight (lb/lb-mole)	70	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device: Vapor Recovery
HAP control efficiency (%): 99.9 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)(740)(42)(8,760)(70)(14.7)}{(-10) + 460}$$

$$= \boxed{1.581 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025914

Source: HON subunit(s) Chlorine Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 1.581 (1 - 99.9/100)

$$= \boxed{0.0016 \text{ Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.0016) (1)

$$= \boxed{0.0016 \text{ Mg/yr}}$$

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and xplain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025915

APPENDIX C
ETHYL CHLORIDE PROCESS UNIT (EC) AND HYDROGEN CHLORIDE PROCESS UNIT (HCL)

SL 025916

APPENDIX C

ETHYL CHLORIDE PROCESS UNIT (EC) AND HYDROGEN CHLORIDE PROCESS UNIT (HCL)

C.1 Process Description

The Ethyl Chloride Unit is designed to produce a high purity liquid ethyl chloride (EC) product by reacting anhydrous hydrogen chloride (HCl) and ethylene. The reaction is as follows:

$$\underset{(C_2H_4)}{\text{Ethylene}} + \underset{(HCl)}{\text{Hydrogen Chloride}} \xrightarrow[\text{Catalyst}]{} \underset{(C_2H_5Cl)}{\text{Ethyl Chloride}}$$

The reaction between these two gases takes place under pressure in the presence of a catalyst in a liquid phase reactor.

Figure C-1 outlines the major steps in ethyl chloride production. Non-volatile tars and catalysts remaining after boiling off EC in the reactor are transferred in a portable tank to the Waste Treatment Unit. Heavy impurities that remain after removal of HCl impurities from the EC in the primary stripper are removed by a "heavies" still and sent to the Bottoms Recovery Unit, which is included in the Waste Treatment Unit. EC is shipped by truck and railcar to customers.

The major equipment used in the EC production includes a reactor, coolers, a condenser, strippers, a distillation column, and day and dock storage tanks. A process schematic showing the major equipment is shown in Figure C-2.

The Hydrogen Chloride unit is in the Ethyl Chloride processing area. Figure C-3 shows the process steps.

The Hydrogen Chloride Unit is designed to perform the following jobs:

1) Store weak acid produced by the incinerators and distribute it to consumers inside the plant and customers outside the plant.

2) Purify weak acid in weak acid purification equipment for use in the Mercury Cell Area.

Figure C-1: EC Process Schematic
See Volume II - Confidential

SL 025918

Figure C-2: Ethyl Chloride
See Volume II - Confidential

Figure C-3: HCl Process Schematic
See Volume II - Confidential

SL 025920

3) Utilize anhydrous HCl gas to produce strong acid to supply consumers inside the plant when weak acid is not available.

The major equipment used in the HCl unit are carbon filters, absorbers, storage tanks, and a vent scrubber.

C.2 1987 Base-Year Emissions

Table C-1 shows the total base-year emissions for the EC and the HCl process units. The total unweighted HAP emissions were 4.286 Mg/yr and the weighted HAP emissions were 5.461 Mg/yr.

C.3 Emissions Reduction Strategy

The EC and HCl process units have three process vents. Two of these have a scrubber for the control of emissions (EIQ 304 and 338), and the emissions from the remaining process vent (EIQ 337) are currently being incinerated.

Emissions from EIQ 304 (startup mode only) will be incinerated as part of the early reduction program. (See Tables C-1 and C-2.)

C.4 Post-Reduction Emissions

Table C-3 shows the total post-reduction unweighted and weighted HAP emissions for the EC and HCl process units.

The total post-reduction unweighted emissions of 0.141 Mg/yr represent a 96.71% decrease in unweighted base-year emissions. The total post-reduction weighted emissions of 1.316 Mg/yr represent a 75.91% decrease in weighted base-year emissions.

SL 025921

SL 025922

C-6

TABLE C-1

1987 BASE YEAR EMISSIONS
ETHYL CHLORIDE PROCESS UNIT (EC)
HYDROGEN CHLORIDE PROCESS UNIT (HCL)

UNIT	EIQ	DESCRIPTION	TYPE	BASE YEAR			
				CONTROL DEVICE		HAP EMISSIONS	
				TYPE	% CONTROL*	UNWEIGHTED MG/YR	WEIGHTED MG/YR
EC/HCL	304	EC Scrubber	P	Scrubber	5.00	4.146	4.146
EC/HCL	337	VCM-I Plant Scrubber	P	Incinerator	99.99	0.000	0.000
EC/HCL	338**	HCl Tails Tower Scrubber	P	Scrubber	5.00	0.139	1.314
				Subtotal Process Vents		4.285	5.46
EC/HCL	373	North Rubber Lined Acid Tank	T	Scrubber	99.00	0.000	0.000
EC/HCL	374	South Rubber Lined Acid Tank	T	Scrubber	99.00	0.001	0.001
				Subtotal Tank Vents		0.001	0.001
				Total Base Year Emissions		4.286	5.461

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

** EIQ 338 also controls emissions from several tanks. These emissions were calculated to be 0.0011 (see tank calculations on pages C-13 and C-14) and are included in the emissions shown.

FILE: ECBASE

SL 025923

C-7

TABLE C-2

EMISSIONS REDUCTIONS STRATEGY AND POST REDUCTION EMISSIONS
ETHYL CHLORIDE PROCESS UNIT (EC)
HYDROGEN CHLORIDE PROCESS UNIT (HCL)

UNIT	EIQ	DESCRIPTION	TYPE	POST REDUCTION			
				ADDITIONAL CONTROL	1994 % CONTROL*	HAP EMISSIONS UNWEIGHTED MG/YR	HAP EMISSIONS WEIGHTED MG/YR
EC/HCL	304***	EC Scrubber	P	Incinerator	99.99	0.001	0.001
EC/HCL	337	VCM-I Plant Scrubber	P	None	99.99	0.000	0.000
EC/HCL	338**	HCl Tails Tower Scrubber	P	None	5.00	0.139	1.314
					Subtotal Process Vents	0.14	1.315
EC/HCL	373	North Rubber Lined Acid Tank	T	None	99.00	0.000	0.000
EC/HCL	374	South Rubber Lined Acid Tank	T	None	99.00	0.001	0.001
					Subtotal Tank Vents	0.001	0.001
				Total Post Reduction Emissions		0.141	1.316

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

** EIQ 338 also controls emissions from several tanks. These emissions were calculated to be 0.0011 (see tank calculations on pages C-10 and C-11) and are included in the emissions shown.

*** These vents have three operating scenarios: non-routine (NR), startup (SU), and shut down (SD). Only the SU and SD modes will be incinerated at 99.99% efficiency. The NR emissions will be vented through the scrubber.

FILE: ECPOST

TABLE C – 3

HAP EMISSIONS SUMMARY
ETHYL CHLORIDE PROCESS UNIT (EC)
HYDROGEN CHLORIDE PROCESS UNIT (HCL)

Type (Units)	Unweighted HAP Emissions Base Year (Mg/yr)	Unweighted HAP Emissions Post Reduction (Mg/yr)	Unweighted HAP Emissions Percent Reduction (%)	Weighted HAP Emissions Base Year (Mg/yr)	Weighted HAP Emissions Post Reduction (Mg/yr)	Weighted HAP Emissions Percent Reduction (%)
P	4.285	0.140	96.73	5.461	1.315	75.92
T	0.001	0.001	0.00	0.001	0.001	0.00
F						
Total	4.286	0.141		5.462	1.316	
Total Percent Reduction (%)		96.71			75.91	

P – Process Vents
T – Tank Vents
F – Fugitive Emissions

APPENDIX C-A
EC PROCESS UNIT
STORAGE TANK CALCULATIONS

Source: HON subunit(s) Ethylene Chloride (EC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE)

HAP: Hydrogen Chloride (HCl) Date: 05/13/92
Year: 1987 Calculator: J. Greer

Tank Designation: EIO 373, North Rubber-lined Tank (60-970)
Product: HCl Acid (20%)

Tank Characteristics

Inside diameter, (ft)	30	$= D$
Height, (ft)	30	$= H_T$
Capacity, (gal) $= \pi \frac{D^2h}{4} * 7.48 \frac{gal}{ft^3}$, if not known	143,640	$= V$
Roof color White		
Shell color White		
Vapor space height, (ft)[a]	15	$= H$

Ambient Conditions

Average atmospheric pressure (psia) (defaults 14.7 psia)	14.7	$= P_A$
Average ambient diurnal temperature (°F)[b]	18	$= dT$
Average annual ambient temperature (°F)	70	$= T_A$

Bulk Liquid Characteristics

Stored liquid temperature (°F)[c]	70	$= T_S$
Total throughput per year (gal)	566,652.4	$= A_N$
Number of turnovers per year[d]	3.94	$= N$
Molecular weight of HAP (lb/lb mole)	36.46	$= M_v$
Mole percent of HAP	11.00	= %
Partial pressure of the HAP at liquid conditions (psia)	0.004	$= P$

Adjustment Factors

Paint factor	1.0	$= F_P$
Small diameter tank factor[e]	1.0	$= C$
Turnover factor[f]	1.0	$= K_N$
Product factor[g]	1.0	$= K_C$

SL 025926

Sourc : HON subunit(s) Ethyl Chloride (EC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Baseline Control

Control device Gas Scrubber
HAP control efficiency (%) 99 = eff

Calculations[h]

Breathing Loss (Mg/yr) =

$$L_B = 1.02E\text{-}05\ (M_V)\left[\frac{(P)}{(P_A) - (P)}\right]^{0.68} (D)^{1.73}(H)^{0.51}(dT)^{0.50}(F_P)(C)(K_C)$$

$$= 1.02E\text{-}05\ (36.46)\left[\frac{0.004}{14.7 - 0.004}\right]^{0.68} (30)^{1.73}(15)^{0.51}(18)^{0.50}(1)(1)(1)$$

$$= \boxed{0.0084 \text{ Mg/yr}}$$

Working Loss (Mg/yr) $= L_W = 1.09E\text{-}08\ M_V PVNK_N K_C$
$= 1.09E\text{-}08 (36.46) (0.004) (143{,}640) (3.94) (1) (1)$

$$= \boxed{0.00089 \text{ Mg/yr}}$$

Total Loss (Mg/yr) =

$$T_L = L_B + L_W = (0.0084) + (0.00089)$$
$$= \boxed{0.00929 \text{ Mg/yr}}$$

If a control device is employed,

HAP Emissions (E_{HAP}) = Total Loss (1 - eff/100)
= 0.00929 (1 - 99/100)

$$= \boxed{9.29\times10^{-5} \text{ Mg/yr}}$$

SL 025927

Source: HON subunit(s) Ethyl Chloride (EC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Calculation (Continued)

Weighted HAP Emissions[i] $= E_{HAP} \quad F_{HP}$
$= (9.29 \times 10^{-5}) \quad (1)$
$= \boxed{9.29\times10^{-5} \text{ Mg/yr}}$

---

[a]If vapor space height is unknown for shell, assume H equals one half tank height. If tank has a cone roof, adjust vapor space height by adding 1/3 of height of cone.

[b]If average ambient diurnal temperature change is unknown, assume 20°F.

[c]Stored liquid temperature may be approximated from average annual ambient temperature.

[d]$N = \frac{AN}{V}$ where N = number of turnovers per year
AN = total throughput per year (gal)
V = tank capacity (gal)

For D≥ 30ft, C=1; For 6 ≤ D < 30 ft, C = 0.0771D-0.0013D2-0.1334.

[f]For turnovers > 36, $K_N = (180 + N)/(6 * N)$
where K_N = turnover factor (dimensionless)
N = number of turnovers per year
For turnovers ≤ 36, $K_N = 1$

[g]K_C = 1.0 for volatile organic liquids

[h]Expression for computing HAP emissions are from "Procedures for Establishing Base Year and Post-Reduction HAP Emissions." The calculation procedure is consistent with AP-42.

[i]For emissions of other HAPs from this EIQ, see summary of calculat d missions from fixed roof storage tanks.

SL 025928

PPG 05/20/92

SL 025929

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE ETHYL CHLORIDE PROCESS UNIT (EC)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
338(t)	60-611	Strong #1 HCL Acid Tank	H20*	82.52	Yellow	12.00	20000	13.00	70.00	42.77	18.020	0.1046	1.30	0.6046	0.87
338(t)	60-611	Strong #1 HCL Acid Tank	HCL	17.48	Yellow	12.00	20000	13.00	70.00	42.77	36.460	0.2050	1.30	0.6046	0.87
338(t)	60-612	Strong #2 HCL Acid Tank	H20*	82.52	Yellow	12.00	20000	13.00	70.00	42.77	18.020	0.1046	1.30	0.6046	0.87
338(t)	60-612	Strong #2 HCL Acid Tank	HCL	17.48	Yellow	12.00	20000	13.00	70.00	42.77	36.460	0.2050	1.30	0.6046	0.87
338(t)	60-613	Weak #1 HCL Acid Tank	H20*	89.00	Green	12.00	20000	13.00	70.00	44.88	18.020	0.1990	1.30	0.6046	0.84
338(t)	60-613	Weak #1 HCL Acid Tank	HCL	11.00	Green	12.00	20000	13.00	70.00	44.88	36.460	0.0040	1.30	0.6046	0.84
338(t)	60-614	Weak #2 HCL Acid Tank	H20*	89.00	Green	12.00	20000	13.00	70.00	44.88	18.020	0.1990	1.30	0.6046	0.84
338(t)	60-614	Weak #2 HCL Acid Tank	HCL	11.00	Green	12.00	20000	13.00	70.00	44.88	36.460	0.0040	1.30	0.6046	0.84
373	60-970	North Rubber Lined Acid Tank	H20*	89.00	White	30.00	143640	15.00	70.00	3.94	18.020	0.1990	1.00	1.0000	1.00
373	60-970	North Rubber Lined Acid Tank	HCL	11.00	White	30.00	143640	15.00	70.00	3.94	36.460	0.0040	1.00	1.0000	1.00
374	60-1192	South Rubber Lined Acid Tank	H20*	82.52	White	43.00	325800	15.00	70.00	11.69	18.020	0.1046	1.00	1.0000	1.00
374	60-1192	South Rubber Lined Acid Tank	HCL	17.48	White	43.00	325800	15.00	70.00	11.69	36.460	0.2050	1.00	1.0000	1.00

(t) = This tank emits through EIQ 338 which is a source.
Emissions from this tank are included in the emissions shown on Tables C-1 and C-2.

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE ETHYL CHLORIDE PROCESS UNIT (EC)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg/yr)	LW Working Loss (Mg/yr)	LT Total Loss (Mg/yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg/yr)	1987 Weighted HAP Emissions (Mg/yr)
338(t)	60-611	Strong #1 HCL Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
338(t)	60-611	Strong #1 HCL Acid Tank	HCL	0.01866	0.06050	0.07916	Scrubber	99.00	7.92E-04	7.92E-04
338(t)	60-612	Strong #2 HCL Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
338(t)	60-612	Strong #2 HCL Acid Tank	HCL	0.01866	0.06050	0.07916	Scrubber	99.00	7.92E-04	7.92E-04
338(t)	60-613	Weak #1 HCL Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
338(t)	60-613	Weak #1 HCL Acid Tank	HCL	0.00126	0.00118	0.00244	Scrubber	99.00	2.44E-05	2.44E-05
338(t)	60-614	Weak #2 HCL Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
338(t)	60-614	Weak #2 HCL Acid Tank	HCL	0.00126	0.00118	0.00244	Scrubber	99.00	2.44E-05	2.44E-05
373	60-970	North Rubber Lined Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
373	60-970	North Rubber Lined Acid Tank	HCL	0.00843	0.00089	0.00933	Scrubber	99.00	9.33E-05	9.33E-05
374	60-1192	South Rubber Lined Acid Tank	H20*	0.00000	0.00000	0.00000	Scrubber	0.00	0.00E+00	0.00E+00
374	60-1192	South Rubber Lined Acid Tank	HCL	0.23234	0.31024	0.54258	Scrubber	99.00	5.43E-03	5.43E-03

(t) = This tank emits through EIQ 338 which is a source.
Emissions from this tank are included in the emissions shown on Tables C-1 and C-2.

* = NON HAPS, emission is not included as a HAP emission

Source: HON subunit(s) Ethylene Dichloride (EDC)
HAPs mitted: Ethylene Dichloride (EDC), Hexachloro 1,3-Butadiene (HCBD), Hexachloroethane (HEXA), 1,1,2,2-Tetrachloroethane (SYM), 1,1,2-Trichloroethane (TCE)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE)

HAP: Ethylene Dichloride (EDC) Date: 05/13/92
Year: 1987 Calculator: J. Greer

Tank Designation: EIQ 312, EDC Bottoms Tank No. 4 (60-0340)
Product: Ethylene Dichloride EDC

Tank Characteristics

Inside diameter, (ft)	12	= D
Height, (ft)	30	= H_T
Capacity, (gal) = $\pi \frac{D^2h}{4} * 7.48 \frac{gal}{ft^3}$, if not known	25,400	= V
Roof color Green		
Shell color Green		
Vapor space height, (ft)[a]	15	= H

Ambient Conditions

Average atmospheric pressure (psia) (defaults 14.7 psia)	14.7	= P_A
Average ambient diurnal temperature (°F)[b]	18	= dT
Average annual ambient temperature (°F)	70	= T_A

Bulk Liquid Characteristics

Stored liquid temperature (°F)[c]	80	= T_S
Total throughput per year (gal)	358,850.3	= A_N
Number of turnovers per year[d]	14.13	= N
Molecular weight of HAP (lb/lb mole)	98.97	= M_v
Mole percent of HAP	76.55	= %
Partial pressure of the HAP at liquid conditions (psia)	1.294	= P

Adjustment Factors

Paint factor	1.3	= F_P
Small diameter tank factor[e]	0.6046	= C
Turnover factor[f]	1.0	= K_N
Product factor[g]	1.0	= K_C

SL 025954

Source: HON subunit(s) Ethylen Dichloride (EDC)
HAPs mitted: EDC, HCBD, HEXA, SYM, TCE

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Baseline Control

Control device Scrubber
HAP control efficiency (%) 5% = eff

Calculations[h]

Breathing Loss (Mg/yr) =

$$L_B = 1.02E\text{-}05\ (M_V)\left[\frac{(P)}{(P_A) - (P)}\right]^{0.68}(D)^{1.73}(H)^{0.51}(dT)^{0.50}(F_P)(C)(K_C)$$

$$= 1.02E\text{-}05\ (98.97)\left[\frac{1.294}{14.7 - 1.294}\right]^{0.68}(12)^{1.73}(15)^{0.51}(18)^{0.50}(1.3)(0.6046)(1)$$

$$= \boxed{0.201\ \text{Mg/yr}}$$

Working Loss (Mg/yr) $= L_W = 1.09E\text{-}08\ M_V PVNK_N K_C$
$= 1.09E\text{-}08\ (98.97)(1.294)(25{,}400)(14.13)(1)(1)$

$$= \boxed{0.500\ \text{Mg/yr}}$$

Total Loss (Mg/yr) =

$$T_L = L_B + L_W = (0.201) + (0.500)$$

$$= \boxed{0.701\ \text{Mg/yr}}$$

If a control device is employed,

HAP Emissions (E_{HAP}) = Total Loss (1 - eff/100)
= 0.701 (1 - 5/100)

$$= \boxed{0.666\ \text{Mg/yr}}$$

SL 025955

Source: HON subunit(s) Ethylene Dichloride (EDC)
HAPs emitted: EDC, HCBD, HEXA, SYM, TCE

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Calculation (Continued)

Weighted HAP Emissions[i] $= E_{HAP} \quad F_{HR}$
$= (0.666) \; (1)$
$= \boxed{0.666 \text{ Mg/yr}}$

---

[a]If vapor space height is unknown for shell, assume H equals one half tank height. If tank has a cone roof, adjust vapor space height by adding 1/3 of height of cone.

[b]If average ambient diurnal temperature change is unknown, assume 20°F.

[c]Stored liquid temperature may be approximated from average annual ambient temperature.

[d]$N = \frac{AN}{V}$ where N = number of turnovers per year
AN = total throughput per year (gal)
V = tank capacity (gal)

[e]For $D \geq 30$ft, C=1; For $6 \leq D < 30$ ft, C = 0.0771D-0.0013D2-0.1334.

[f]For turnovers > 36, $K_N = (180 + N)/(6 * N)$
where K_N = turnover factor (dimensionless)
N = number of turnovers per year
For turnovers ≤ 36, $K_N = 1$

[g]$K_C = 1.0$ for volatile organic liquids

[h]Expression for computing HAP emissions are from "Procedures for Establishing Base Year and Post-Reduction HAP Emissions." The calculation procedure is consistent with AP-42.

[i]For emissions of other HAPs from this EIQ, see summary of calculated emissions from fixed roof storage tanks.

SL 025956

SL 025957

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE ETHYLENE DICHLORIDE PROCESS UNIT (EDC)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb/lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
312	60-0340	EDC Bottoms Storage Tank No. 4	EDC	76.55	Green	12.00	25400	15.00	80.00	14.13	98.970	1.294	1.30	0.6046	1.00
312	60-0340	EDC Bottoms Storage Tank No. 4	HCBD	0.78	Green	12.00	25400	15.00	80.00	14.13	260.760	0.000	1.30	0.6046	1.00
312	60-0340	EDC Bottoms Storage Tank No. 4	HEXA	2.71	Green	12.00	25400	15.00	80.00	14.13	236.760	0.000	1.30	0.6046	1.00
312	60-0340	EDC Bottoms Storage Tank No. 4	SYM	4.55	Green	12.00	25400	15.00	80.00	14.13	167.860	0.006	1.30	0.6046	1.00
312	60-0340	EDC Bottoms Storage Tank No. 4	TCE	15.42	Green	12.00	25400	15.00	80.00	14.13	133.410	0.077	1.30	0.6046	1.00
312	60-0342	EDC Bottoms Storage Tank No. 2	EDC	76.55	Blue	12.00	25400	15.00	80.00	14.13	98.970	1.294	1.30	0.6046	1.00
312	60-0342	EDC Bottoms Storage Tank No. 2	HCBD	0.78	Blue	12.00	25400	15.00	80.00	14.13	260.760	0.000	1.30	0.6046	1.00
312	60-0342	EDC Bottoms Storage Tank No. 2	HEXA	2.71	Blue	12.00	25400	15.00	80.00	14.13	236.760	0.000	1.30	0.6046	1.00
312	60-0342	EDC Bottoms Storage Tank No. 2	SYM	4.55	Blue	12.00	25400	15.00	80.00	14.13	167.860	0.006	1.30	0.6046	1.00
312	60-0342	EDC Bottoms Storage Tank No. 2	TCE	15.42	Blue	12.00	25400	15.00	80.00	14.13	133.410	0.077	1.30	0.6046	1.00
313	60-0330	EDC North Dock Storage No. 1	EDC	75.88	Aqua Green	50.00	470000	15.00	70.00	8.64	98.970	1.009	1.30	1.0000	1.00
313	60-0330	EDC North Dock Storage No. 1	TCE	24.12	Aqua Green	50.00	470000	15.00	70.00	8.64	133.410	0.092	1.30	1.0000	1.00
313	60-0347	EDC North Dock Storage No. 2	EDC	75.88	Aqua Green	50.00	470000	15.00	70.00	8.64	98.970	1.009	1.30	1.0000	1.00
313	60-0347	EDC North Dock Storage No. 2	TCE	24.12	Aqua Green	50.00	470000	15.00	70.00	8.64	133.410	0.092	1.30	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	BROMO*	0.93	White	100.00	2520000	22.00	70.00	0.97	143.430	0.001	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	CCL4	4.44	White	100.00	2520000	22.00	70.00	0.97	153.820	0.053	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	CIS*	1.46	White	100.00	2520000	22.00	70.00	0.97	96.940	0.049	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	Chloroform	1.68	White	100.00	2520000	22.00	70.00	0.97	119.370	0.053	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	DCE	5.22	White	100.00	2520000	22.00	70.00	0.97	98.970	0.191	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	EC	1.09	White	100.00	2520000	22.00	70.00	0.97	64.520	0.221	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	EDC	43.47	White	100.00	2520000	22.00	70.00	0.97	98.970	0.578	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	HCB	0.25	White	100.00	2520000	22.00	70.00	0.97	284.800	0.000	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	HEXA	0.56	White	100.00	2520000	22.00	70.00	0.97	236.760	0.000	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	PENTA*	0.04	White	100.00	2520000	22.00	70.00	0.97	202.290	0.000	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	PER	1.65	White	100.00	2520000	22.00	70.00	0.97	165.850	0.005	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	SYM	0.81	White	100.00	2520000	22.00	70.00	0.97	167.850	0.001	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	TCE	17.09	White	100.00	2520000	22.00	70.00	0.97	133.410	0.065	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	TRI	0.57	White	100.00	2520000	22.00	70.00	0.97	131.380	0.007	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	UNKNOWN	19.60	White	100.00	2520000	22.00	70.00	0.97	250.000	0.255	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	UNSYM*	0.86	White	100.00	2520000	22.00	70.00	0.97	167.864	0.002	1.00	1.0000	1.00
314	60-1213	EDC South Dock Storage No. 1	VCM	0.29	White	100.00	2520000	22.00	70.00	0.97	62.490	0.150	1.00	1.0000	1.00

* = NON HAP, Emission is not included as a HAP emission.

SL 025958

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE ETHYLENE DICHLORIDE PROCESS UNIT (EDC)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg/yr)	LW Working Loss (Mg/yr)	LT Total Loss (Mg/yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg/yr)	1987 Weighted HAP Emissions (Mg/yr)
312	60-0340	EDC Bottoms Storage Tank No. 4	EDC	0.20110	0.50079	0.70188	Scrubber	5.00	0.66679	0.66679
312	60-0340	EDC Bottoms Storage Tank No. 4	HCBD	0.00029	0.00002	0.00031	Scrubber	5.00	0.00030	0.00030
312	60-0340	EDC Bottoms Storage Tank No. 4	HEXA	0.00168	0.00032	0.00200	Scrubber	5.00	0.00190	0.00190
312	60-0340	EDC Bottoms Storage Tank No. 4	SYM	0.00865	0.00419	0.01283	Scrubber	5.00	0.01219	0.12189
312	60-0340	EDC Bottoms Storage Tank No. 4	TCE	0.03755	0.04023	0.07777	Scrubber	5.00	0.07389	0.07389
312	60-0342	EDC Bottoms Storage Tank No. 2	EDC	0.20110	0.50079	0.70188	Scrubber	5.00	0.66679	0.66679
312	60-0342	EDC Bottoms Storage Tank No. 2	HCBD	0.00029	0.00002	0.00031	Scrubber	5.00	0.00030	0.00030
312	60-0342	EDC Bottoms Storage Tank No. 2	HEXA	0.00168	0.00032	0.00200	Scrubber	5.00	0.00190	0.00190
312	60-0342	EDC Bottoms Storage Tank No. 2	SYM	0.00865	0.00419	0.01283	Scrubber	5.00	0.01219	0.12189
312	60-0342	EDC Bottoms Storage Tank No. 2	TCE	0.03755	0.04023	0.07777	Scrubber	5.00	0.07389	0.07389
313	60-0330	EDC North Dock Storage No. 1	EDC	3.27059	4.41903	7.68962	RVR	99.00	0.07690	0.07690
313	60-0330	EDC North Dock Storage No. 1	TCE	0.82562	0.54111	1.36672	RVR	99.00	0.01367	0.01367
313	60-0347	EDC North Dock Storage No. 2	EDC	3.27059	4.41903	7.68962	RVR	99.00	0.07690	0.07690
313	60-0347	EDC North Dock Storage No. 2	TCE	0.82562	0.54111	1.36672	RVR	99.00	0.01367	0.01367
314	60-1213	EDC South Dock Storage No. 1	BROMO*	0.00000	0.00000	0.00000	INC	89.00	0.00000	0.00000
314	60-1213	EDC South Dock Storage No. 1	CCL4	2.03850	0.21866	2.25715	INC	89.00	0.24829	0.24829
314	60-1213	EDC South Dock Storage No. 1	CIS*	0.00000	0.00000	0.00000	INC	89.00	0.00000	0.00000
314	60-1213	EDC South Dock Storage No. 1	Chloroform	1.57464	0.16854	1.74318	INC	89.00	0.19175	0.19175
314	60-1213	EDC South Dock Storage No. 1	DCE	3.14928	0.50532	3.65460	INC	89.00	0.40201	0.40201
314	60-1213	EDC South Dock Storage No. 1	EC	2.27001	0.38108	2.65109	INC	89.00	0.29162	0.29162
314	60-1213	EDC South Dock Storage No. 1	EDC	6.80181	1.52622	8.32803	INC	89.00	0.91608	0.91608
314	60-1213	EDC South Dock Storage No. 1	HCB	0.04346	0.00057	0.04403	INC	89.00	0.00484	0.04843
314	60-1213	EDC South Dock Storage No. 1	HEXA	0.02682	0.00031	0.02713	INC	89.00	0.00298	0.00298
314	60-1213	EDC South Dock Storage No. 1	PENTA*	0.00000	0.00000	0.00000	INC	89.00	0.00000	0.00000
314	60-1213	EDC South Dock Storage No. 1	PER	0.42569	0.02116	0.44684	INC	89.00	0.04915	0.04915
314	60-1213	EDC South Dock Storage No. 1	SYM	0.12883	0.00363	0.13246	INC	89.00	0.01457	0.14571
314	60-1213	EDC South Dock Storage No. 1	TCE	2.02316	0.23104	2.25420	INC	89.00	0.24796	0.24796
314	60-1213	EDC South Dock Storage No. 1	TRI	0.42800	0.02380	0.45180	INC	89.00	0.04970	0.04970
314	60-1213	EDC South Dock Storage No. 1	UNKNOWN*	0.00000	0.00000	0.00000	INC	89.00	0.00000	0.00000
314	60-1213	EDC South Dock Storage No. 1	UNSYM*	0.00000	0.00000	0.00000	INC	89.00	0.00000	0.00000
314	60-1213	EDC South Dock Storage No. 1	VCM	1.68021	0.24977	1.92998	INC	89.00	0.21230	2.12298

* = NON HAPS, emission is not included as a HAP emission

APPENDIX D-B
EDC PROCESS UNIT
PROCESS VENT CALCULATIONS

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)
HAPs emitted: Ethyl Chloride (EC), Ethylene Dichloride (EDC), and Hydrogen Chloride (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethyl Chloride (EC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 300 (non-routine)
Description: No. 1 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Process Design Rate
Date of concentration measurement	1985
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	75,846
Production rate during sampling (lbs/hr)	75,846
Average production rate during base year (lbs/hr)	109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	84.6	= Q
HAP concentration (ppmv)	20,000	= C
Annual hours of operation (hrs)	2	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	64	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

Uncontrolled Emissions (E_U) = $\frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$

Uncontrolled Emissions (E_U) =

$$\frac{(2.54E-09)(84.6)(20,000)(2)(64)(14.7)}{(80) + 460}$$

$$= \boxed{0.0149 \text{ Mg/yr}}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)

SL 025960

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.0149 (1 - 5/100)

$$= \boxed{0.014 \text{ Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.014) (1)

$$= \boxed{0.014 \text{ Mg/yr}}$$

This emission rate is for EC, total emissions can be found in Attachment I.

Total HAP Emissions* = 0.07 Mg/yr
Total Weighted HAP Emissions = 0.07 Mg/yr

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

Stack 300 operates in three modes, non-routine, startup and shutdown. Emission data calculated here are for the non-routine mode. Non-routine emissions occur sporadically throughout the year. In 1987, there were two hours of such emissions. It is difficult to predict how many hours of non-routine emissions will occur, and therefore, no extrapolation can be justified. The actual hours used here are those of 1987, the composition data is from 1985.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

A typical non-routine vent was analyzed in 1985. Sample was taken by a syringe from the stack and analyzed by GC using a TC detector. The composition of the vent was as follows:

SL 025961

Sourc : HON subunit(s) Ethylene Dichloride Process Unit (EDC)

Component	ppmv
O_2	50,000
N_2	20,000
CO_2	50,000
CH_4	60,000
HCL	350,000
C_2H_4	400,000
EC (ethyl chloride)	20,000
EDC (1,2-dichloroethane)	50,000

Vent flow at maximum operating rate of 570 tpd is:

6000 scfh @ 2 psig, 40°F

The flow rate is therefore:

$$(6000\,scfh)\left(\frac{HR}{60\,MIN}\right)\left(\frac{40+460}{520}\right)\left(\frac{14.7}{16.7}\right) = 84.6\ \frac{FT^3}{MIN}$$

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 025962

SL 025963

ATTACHMENT I

SUBUNIT:	EDC
VENT ID:	300
SCENARIO:	NON-ROUTINE
DESCRIPTION:	NO. 1 LP-EDC STARTUP SCRUBBER

YEAR: 1987

Q = Average vent stream flow rate (ft3/min)
C = HAP Concentration (ppmv)
h = Annual hours of operation (hrs)
T = Vent stream discharge temperature (F)
MW = HAP molecular weight (lb/lb-mole)
P = Pressure at point of discharge (psia)
FHR = HAP high risk weighting factor
eff = HAP control efficiency (%)
EU = Uncontrolled emissions (Mg/yr) ; EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP = Controlled emissions (Mg/yr) ; EHAP = EU x (1 - (eff/100))
EW = Weighted HAP emissions (Mg/yr) ; EW = EHAP x FHR

D-19

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EC	84.6	20,000	2	64	14.7	80	5.00	1	0.015	0.014	0.014
EDC	84.6	50,000	2	99	14.7	80	5.00	1	0.058	0.055	0.055
HCL	84.6	350,000	2	36	14.7	80	99.00	1	0.147	0.001	0.001
								TOTAL	0.220	0.071	0.071

FILE: N1

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)
HAPs emitted: Ethyl Chloride (EC), Ethylene Dichloride (EDC), and Hydrogen Chloride (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethyl Chloride (EC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 300 (startup)
Description: No. 1 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	N/A
Production rate during flow determination (lbs/hr)	75,846
Production rate during sampling (lbs/hr)	75,846
Average production rate during base year (lbs/hr)	109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	84.6	= Q
HAP concentration (ppmv)	2,913	= C
Annual hours of operation (hrs)	2	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	64	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 5 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(84.6)(2,913)(2)(64)(14.7)}{(80) + 460}$$

$$= \boxed{0.002\ \text{Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - \text{eff}/100)$$

SL 025964

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.002 (1 - 5/100)

= $\boxed{0.002 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.002) (1)

= $\boxed{0.002 \text{ Mg/yr}}$

This emission rate is for EC, total emissions can be found in Attachment I.

Total HAP Emissions* = 0.084 Mg/yr
Total Weighted HAP Emissions = 0.084 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

This is the startup scenario of Stack 300. Quantity of gas going through the scrubber is specific to the process. A typical startup sequence is as follows:

Step One: Ethylene purge for 20 minutes @ 500 scfm.

$$(500\,scfm)\left(\frac{60\,MIN}{HR}\right)\left(\frac{28\,LB}{379\,scf}\right) = 2216\,\frac{LB}{HR}$$
$$= 79\,\frac{MOLE}{HR}$$

SL 025965

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

79 moles ethylene leave at 40°F, 11 psig vapor pressure of EDC at 40°F is 0.57 psia. Mole fraction of EDC in the vapor phase is:

$$Y_{EDC} = \frac{0.57 \text{ psia}}{(11 + 14.7) \text{ psia}} = 0.022$$

$$Yc_2H_4 = 1 - .022 = 0.978$$

Total Flow to Scrubber is then:

$$\frac{79 \text{ MOLES } C_2H_4}{0.978} = 81 \frac{\text{MOLE}}{\text{HR}}$$

$$\text{MOLES EDC} = 81 - 79 = 2 \frac{\text{MOLE}}{\text{HR}}$$

$$= 2 \times \frac{99 \text{ LB}}{\text{LB MOLE}} = 198 \frac{\text{LB}}{\text{HR}} \text{ EDC}$$

$$= \frac{66 \text{ LB}}{20 \text{ MIN}}$$

Step Two: 45 minute reaction temperature rise ethylene feed is raised to 665 scfm and CL_2 is added to 500 scfm. Emissions will be due to excess ethylene (667 - 500 = 167 scfm), stripped EDC and inerts. CL_2 is 99% pure, therefore, inerts are neglected. Excess ethylene lost is:

$$(167 \text{ scfm}) \left(\frac{60 \text{ MIN}}{\text{HR}}\right) \left(\frac{28 \text{ LB } C_2H_4}{279 \text{ SCF}}\right) = 740 \frac{\text{LB } C_2H_4}{\text{HR}}$$

$$= 26 \frac{\text{MOLE } C_2H_4}{\text{HR}}$$

SL 025966

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

26.4 Moles Ethylene leave at 40°F, 11 psig. Vapor pressure of EDC at 40°F is 0.57 psia. Mole fraction of EDC in the vapor phase is:

$$Y_{EDC} = \frac{0.57 \text{ psia}}{(11 + 14.7) \text{ psia}} = 0.022$$

$$Yc_2H_4 = 1 - .022 = 0.978$$

Total Flow to the Scrubber is:

$$\frac{26 \text{ MOLES } C_2H_4}{0.978} = 26.6 \frac{\text{MOLE}}{\text{HR}} \text{ TOTAL}$$

$$26.6 - 26 = 0.6 \frac{\text{MOLE}}{\text{HR}} \text{ EDC}$$

$$= 0.6 \times \frac{99 \text{ LB}}{\text{LB MOLE}} = 59 \frac{\text{LB}}{\text{HR}} \text{ EDC}$$

$$= \frac{44 \text{ LB}}{25 \text{ MIN}}$$

Step Three: 10 minutes EDC vents diversion while at maximum rates:

Component	LB/10 MIN
Ethyl Chloride (EC)	3.0
1,2-Dichloroethane (EDC)	9.1
HCL	4.5

Total Startup HAP Emissions:

Component	LB/75 MIN	LB/HR
Ethyl Chloride (EC)	3.0	2.4
1,2-Dichloroethane (EDC)	119	95.2
HCL	4.5	3.6

These rates were specified for 1985 and are unchanged, therefore, no extrapolation is needed. For determination of HAP emission in the base year (1987) these rates are used along with the startup hours in 1987. (Th se are uncontrolled emissions.)

SL 025967

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

Concentration of pollutants in the vent can be calculated as follows:

$$A = \frac{M \text{ (LB/HR COMPONENT)}}{Q \text{ (FT}^3\text{/MIN VENT) X 60 MIN/HR X MW}} = \frac{\text{MOLE POLL}}{\text{FT}^3 \text{ VENT}}$$

$$C = A \times \frac{0.7302 \text{ (FT}^3 \text{ ATM/LB MOLE °R) x (T + 460)}}{1 \text{ ATM}} \times 10^6 = \text{PPM}$$

No extrapolation is needed since startup emissions do not change with production rate.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M thod 301, provide justification and supporting calculations:

Mass flow rates of HAPs were calculated, see above. The average flow rate (Q) is assumed to the same as that for the non-routine mode.

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 025968

SL 025969

ATTACHMENT I

SUBUNIT:	EDC
VENT ID:	300
SCENARIO:	STARTUP
DESCRIPTION:	NO. 1 LP–EDC STARTUP SCRUBBER

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb–mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E–09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 – (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

D-25

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EC	84.6	2,913	2	64	14.7	80	5.00	1	0.002	0.002	0.002
EDC	84.6	74,700	2	99	14.7	80	5.00	1	0.087	0.082	0.082
HCL	84.6	7,768	2	36	14.7	80	99.00	1	0.003	0.000	0.000
								TOTAL	0.092	0.084	0.084

FILE: N2

Sourc : HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethylene Dichloride (EDC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 300 (shutdown)
Description: No. 1 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	N/A
Production rate during flow determination (lbs/hr)	75,846
Production rate during sampling (lbs/hr)	75,846
Average production rate during base year (lbs/hr)	109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	84.6	= Q
HAP concentration (ppmv)	155,362	= C
Annual hours of operation (hrs)	0.27	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 5 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(84.6)(155,362)(0.27)(99)(14.7)}{(80) + 460}$$

$$= \boxed{0.024 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025970

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.024 (1 - 5/100)

$$= \boxed{0.023\ Mg/yr}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.018) (1)

$$= \boxed{0.023\ Mg/yr}$$

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

This is the shutdown scenario of Stack 300. Rates are cut and vents are sent to the scrubber. An ethylene purge remains for 10 minutes @ 500 scfm.

$$(500\ scfm)\left(\frac{60\ MIN}{HR}\right)\left(\frac{28\ LB}{379\ FT^3}\right) = 2216\ \frac{LB}{HR}$$

$$= 79\ \frac{MOLE}{HR}$$

79 moles ethylene leave at 40°F, 11 psig. Vapor pressure of EDC at 40°F is 0.57 psia. Mole fraction of EDC in the vapor phase is:

$$Y_{EDC} = \frac{0.57\ psia}{(11 + 14.7)\ psia} = 0.022$$

$$Yc_2H_4 = 1 - .022 = 0.978$$

SL 025971

Sourc : HON subunit(s) Ethylene Dichloride Process Unit (EDC)

Total Flow to Scrubber is then:

$$\frac{79\ MOLES\ C_2H_4}{0.978} = 81\ \frac{MOLE}{HR}$$

$$MOLES\ EDC = 81 - 79 = 2\ \frac{MOLE}{HR}$$

$$= 2 \times \frac{99\ LB}{LB\ MOLE} = 198\ \frac{LB}{HR}\ EDC$$

Concentrations are calculated same as in 300 startup.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Meth d 301, provide justification and supporting calculations:

Mass flow of HAPs was calculated, see above.

The average flow rate (Q) is same as that for the non-routine mode.

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emissions" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025972

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)
HAPs emitted: Ethyl Chloride (EC), Ethylene Dichloride (EDC), and Hydrogen Chloride (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethyl Chloride (EC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 301 (non-routine)
Description: No. 2 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Process Design Rate
Date of concentration measurement	1985
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	75,846
Production rate during sampling (lbs/hr)	75,846
Average production rate during base year (lbs/hr)	109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	98.75	= Q
HAP concentration (ppmv)	15,000	= C
Annual hours of operation (hrs)	24	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	64	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 5 = eff

Calculations[a]

Uncontrolled Emissions (E_U) = $\frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$

Uncontrolled Emissions (E_U) =
$$\frac{(2.54E-09)(98.75)(15,000)(24)(64)(14.7)}{(80) + 460}$$

$$= \boxed{0.157\ Mg/yr}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)

SL 025973

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.157 (1 - 5/100)

= $\boxed{0.15\ Mg/yr}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.15) (1)

= $\boxed{0.15\ Mg/yr}$

Total HAP Emissions* = 0.614 Mg/yr
Total Weighted HAP Emissions = 0.614 Mg/yr

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and explain:

Stack 301 operates in three modes, non-routine, startup and shutdown. Emission data calculated here are for the non-routine mode. Non-routine emissions occur sporadically throughout the year. In 1987, there were 24 hours of such emissions. It is difficult to predict how many hours of non-routine emissions will occur, and therefore, no extrapolation can be justified. The actual hours of non-routine emission used here are those of 1987, the composition data is from 1985.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

A typical non-routine vent was analyzed in 1985. Sample was taken by a syringe from the stack and analyzed by GC using a TC detector. The composition of the vent was as follows:

SL 025974

Source: HON subunit(s) Ethylene Dichlorid Process Unit (EDC)

Component	ppmv
O_2	150,000
N_2	20,000
CO_2	240,000
C_2H_4	120,000
CH_4	190,000
C_2H_6	15,000
EC (ethyl chloride)	15,000
EDC (1,2-Dichloroethane)	3,000
HCL	4,000

Vent flow at maximum operating rate of 570 tpd is:

7000 scfh @ 2 psig, 40°F

The flow rate is, therefore:

$$(7000scfh)\ x \left(\frac{HR}{60MIN}\right) x \left(\frac{40\ +460}{520}\right)\left(\frac{14.7\ psia}{16.7\ psia}\right) = 98.75\ \frac{FT^3}{MIN}$$

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 025975

SL 025976

ATTACHMENT I

SUBUNIT:	EDC
VENT ID:	301
SCENARIO:	NON-ROUTINE
DESCRIPTION:	NO. 2 LP-EDC STARTUP SCRUBBER

YEAR: 1987

Q = Average vent stream flow rate (ft3/min)
C = HAP Concentration (ppmv)
h = Annual hours of operation (hrs)
T = Vent stream discharge temperature (F)
MW = HAP molecular weight (lb/lb-mole)
P = Pressure at point of discharge (psia)
FHR = HAP high risk weighting factor
eff = HAP control efficiency (%)
EU = Uncontrolled emissions (Mg/yr) : EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP = Controlled emissions (Mg/yr) : EHAP = EU x (1 - (eff/100))
EW = Weighted HAP emissions (Mg/yr) : EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EC	98.8	15,000	24	64	14.7	80	5.00	1	0.157	0.149	0.149
EDC	98.8	30,000	24	99	14.7	80	5.00	1	0.487	0.462	0.462
HCL	98.8	40,000	24	36	14.7	80	99.00	1	0.236	0.002	0.002
								TOTAL	0.880	0.614	0.614

FILE: N4

D-32

Sourc : HON subunit(s) Ethylene Dichloride Process Unit (EDC)
HAPs emitted: Ethyl Chloride (EC), Ethylene Dichloride (EDC), and Hydrogen Chloride (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethyl Chloride (EC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 301 (startup)
Description: No. 2 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement		---
Method of flow measurement	Calculated	
Date of concentration measurement		---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated	
Describe any problems encountered during testing	N/A	
Production rate during flow determination (lbs/hr)		75,846
Production rate during sampling (lbs/hr)		75,846
Average production rate during base year (lbs/hr)		109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	98.75	= Q
HAP concentration (ppmv)	2,495	= C
Annual hours of operation (hrs)	13	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	64	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)(98.75)(2.495)(13)(64)(14.7)}{(80) + 460}$$

$$= \boxed{0.014 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025977

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.014 (1 - 5/100)

= $\boxed{0.013 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.013) (1)

= $\boxed{0.013 \text{ Mg/yr}}$

Total HAP Emissions* = 0.548 Mg/yr
Total Weighted HAP Emissions = 0.548 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and xplain:

This is the startup scenario of Stack 301. Mass flow of gas going through the scrubber is same as that for stack 300 (startup).

The calculated total uncontrolled HAP emissions are:

Component	LB/HR
EC	2.4
EDC	95.2
HCL	3.6

These rates do not change with production rate. (See Page D-20.)

SL 025978

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

Mass flow rates of HAPs and concentrations were calculated same as in 300 startup. The average vent flow rate is same as that for the non-routine mode.

---

[a] Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 025979

SL 025980

ATTACHMENT I

SUBUNIT:	EDC
VENT ID:	301
SCENARIO:	STARTUP
DESCRIPTION:	N0. 2 LP–EDC STARTUP SCRUBBER

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb–mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E–09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 – (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

D-36

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EC	98.75	2,495	13	64	14.7	80	5.00	1	0.014	0.013	0.013
EDC	98.75	63,995	13	99	14.7	80	5.00	1	0.562	0.534	0.534
HCL	98.75	6,655	13	36	14.7	80	99.00	1	0.021	0.000	0.000
								TOTAL	0.598	0.548	0.548

FILE: N5

Source: HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethyl Dichloride (EDC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 301 (shutdown)
Description: No. 2 LP-EDC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	N/A
Production rate during flow determination (lbs/hr)	75,846
Production rate during sampling (lbs/hr)	75,846
Average production rate during base year (lbs/hr)	109,995

Stream Characteristics

Average vent stream flow rate (ft^3/min)	98.75	= Q
HAP concentration (ppmv)	133,100	= C
Annual hours of operation (hrs)	13	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(98.75)(133,100)(13)(99)(14.7)}{(80) + 460}$$

$$= \boxed{1.17 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 025981

Sourc : HON subunit(s) Ethylene Dichloride Process Unit (EDC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 1.17 (1 - 5/100)

$$= \boxed{1.11 \text{ Mg/yr}}$$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (1.11) (1)

$$= \boxed{1.11 \text{ Mg/yr}}$$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

This is the shutdown scenario of Stack 301. Vent flow calculations are identical to Stack 300. Total mass flow of HAPs to the scrubber is 198 LB/HR EDC.

Concentrations are calculated same as in 300 startup.

The hourly emissions from shutdown operations do not change with production rate.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

Mass flow of HAP was calculated, see above.

The average flow rate (Q) is same as that for the non-routine mode.

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 025982

APPENDIX E
PERCHLOROETHYLENE/TRICHLOROETHYLENE PROCESS UNIT (PER/TRI)

APPENDIX E

PERCHLOROETHYLENE/TRICHLOROETHYLENE PROCESS UNIT (PER/TRI)

E.1 Process Description

Perchloroethylene (Per) and Trichloroethylene (Tri) are manufactured simultaneously in the Per/Tri Unit from a feedstock of oxygen, 1,1,2-trichloroethane (TCE), 1,1,2,2-tetrachloroethane (Sym), 1,1,1,2-tetrachloroethane (Unsym), and heavier chlorinated organics.

$$\underset{(C_2H_3Cl_3)}{\text{1,1,2-Trichloroethane}} + \text{Heavies} + \underset{(HCl)}{\text{Hydrogen Chloride}} + \underset{(O_2)}{\text{Oxygen}} \xrightarrow[\text{Catalyst}]{}$$

$$\underset{(C_2HCl_3)}{\text{Trichloroethylene}} + \underset{(C_2Cl_4)}{\text{Perchloroethylene}} + \underset{(H_2O)}{\text{Water}} + \underset{(HCl)}{\text{Hydrogen Chloride}}$$

Per and Tri are formed by a complex series of successive chlorination and cracking reactions in which HCl is cracked off the chlorinated molecules. There are five similar independently operated reactors. Figure E-1 outlines the major steps in the production of these solvents. Figure E-2 is a flow diagram showing the major equipment used in the process and the location of vents.

Feed stocks of oxygen and vaporized organics enter the reactors and rise through the fluid bed of suspended catalyst particles. A mixture of Per, Tri, water and other gaseous organics flow out the reactor to graphite condensers. This mixture is condensed except for inerts which are vented to the incinerators. The resulting organic/water mixture is dried by phase separation and azeotropic distillation. A dry crude product is sent to the distillation section for purification.

At the distillation section the crude organic mixture is first split into a crude Per product and a crude Tri product. The crude Per product is purified by first removing heavies in a heavies still. Then two Per stills remove light impurities to produce a Per product which is neutralized and stored. Heavy impurities are sent to the Bottoms Unit in the Waste Treatment Unit and lights are recycled back into the system.

Figure E-1: PER/TRI Process Schematic
See Volume II - Confidential

SL 025985

Figure E-2: Perchloroethylene - Trichloroethylene (PER/TRI)
See Volume II - Confidential

SL 025986

The crude Tri product is separated from light impurities. The lights are transferred to either transdichloroethylene recovery or recycled to the PER/TRI reactors. A pure Tri product is neutralized and stored.

Both Per and Tri are stabilized with special chemicals and then sent to product storage to await shipment via barges, ships, tank trucks, drums, and railcars.

E.2 1987 Base-Year Emissions

Table E-1 shows the total base-year emissions for the PER/TRI process unit. The total unweighted HAP emissions were 206.784 Mg/yr. Emissions from four process vents (EIQ 303, 339, 340 and 341) and one storage tank (EIQ 360) required using weighting factors. The total base-year weighted HAP emissions for the PER/TRI unit were 366.552 Mg/yr.

E.3 Emissions Reduction Strategy

Table E-2 shows the control strategy for the PER/TRI unit that will be implemented to help achieve a plantwide reduction in emissions for all SOCMI sources at the facility. The general control strategy is as follows:

- Emissions from four process vents, EIQ 303 (startup mode only), 339, and 341 will be incinerated,
- Emissions from one process vent, EIQ 359, will be vented to a cooling tower water condenser, and
- Emissions from three storage tanks, EIQ 329, 334, and 360, will be incinerated.

With the inclusion of these controls, the total overall control level for the PER/TRI unit is estimated to be 87.65% for unweighted HAPs and 85.62% for weighted HAPs.

E.4 Post-Reduction Emissions

Table E-3 shows the total unweighted and weighted HAP emissions for the PER/TRI process unit. The total post-reduction unweighted emissions of 25.535 Mg/yr represent a 181.249 Mg/yr decrease (87.65% reduction) in unweighted HAP base-year emissions. The total post-reduction weighted emissions of 52.705 Mg/yr represent a 313.847 Mg/yr decrease (85.62% reduction) in weighted HAP base-year emissions.

SL 025988

TABLE E-1

1987 BASE YEAR EMISSIONS
PERCHLOROETHYLENE/TRICHLOROETHYLENE PROCESS UNIT (PER/TRI)

UNIT	EIQ	DESCRIPTION	TYPE	BASE YEAR			
				CONTROL DEVICE		HAP EMISSIONS	
				TYPE	% CONTROL*	UNWEIGHTED MG/YR	WEIGHTED MG/YR
PER/TRI	303	Per/Tri Startup Scrubber	P	Scrubber	5.00	7.157	32.341
PER/TRI	339	Per/Tri Still Line Scrubber	P	Scrubber	5.00	67.524	190.118
PER/TRI	340	Per/Tri DH System Vent Scrubber	P	Scrubber	5.00	0.095	0.901
PER/TRI	341	Per/Tri Acid Tank Scrubber	P	Scrubber	5.00	1.964	5.956
PER/TRI	359	Per/Tri Product Dryer Regen.	P	Scrubber	5.00	87.140	87.140
				Subtotal Process Vents		163.880	316.456
PER/TRI	327	Per Dock Storage Tank	T	None	0.00	7.179	7.179
PER/TRI	328	Per Process Storage	T	Ref. Cond.	73.10	1.051	1.051
PER/TRI	329	Per 208 Shipping Tank	T	None	0.00	0.681	0.681
PER/TRI	330	Tri Dock Storage	T	Ref. Cond.	66.70	4.782	4.782
PER/TRI	331	Tri Process Storage	T	Ref. Cond.	69.20	3.172	3.172
PER/TRI	334	Tri Shipping Tank	T	None	0.00	2.162	2.162
PER/TRI	360	Per/Tri Still Line Tk.	T	Scrubber	5.00	23.721	30.913
PER/TRI	362	Per/Tri BLM Tank No. 1	T	None	0.00	0.152	0.152
PER/TRI	363	Per/Tri BLM Tank No. 2	T	None	0.00	0.000	0,000
PER/TRI	376	Dowtherm "A" Makup Tank	T	None	0.00	0.004	0.004
PER/TRI	377	Dowtherm Recycle Water recovery Tk.	T	None	0.00	0.000	0.000
				Subtotal Tank Vents		42.904	50.096
				Total Base Year Emissions		206.784	366.552

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

FILE: PTBASE

SL 025989

E-6

TABLE E-2

EMISSIONS REDUCTIONS STRATEGY AND POST REDUCTION EMISSIONS
PERCHLOROETHYLENE/TRICHLOROETHYLENE PROCESS UNIT (PER/TRI)

UNIT	EIQ	DESCRIPTION	TYPE	POST REDUCTION			
				ADDITIONAL CONTROL	1994 % CONTROL*	HAP EMISSIONS UNWEIGHTED MG/YR	HAP EMISSIONS WEIGHTED MG/YR
PER/TRI	303	Per/Tri Su Scrubber	P	Incinerator	99.99	6.759	30.543
PER/TRI	339	Per/Tri Still Line Scrubber	P	Incinerator	98.00**	1.422	4.000
PER/TRI	340	Per/Tri DH System Scrubber	P	None	5.00	0.095	0.901
PER/TRI	341	Per/Tri acid Tank scrubber	P	Incinerator	99.99	0.000	0.001
PER/TRI	359	Per/Tri Product Dryer Regen.	P	Cooling Water Cond.	99.00	0.917	0.917
				Subtotal Process Vents		9.193	36.362
PER/TRI	327	Per Dock Storage Tank	T	None	0.00	7.179	7.179
PER/TRI	328	Per Process Storage	T	None	73.10	1.051	1.051
PER/TRI	329	Per 208 Shipping Tank	T	Incinerator	99.99	0.000	0.000
PER/TRI	330	Tri Dock Storage	T	None	66.70	4.782	4.782
PER/TRI	331	Tri Process Storage	T	None	69.20	3.172	3.172
PER/TRI	334	Tri Shipping Tank	T	Incinerator	99.99	0.000	0.000
PER/TRI	360	Per/Tri Still Line Tk.	T	Incinerator	99.99	0.002	0.003
PER/TRI	362	Per/Tri BLM Tank No. 1	T	None	0.00	0.152	0.152
PER/TRI	363	Per/Tri BLM Tank No. 2	T	None	0.00	0.000	0.000
PER/TRI	376	Dowtherm "A" Makup Tank	T	None	0.00	0.004	0.004
PER/TRI	377	Dowtherm Recycle Water recovery Tk.	T	None	0.00	0.000	0.000
				Subtotal Tank Vents		16.342	16.343
				Total Post Reduction Emissions		25.535	52.705

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

** Due to process specific conditions, some vents from this source will not be incinerated. Therefor , the control efficiency is 98% rather than 99.99% in order to allow room for operations which will not be routed to the incinerator.

FILE: PTPOST

TABLE E-3

HAP EMISSIONS SUMMARY
PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER/TRI)

Type (Units)	Unweighted HAP Emissions Base Year (Mg/yr)	Unweighted HAP Emissions Post Reduction (Mg/yr)	Unweighted HAP Emissions Percent Reduction (%)	Weighted HAP Emissions Base Year (Mg/yr)	Weighted HAP Emissions Post Reduction (Mg/yr)	Weighted HAP Emissions Percent Reduction (%)
P	163.880	9.193	94.39	316.456	36.362	88.51
T	42.904	16.342	61.91	50.096	16.343	67.38
F						
Total	206.784	25.535		366.552	52.705	
Total Percent Reduction (%)		87.65			85.62	

P-Process Vents
T-Tank Vents
F-Fugitive Emissions

APPENDIX E-A
PERCHLOROETHYLENE/TRICHLOROETHYLENE PROCESS UNIT
STORAGE TANK CALCULATIONS

Source: HON subunit(s) P rchloroethylene/Trichloroethylene (P/T)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE)

HAP: Perchloroethylene (Per) Date: 05/13/92
Year: 1987 Calculator: J. Greer

Tank Designation: EIO 327 Per Dock Storage Tank No. 1 (60-0523)
Product: Perchloroethylene

Tank Characteristics

Inside diameter, (ft)	48	= D
Height, (ft)	32	= H_T
Capacity, (gal) = $\pi \frac{D^2h}{4} * 7.48 \frac{gal}{ft^3}$, if not known	433,135	= V
Roof color	White	
Shell color	White	
Vapor space height, (ft)[a]	16	= H

Ambient Conditions

Average atmospheric pressure (psia) (defaults 14.7 psia)	14.7	= P_A
Average ambient diurnal temperature (°F)[b]	18	= dT
Average annual ambient temperature (°F)	70	= T_A

Bulk Liquid Characteristics

Stored liquid temperature (°F)[c]	70	= T_S
Total throughput per year (gal)	1,643,490	= A_N
Number of turnovers per year[d]	3.79	= N
Molecular weight of HAP (lb/lb mole)	165.82	= M_v
Mole percent of HAP	100	= %
Partial pressure of the HAP at liquid conditions (psia)	0.29	= P

Adjustment Factors

Paint factor	1.0	= F_P
Small diameter tank factor[e]	1.0	= C
Turnover factor[f]	1.0	= K_N
Product factor[g]	1.0	= K_C

SL 025992

Source: HON subunit(s) Perchloroethylene/Trichloroethylene (P/T)
HAPs emitt d: Perchloroethylene (Per)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Baseline Control

Control device None

HAP control efficiency (%) 0% = eff

Calculations[h]

Breathing Loss (Mg/yr) =

$$L_B = 1.02E\text{-}05\,(M_V)\left[\frac{(P)}{(P_A)-(P)}\right]^{0.68}(D)^{1.73}(H)^{0.51}(dT)^{0.50}(F_P)(C)(K_C)$$

$$= 1.02E\text{-}05\,(165.82)\left[\frac{0.29}{14.7-0.29}\right]^{0.68}(48)^{1.73}(16)^{0.51}(18)^{0.50}(1)(1)(1)$$

= $\boxed{1.68 \text{ Mg/yr}}$

Working Loss (Mg/yr) = $L_W = 1.09E\text{-}08\ M_V P V N K_N K_C$
= 1.09E-08(165.82)(0.29)(433,135)(3.79)(1)(1)

= $\boxed{0.86 \text{ Mg/yr}}$

Total Loss (Mg/yr) =

$T_L = L_B + L_W$ = (1.68) + (0.86)
= $\boxed{2.54 \text{ Mg/yr}}$

If a control device is employed,

HAP Emissions (E_{HAP}) = Total Loss (1 - eff/100)
= 2.540 (1 - 0/100)

= $\boxed{2.540 \text{ Mg/yr}}$

SL 025993

Source: HON subunit(s) Perchloroethylene/Trichloroethylene (P/T)
HAPs emitted: Perchloroethylene (P r)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Calculation (Continued)

Weighted HAP Emissions[i] $= E_{HAP} \quad F_{HR}$
$= (2.54) \quad (1)$
$= \boxed{2.54 \text{ Mg/yr}}$

---

[a]If vapor space height is unknown for shell, assume H equals one half tank height. If tank has a cone roof, adjust vapor space height by adding 1/3 of height of cone.

[b]If average ambient diurnal temperature change is unknown, assume 20°F.

[c]Stored liquid temperature may be approximated from average annual ambient temperature.

[d]$N = \frac{AN}{V}$ where N = number of turnovers per year
AN = total throughput per year (gal)
V = tank capacity (gal)

[e]For $D \geq 30$ft, $C=1$; For $6 \leq D < 30$ ft, $C = 0.0771D-0.0013D2-0.1334$.

[f]For turnovers > 36, $K_N = (180 + N)/(6 * N)$
where K_N = turnover factor (dimensionless)
N = number of turnovers per year
For turnovers ≤ 36, $K_N = 1$

[g]$K_C = 1.0$ for volatile organic liquids

[h]Expression for computing HAP emissions are from "Procedures for Establishing Base Year and Post-Reduction HAP Emissions." The calculation procedure is consistent with AP-42.

[i]For emissions of other HAPs from this EIQ, see summary of calculat d emissions from fixed roof storage tanks.

SL 025994

SL 025995

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (oF)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
327	60-0523	PER Dock Storage Tank No. 1	PER	100.00	White	48.00	433135	16.00	70.00	3.79	165.820	0.290	1.00	1.0000	1.00
327	60-0823	PER Dock Storage Tank No. 2	PER	100.00	White	48.00	433135	16.00	70.00	2.82	165.820	0.290	1.00	1.0000	1.00
327	60-1142	PER Dock Storage Tank No. 3	PER	100.00	White	48.00	433135	16.00	70.00	2.82	165.820	0.290	1.00	1.0000	1.00
328	60-0483	DG 3 PER 232 Batch Tank	PER	100.00	Green	12.00	14800	9.00	70.00	46.88	165.820	0.290	1.30	0.6046	0.81
328	60-0484	DG 4 PER 232 Batch Tank	PER	100.00	Green	12.00	14800	9.00	70.00	46.88	165.820	0.290	1.30	0.6046	0.81
328	60-0498	No. 2 DG PER Stab Tank	PER	100.00	Lt. Beige	12.00	14800	9.00	70.00	7.87	165.820	0.290	1.30	0.6046	1.00
328	60-0501	No. 1 DG PER Stab Tank	PER	100.00	Lt. Beige	12.00	14800	9.00	70.00	7.87	165.820	0.290	1.30	0.6046	1.00
328	60-1138	PER 232 Shipping Tank	PER	100.00	Green	20.00	70500	15.00	70.00	9.84	165.820	0.290	1.30	0.8886	1.00
328	60-1139	No. 1 PER Stab Tank	PER	100.00	Pink	20.00	70500	15.00	70.00	16.77	165.820	0.290	1.30	0.8886	1.00
328	60-1140	No. 2 PER Stab Tank	PER	100.00	Pink	20.00	70500	15.00	70.00	16.77	165.820	0.290	1.30	0.8886	1.00
329	60-0427	PER 208 Shipping Tank	PER	100.00	Aqua Green	12.00	25400	15.00	70.00	74.81	165.820	0.290	1.30	0.6046	0.57
330	60-0522	TRI-Dock Storage Tank No. 1	TRI	100.00	White	48.00	433135	16.00	70.00	1.52	131.400	1.200	1.00	1.0000	1.00
330	60-0824	TRI-Dock Storage Tank No. 2	TRI	100.00	White	48.00	433135	16.00	70.00	1.52	131.400	1.200	1.00	1.0000	1.00
330	60-1141	TRI-Dock Storage Tank No. 3	TRI	100.00	White	48.00	433135	16.00	70.00	1.52	131.400	1.200	1.00	1.0000	1.00
331	60-0649	No. 1 HP Stab Tank	TRI	100.00	Lt. Beige	12.00	14800	9.00	70.00	10.02	131.400	1.200	1.30	0.6046	1.00
331	60-0650	No. 2 HP Stab Tank	TRI	100.00	Lt. Beige	12.00	14800	9.00	70.00	7.48	131.400	1.200	1.30	0.6046	1.00
331	60-0652	N . 3 HP Stab Tank	TRI	100.00	Lt. Beige	12.00	14800	9.00	70.00	7.48	131.400	1.200	1.30	0.6046	1.00
331	60-1137	No. 1 TRI Stab Tank	TRI	100.00	Lt. Blue	20.00	70500	15.00	70.00	30.05	131.400	1.200	1.30	0.8886	1.00
331	60-1216	No. 3 TRI Stab Tank	TRI	100.00	Lt. Blue	20.00	70500	15.00	70.00	30.05	131.400	1.200	1.30	0.8886	1.00
334	60-0428	TRI Shipping Tank	TRI	100.00	White	12.00	25400	15.00	70.00	90.43	131.400	1.200	1.00	0.6046	0.50
341	P/T Acid TPer/ Tri Acid Tank Scrubber		DCE	0.00	Black	10.50	10000	4.00	100.00	5.83	98.970	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		EDC	0.00	Black	10.50	10000	4.00	100.00	5.83	98.970	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		H2O*	99.99	Black	10.50	10000	4.00	100.00	5.83	18.020	0.950	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		MECL2	0.00	Black	10.50	10000	4.00	100.00	5.83	84.930	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		SYM	0.00	Black	10.50	10000	4.00	100.00	5.83	167.850	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		TCE	0.00	Black	10.50	10000	4.00	100.00	5.83	133.410	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		UNSYM*	0.00	Black	10.50	10000	4.00	100.00	5.83	167.850	0.000	1.50	0.5328	1.00
341	P/T Acid TPer/ Tri Acid Tank Scrubber		VDC	0.00	Black	10.50	10000	4.00	100.00	5.83	96.940	0.000	1.50	0.5328	1.00
360	60-0468	No. 1 Still Line Feed Tank	CCL4	1.53	Lt. Blue	12.00	20000	12.00	100.00	315.25	153.820	0.055	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	CIS*	0.81	Lt. Blue	12.00	20000	12.00	100.00	315.25	96.950	0.054	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	HCBD	1.80	Lt. Blue	12.00	20000	12.00	100.00	315.25	260.760	0.000	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	HEXA	0.13	Lt. Blue	12.00	20000	12.00	100.00	315.25	236.760	0.000	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	PCBD*	0.35	Lt. Blue	12.00	20000	12.00	100.00	315.25	226.200	0.001	1.30	0.6046	0.26
360	60-0468	N . 1 Still Line Feed Tank	PENTA*	0.70	Lt. Blue	12.00	20000	12.00	100.00	315.25	202.290	0.001	1.30	0.6046	0.26

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SL 025996

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PER / TRI PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
327	60-0523	PER Dock Storage Tank No. 1	PER	1.67904	0.86145	2.54049	None	0.00	2.54049	2.54049
327	60-0823	PER Dock Storage Tank No. 2	PER	1.67904	0.64016	2.31920	None	0.00	2.31920	2.31920
327	60-1142	PER Dock Storage Tank No. 3	PER	1.67904	0.64016	2.31920	None	0.00	2.31920	2.31920
328	60-0483	DG 3 PER 232 Batch Tank	PER	0.08943	0.29334	0.38277	RVR	73.10	0.10297	0.10297
328	60-0484	DG 4 PER 232 Batch Tank	PER	0.08943	0.29334	0.38277	RVR	73.10	0.10297	0.10297
328	60-0498	No. 2 DG PER Stab Tank	PER	0.08943	0.06102	0.15044	RVR	73.10	0.04047	0.04047
328	60-0501	No. 1 DG PER Stab Tank	PER	0.08943	0.06102	0.15044	RVR	73.10	0.04047	0.04047
328	60-1138	PER 232 Shipping Tank	PER	0.41272	0.36371	0.77642	RVR	73.10	0.20886	0.20886
328	60-1139	No. 1 PER Stab Tank	PER	0.41272	0.61967	1.03238	RVR	73.10	0.27771	0.27771
328	60-1140	No. 2 PER Stab Tank	PER	0.41272	0.61967	1.03238	RVR	73.10	0.27771	0.27771
329	60-0427	PER 208 Shipping Tank	PER	0.11604	0.56540	0.68144	None	0.00	0.68144	0.68144
330	60-0522	TRI-Dock Storage Tank No. 1	TRI	3.65339	1.13371	4.78710	RVR	66.70	1.59411	1.59411
330	60-0824	TRI-Dock Storage Tank No. 2	TRI	3.65339	1.13371	4.78710	RVR	66.70	1.59411	1.59411
330	60-1141	TRI-Dock Storage Tank No. 3	TRI	3.65339	1.13371	4.78710	RVR	66.70	1.59411	1.59411
331	60-0649	No. 1 HP Stab Tank	TRI	0.19458	0.25486	0.44945	RVR	69.20	0.13843	0.13843
331	60-0650	No. 2 HP Stab Tank	TRI	0.19458	0.19028	0.38487	RVR	69.20	0.11854	0.11854
331	60-0652	No. 3 HP Stab Tank	TRI	0.19458	0.19028	0.38487	RVR	69.20	0.11854	0.11854
331	60-1137	No. 1 TRI Stab Tank	TRI	0.89802	3.64096	4.53898	RVR	69.20	1.39801	1.39801
331	60-1216	No. 3 TRI Stab Tank	TRI	0.89802	3.64096	4.53898	RVR	69.20	1.39801	1.39801
334	60-0428	TRI Shipping Tank	TRI	0.19423	1.96761	2.16184	None	0.00	2.16184	2.16184
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	DCE	0.00027	0.00002	0.00029	None	0.00	0.00029	0.00029
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	EDC	0.00015	0.00001	0.00016	None	0.00	0.00016	0.00016
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	H2O*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	MECL2	0.00012	0.00001	0.00013	None	0.00	0.00013	0.00013
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	SYM	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00003
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	TCE	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	UNSYM*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
341	P/T Acid TK	Per/ Tri Acid Tank Scrubber	VDC	0.00014	0.00001	0.00015	None	0.00	0.00015	0.00149
360	60-0468	No. 1 Still Line Feed Tank	CCL4	0.03078	0.15301	0.18379	Scrubber	5.00	0.17460	0.17460
360	60-0468	No. 1 Still Line Feed Tank	CIS*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0468	No. 1 Still Line Feed Tank	HCBD	0.00075	0.00051	0.00126	Scrubber	5.00	0.00119	0.00119
360	60-0468	No. 1 Still Line Feed Tank	HEXA	0.00031	0.00015	0.00046	Scrubber	5.00	0.00044	0.00044
360	60-0468	No. 1 Still Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0468	No. 1 Still Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000

* = NON HAPS, emission is not included as a HAP emission

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
360	60-0468	No. 1 Still Line Feed Tank	PER	64.22	Lt. Blue	12.00	20000	12.00	100.00	315.25	165.820	0.440	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	SYM	0.03	Lt. Blue	12.00	20000	12.00	100.00	315.25	167.860	0.000	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	TCE	0.12	Lt. Blue	12.00	20000	12.00	100.00	315.25	133.410	0.001	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	TRANS*	0.32	Lt. Blue	12.00	20000	12.00	100.00	315.25	96.950	0.033	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	TRI	29.79	Lt. Blue	12.00	20000	12.00	100.00	315.25	131.400	0.751	1.30	0.6046	0.26
360	60-0468	N . 1 Still Line Feed Tank	UNSYM*	0.05	Lt. Blue	12.00	20000	12.00	100.00	315.25	167.864	0.000	1.30	0.6046	0.26
360	60-0468	No. 1 Still Line Feed Tank	VDC	0.16	Lt. Blue	12.00	20000	12.00	100.00	315.25	96.950	0.028	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	CCL4	1.53	Lt. Blue	12.00	20000	12.00	100.00	315.25	153.820	0.055	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	CIS*	0.81	Lt. Blue	12.00	20000	12.00	100.00	315.25	96.950	0.054	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	HCBD	1.80	Lt. Blue	12.00	20000	12.00	100.00	315.25	260.760	0.000	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	HEXA	0.13	Lt. Blue	12.00	20000	12.00	100.00	315.25	236.760	0.000	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	PCBD*	0.35	Lt. Blue	12.00	20000	12.00	100.00	315.25	226.200	0.001	1.30	0.6046	0.26
360	60-0472	N . 2 Still Line Feed Tank	PENTA*	0.70	Lt. Blue	12.00	20000	12.00	100.00	315.25	202.290	0.001	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	PER	64.22	Lt. Blue	12.00	20000	12.00	100.00	315.25	165.820	0.440	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	SYM	0.03	Lt. Blue	12.00	20000	12.00	100.00	315.25	167.860	0.000	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	TCE	0.12	Lt. Blue	12.00	20000	12.00	100.00	315.25	133.410	0.001	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	TRANS*	0.32	Lt. Blue	12.00	20000	12.00	100.00	315.25	97.000	0.033	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	TRI	29.79	Lt. Blue	12.00	20000	12.00	100.00	315.25	131.400	0.751	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	UNSYM*	0.05	Lt. Blue	12.00	20000	12.00	100.00	315.25	167.864	0.000	1.30	0.6046	0.26
360	60-0472	No. 2 Still Line Feed Tank	VDC	0.16	Lt. Blue	12.00	20000	12.00	100.00	315.25	96.950	0.028	1.30	0.6046	0.26
360	60-0490	No. 1 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0490	N . 1 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0490	No. 1 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0490	No. 1 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0490	No. 1 Aux Line Feed Tank	PER	87.18	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0490	No. 1 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0490	No. 1 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6048	1.00
360	60-0491	No. 2 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0491	No. 2 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0491	No. 2 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0491	N . 2 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0491	No. 2 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0491	No. 2 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0491	No. 2 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PER / TRI PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
360	60-0468	No. 1 Still Line Feed Tank	PER	0.13837	1.31138	1.44976	Scrubber	5.00	1.37727	1.37727
360	60-0468	No. 1 Still Line Feed Tank	SYM	0.00036	0.00021	0.00057	Scrubber	5.00	0.00054	0.00545
360	60-0468	No. 1 Still Line Feed Tank	TCE	0.00177	0.00246	0.00423	Scrubber	5.00	0.00402	0.00402
360	60-0468	No. 1 Still Line Feed Tank	TRANS*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0468	No. 1 Still Line Feed Tank	TRI	0.16020	1.77522	1.93542	Scrubber	5.00	1.83865	1.83865
360	60-0468	No. 1 Still Line Feed Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0468	No. 1 Still Line Feed Tank	VDC	0.01224	0.04909	0.06134	Scrubber	5.00	0.05827	0.58268
360	60-0472	No. 2 Still Line Feed Tank	CCL4	0.03075	0.15275	0.18350	Scrubber	5.00	0.17432	0.17432
360	60-0472	No. 2 Still Line Feed Tank	CIS*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0472	No. 2 Still Line Feed Tank	HCBD	0.00075	0.00051	0.00126	Scrubber	5.00	0.00119	0.00119
360	60-0472	No. 2 Still Line Feed Tank	HEXA	0.00031	0.00015	0.00046	Scrubber	5.00	0.00044	0.00044
360	60-0472	No. 2 Still Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0472	No. 2 Still Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0472	No. 2 Still Line Feed Tank	PER	0.13837	1.31139	1.44976	Scrubber	5.00	1.37727	1.37727
360	60-0472	No. 2 Still Line Feed Tank	SYM	0.00036	0.00021	0.00057	Scrubber	5.00	0.00054	0.00545
360	60-0472	No. 2 Still Line Feed Tank	TCE	0.00177	0.00246	0.00423	Scrubber	5.00	0.00402	0.00402
360	60-0472	No. 2 Still Line Feed Tank	TRANS*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0472	No. 2 Still Line Feed Tank	TRI	0.16021	1.77522	1.93543	Scrubber	5.00	1.83865	1.83865
360	60-0472	No. 2 Still Line Feed Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0472	No. 2 Still Line Feed Tank	VDC	0.01224	0.04909	0.06134	Scrubber	5.00	0.05827	0.58268
360	60-0490	No. 1 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0490	No. 1 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0490	No. 1 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0490	No. 1 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0490	No. 1 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0490	No. 1 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0490	No. 1 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0491	No. 2 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0491	No. 2 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0491	No. 2 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0491	No. 2 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0491	No. 2 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0491	No. 2 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0491	No. 2 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775

* = NON HAPS, emission is not included as a HAP emission

SL 025998

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
360	60-0492	No. 4 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0492	No. 4 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0493	No. 3 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0494	No. 7 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0495	No. 5 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0496	No. 6 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SL 026000

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PER / TRI PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
360	60-0492	No. 4 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0492	No. 4 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0492	No. 4 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0492	No. 4 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0492	No. 4 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0492	No. 4 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0492	No. 4 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0493	No. 3 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0493	No. 3 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0493	No. 3 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0493	No. 3 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0493	No. 3 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0493	No. 3 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0493	No. 3 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0494	No. 7 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0494	No. 7 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0494	No. 7 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0494	No. 7 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0494	No. 7 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0494	No. 7 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0494	No. 7 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0495	No. 5 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0495	No. 5 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0495	No. 5 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0495	No. 5 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0495	No. 5 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0495	No. 5 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0495	No. 5 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0496	No. 6 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0496	No. 6 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0496	No. 6 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0496	No. 6 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0496	No. 6 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0496	N . 6 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686

= NON HAPS, emission is not included as a HAP emission

SL 026001

E.1a

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
360	60-0496	No. 6 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0499	No. 10 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0499	N . 10 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0499	No. 10 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0499	No. 10 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0499	No. 10 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0499	N . 10 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0499	N . 10 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0500	No. 9 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0500	N . 9 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0500	No. 9 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00
360	60-0500	No. 9 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0500	N . 9 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0500	No. 9 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0500	No. 9 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-0503	Heavies Still Feed Tank	HCBD	2.61	Aqua Green	12.00	20000	12.00	150.00	380.53	260.760	0.003	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	HEXA	0.72	Aqua Green	12.00	20000	12.00	150.00	380.53	236.760	0.001	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	PCBD*	1.13	Aqua Green	12.00	20000	12.00	150.00	380.53	226.200	0.009	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	PENTA*	1.68	Aqua Green	12.00	20000	12.00	150.00	380.53	202.290	0.011	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	PER	92.27	Aqua Green	12.00	20000	12.00	150.00	380.53	165.820	2.119	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	SYM	1.01	Aqua Green	12.00	20000	12.00	150.00	380.53	167.860	0.010	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	TCE	0.38	Aqua Green	12.00	20000	12.00	150.00	380.53	133.410	0.011	1.30	0.6046	0.25
360	60-0503	Heavies Still Feed Tank	UNSYM*	0.20	Aqua Green	12.00	20000	12.00	150.00	380.53	167.864	0.004	1.30	0.6046	0.25
360	60-0586	No. 1 PER/TRI Bottoms Tank	EDC	3.44	Lt. Beige	12.00	20000	12.00	130.00	461.88	98.970	0.187	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	HCBD	5.22	Lt. Beige	12.00	20000	12.00	130.00	461.88	260.760	0.005	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	HEXA	3.59	Lt. Beige	12.00	20000	12.00	130.00	461.88	236.760	0.003	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	PENTA*	10.10	Lt. Beige	12.00	20000	12.00	130.00	461.88	202.290	0.040	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	PER	41.05	Lt. Beige	12.00	20000	12.00	130.00	461.88	165.820	0.597	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	SYM	11.15	Lt. Beige	12.00	20000	12.00	130.00	461.88	167.860	0.064	1.30	0.6046	0.23
360	60-0586	N . 1 PER/TRI Bottoms Tank	TCE	15.31	Lt. Beige	12.00	20000	12.00	130.00	461.88	133.410	0.282	1.30	0.6046	0.23
360	60-0586	No. 1 PER/TRI Bottoms Tank	UNSYM*	10.14	Lt. Beige	12.00	20000	12.00	130.00	461.88	167.864	0.111	1.30	0.6046	0.23
360	60-0651	No. 8 Aux Line Feed Tank	HCBD	1.29	Aqua Green	12.00	14700	12.00	70.00	0.37	260.760	0.000	1.30	0.6046	1.00
360	60-0651	No. 8 Aux Line Feed Tank	HEXA	0.71	Aqua Green	12.00	14700	12.00	70.00	0.37	236.760	0.000	1.30	0.6046	1.00
360	60-0651	No. 8 Aux Line Feed Tank	PCBD*	0.74	Aqua Green	12.00	14700	12.00	70.00	0.37	226.200	0.001	1.30	0.6046	1.00

* = NON HAP, Emission is not included as a HAP emission.

SL 026002

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PER / TRI PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
360	60-0496	No. 6 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0499	No. 10 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0499	No. 10 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0499	No. 10 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0499	No. 10 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0499	No. 10 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0499	No. 10 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0499	No. 10 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0500	No. 9 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0500	No. 9 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0500	No. 9 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0500	No. 9 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0500	No. 9 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0500	No. 9 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0500	No. 9 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-0503	Heavies Still Feed Tank	HCBD	0.00696	0.01523	0.02220	Scrubber	5.00	0.02109	0.02109
360	60-0503	Heavies Still Feed Tank	HEXA	0.00296	0.00453	0.00749	Scrubber	5.00	0.00712	0.00712
360	60-0503	Heavies Still Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0503	Heavies Still Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0503	Heavies Still Feed Tank	PER	0.43908	7.15460	7.59368	Scrubber	5.00	7.21400	7.21400
360	60-0503	Heavies Still Feed Tank	SYM	0.01018	0.03273	0.04291	Scrubber	5.00	0.04076	0.40761
360	60-0503	Heavies Still Feed Tank	TCE	0.00892	0.03003	0.03894	Scrubber	5.00	0.03699	0.03699
360	60-0503	Heavies Still Feed Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0586	No. 1 PER/TRI Bottoms Tank	EDC	0.04562	0.43136	0.47698	Scrubber	5.00	0.45313	0.45313
360	60-0586	No. 1 PER/TRI Bottoms Tank	HCBD	0.01046	0.03175	0.04221	Scrubber	5.00	0.04010	0.04010
360	60-0586	No. 1 PER/TRI Bottoms Tank	HEXA	0.00584	0.01411	0.01995	Scrubber	5.00	0.01896	0.01896
360	60-0586	No. 1 PER/TRI Bottoms Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0586	No. 1 PER/TRI Bottoms Tank	PER	0.17176	2.30975	2.48151	Scrubber	5.00	2.35744	2.35744
360	60-0586	No. 1 PER/TRI Bottoms Tank	SYM	0.03714	0.25073	0.28787	Scrubber	5.00	0.27348	2.73480
360	60-0586	No. 1 PER/TRI Bottoms Tank	TCE	0.08172	0.87740	0.95912	Scrubber	5.00	0.91116	0.91116
360	60-0586	No. 1 PER/TRI Bottoms Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0651	No. 8 Aux Line Feed Tank	HCBD	0.00028	0.00000	0.00028	Scrubber	5.00	0.00027	0.00027
360	60-0651	No. 8 Aux Line Feed Tank	HEXA	0.00047	0.00000	0.00047	Scrubber	5.00	0.00044	0.00044
360	60-0651	No. 8 Aux Line Feed Tank	PCBD*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000

* = NON HAPS, emission is not included as a HAP emission

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PERCHLOROETHYLENE / TRICHLOROETHYLENE PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
360	60-0651	N . 8 Aux Line Feed Tank	PENTA*	2.08	Aqua Green	12.00	14700	12.00	70.00	0.37	202.290	0.001	1.30	0.6046	1.00
360	60-0651	No. 8 Aux Line Feed Tank	PER	87.16	Aqua Green	12.00	14700	12.00	70.00	0.37	165.820	0.253	1.30	0.6046	1.00
360	60-0651	No. 8 Aux Line Feed Tank	SYM	5.51	Aqua Green	12.00	14700	12.00	70.00	0.37	167.860	0.006	1.30	0.6046	1.00
360	60-0651	No. 8 Aux Line Feed Tank	TCE	2.52	Aqua Green	12.00	14700	12.00	70.00	0.37	133.410	0.010	1.30	0.6046	1.00
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	EDC	3.44	Lt. Beige	12.00	20000	12.00	130.00	525.00	98.970	0.187	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	HCBD	5.22	Lt. Beige	12.00	20000	12.00	130.00	525.00	260.760	0.005	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	HEXA	3.59	Lt. Beige	12.00	20000	12.00	130.00	525.00	236.760	0.003	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	PENTA*	10.10	Lt. Beige	12.00	20000	12.00	130.00	525.00	202.290	0.040	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	PER	41.05	Lt. Beige	12.00	20000	12.00	130.00	525.00	165.820	0.597	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	SYM	11.15	Lt. Beige	12.00	20000	12.00	130.00	525.00	167.860	0.064	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	TCE	15.31	Lt. Beige	12.00	20000	12.00	130.00	525.00	133.410	0.282	1.30	0.6046	0.22
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	UNSYM*	10.14	Lt. Beige	12.00	20000	12.00	130.00	525.00	167.864	0.111	1.30	0.6046	0.22
362	60-505	PER/TRI BLM Tank No. 1	Butylene Ox	100.00	Yellow	9.00	6000	10.00	70.00	4.25	72.120	2.706	1.30	0.4552	1.00
363	60-647	PER/TRI BLM Tank No. 2	Butylene Ox	100.00	Green	9.00	4100	0.00	70.00	0.00	72.120	2.706	1.30	0.4552	1.00
376	60-1865	Dowtherm "A" Make-up Tank	BIPHENYL	27.00	White	10.00	8700	6.00	200.00	0.24	166.000	0.014	1.00	0.5076	1.00
376	60-1865	Dowtherm "A" Make-up Tank	DIPHENYL(	73.00	White	10.00	8700	6.00	200.00	0.24	166.000	0.037	1.00	0.5076	1.00
377	60-2173	Dowtherm Recycle H20 Recovery Tank	BIPHENYL	0.00	Green	12.00	6768	5.00	200.00	0.31	166.000	0.000	1.30	0.6046	1.00
377	60-2173	Dowtherm Recycle H20 Recovery Tank	DIPHENYL(	0.00	Green	12.00	6768	5.00	200.00	0.31	166.000	0.000	1.30	0.6046	1.00
377	60-2173	Dowtherm Recycle H20 Recovery Tank	H20*	100.00	Green	12.00	6768	5.00	200.00	0.31	18.020	11.380	1.30	0.6046	1.00

* = NON HAP, Emission is not included as a HAP emission.

SL 026004

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE PER / TRI PROCESS UNIT (PER / TRI)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
360	60-0651	No. 8 Aux Line Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-0651	No. 8 Aux Line Feed Tank	PER	0.09415	0.00249	0.09664	Scrubber	5.00	0.09181	0.09181
360	60-0651	No. 8 Aux Line Feed Tank	SYM	0.00698	0.00005	0.00704	Scrubber	5.00	0.00669	0.06686
360	60-0651	No. 8 Aux Line Feed Tank	TCE	0.00809	0.00008	0.00816	Scrubber	5.00	0.00775	0.00775
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	EDC	0.04562	0.47378	0.51940	Scrubber	5.00	0.49343	0.49343
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	HCBD	0.01046	0.03487	0.04534	Scrubber	5.00	0.04307	0.04307
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	HEXA	0.00584	0.01550	0.02134	Scrubber	5.00	0.02027	0.02027
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	PER	0.17176	2.53690	2.70866	Scrubber	5.00	2.57323	2.57323
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	SYM	0.03695	0.27332	0.31028	Scrubber	5.00	0.29476	2.94764
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	TCE	0.08172	0.96369	1.04540	Scrubber	5.00	0.99313	0.99313
360	60-1683	No. 2 PER/TRI Bottoms Feed Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
362	60-505	PER/TRI BLM Tank No. 1	Butylene Oxide	0.09723	0.05430	0.15153	None	0.00	0.15153	0.15153
363	60-647	PER/TRI BLM Tank No. 2	Butylene Oxide	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
376	60-1665	Dowtherm "A" Make-up Tank	BIPHENYL	0.00426	0.00005	0.00432	None	0.00	0.00432	0.00432
376	60-1665	Dowtherm "A" Make-up Tank	DIPHENYL.OX*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
377	60-2173	Dowtherm Recycle H20 Recovery Tank	BIPHENYL	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
377	60-2173	Dowtherm Recycle H20 Recovery Tank	DIPHENYL.OX*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
377	60-2173	Dowtherm Recycle H20 Recovery Tank	H20*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000

* = NON HAPS, emission is not included as a HAP emission

E-21

APPENDIX E-B
PER/TRI PROCESS UNIT
PROCESS VENT CALCULATION

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Vinyl Chloride (VC), Vinylidene Chloride (VDC), 1,1-Dichloroethane (DCE), Chloroform, Carbon Tetrachloride, Trichloroethylene (TCE), Ethyl Chloride (EC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Vinyl Chloride (VC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 303 (non-routine)
Description: Per/Tri Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	1983
Method of flow measurement	Hot Wire Anemometer
Date of concentration measurement	1990
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	14,810[1]
Production rate during sampling (lbs/hr)	15,002[1]
Average production rate during base year (lbs/hr)	20,105

Stream Characteristics

Average vent stream flow rate (ft^3/min)	792	= Q
HAP concentration (ppmv)	2,842	= C
Annual hours of operation (hrs)	88	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	63	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	10	= F_{HR}

Control

Control device Scrubber

HAP control efficiency (%)	5	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(792)(2,842)(88)(63)(14.7)}{(80) + 460}$$

$$= \boxed{0.863\ \text{Mg/yr}}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)

[1]See next page.

SL 026006

Sourc : HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.863 (1 - 5/100)

= $\boxed{0.820 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.82) (10)

= $\boxed{8.197 \text{ Mg/yr}}$

Total HAP Emissions* = 6.759 Mg/yr
Total Weighted HAP Emissions = 30.543 Mg/yr

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and explain:

This is the non-routine scenario of Stack 303. The composition data for this vent is available from 1990.

In order to be consistent with operating conditions in 1987, the 1987 stack flow rate was used which was the same as the flow rate measured in 1983.

If the flow or concentration were not measured using an EPA r ference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 026008

ATTACHMENT I

SUBUNIT:	PER/TRI
VENT ID:	303
SCENARIO:	NON-ROUTINE
DESCRIPTION:	PER/TRI STARTUP SCRUBBER'

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb-mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 - (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
VC	792	2,842	88	63	14.7	80	5.00	10	0.863	0.820	8.197
VDC	792	4,105	88	97	14.7	80	5.00	10	1.919	1.823	18.229
DCE	792	947	88	99	14.7	80	5.00	1	0.452	0.429	0.429
CHCL3	792	737	88	119	14.7	80	5.00	1	0.423	0.402	0.402
CCL4	792	947	88	154	14.7	80	5.00	1	0.703	0.668	0.668
TRI	792	4,211	88	131	14.7	80	5.00	1	2.658	2.525	2.525
EC	792	316	88	64	14.7	80	5.00	1	0.097	0.093	0.093
								TOTAL	7.115	6.759	30.543

FILE: N12

Sourc : HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Vinyl Chloride (VC), Vinylidene Chloride (VDC), 1,1-Dichloroethane (DCE), Chloroform, Carbon Tetrachloride, Trichloroethylene (TCE), Ethyl Chloride (EC)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Vinyl Chloride (VC) Date: April 1992

Year: 1987 Calculator: S.R.

Process Vent Identification: 303 (startup)

Description: Per/Tri Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	1983
Method of flow measurement	Hot Wire Anemometer
Date of concentration measurement	1990
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	14,810
Production rate during sampling (lbs/hr)	15,002
Average production rate during base year (lbs/hr)	20,105

Stream Characteristics

Average vent stream flow rate (ft^3/min)	55.4	= Q
HAP concentration (ppmv)	2,842	= C
Annual hours of operation (hrs)	74	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	63	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	10	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(55.4)(2,842)(74)(63)(14.7)}{(80) + 460}$$

$$= \boxed{0.051\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.051 (1 - 5/100)

= $\boxed{0.048\ Mg/yr}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.048) (10)

= $\boxed{0.483\ Mg/yr}$

Total HAP Emissions* = 0.398 Mg/yr
Total Weighted HAP Emissions = 1.798 Mg/yr

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and explain:

This is the startup scenario of Stack 303. Emission concentrations from the source are same as those in non-routine scenario. Composition data are available from 1990.

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 026011

ATTACHMENT I

SUBUNIT:	PER/TRI
VENT ID:	303
SCENARIO:	STARTUP
DESCRIPTION:	PER/TRI STARTUP SCRUBBER'

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb-mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 - (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

E-28

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
VC	55.44	2,842	74	63	14.7	80	5.00	10	0.051	0.048	0.483
VDC	55.44	4,105	74	97	14.7	80	5.00	10	0.113	0.107	1.073
DCE	55.44	947	74	99	14.7	80	5.00	1	0.027	0.025	0.025
CHCL3	55.44	737	74	119	14.7	80	5.00	1	0.025	0.024	0.024
CCL4	55.44	947	74	154	14.7	80	5.00	1	0.041	0.039	0.039
TRI	55.44	4,211	74	131	14.7	80	5.00	1	0.156	0.149	0.149
EC	55.44	316	74	64	14.7	80	5.00	1	0.006	0.005	0.005
								TOTAL	0.419	0.398	1.798

FILE: N12A

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Vinylidene Chloride (VDC), Carbon Tetrachloride (CCl_4), Trichloroethylene (Tri), Perchloroethylene (Per)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Vinylidene Chloride (VDC)   Date: April 1992
Year: 1987   Calculator: S.R.

Process Vent Identification: 339
Description: Per/Tri Still Line Vent Scrubber

Process Conditions/Sampling

Date of flow measurement	1987
Method of flow measurement	Hot Wire Anemometer
Date of concentration measurement	1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Integrated Bag Sample, GC/TCD or FID
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	16,372
Production rate during sampling (lbs/hr)	16,372
Average production rate during base year (lbs/hr)	16,372

Stream Characteristics

Average vent stream flow rate (ft^3/min)	16.6	= Q
HAP concentration (ppmv)	14,737	= C
Annual hours of operation (hrs)	8,760	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	97	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	10	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(16.6)(14,737)(8,760)(97)(14.7)}{(80) + 460}$$

$$= \boxed{14.338 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 14.338 (1 - 5/100)

= $\boxed{13.622 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (13.622) (10)

= $\boxed{136.215 \text{ Mg/yr}}$

Total HAP Emissions* = 67.524 Mg/yr
Total Weighted HAP Emissions = 190.118 Mg/yr

If the conditions during testing are not representative of base y ar peration, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA refer nce method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 026014

ATTACHMENT I

SUBUNIT:	PER/TRI
VENT ID:	339
SCENARIO:	NORMAL
DESCRIPTION:	PER/TRI STILL LINE VENT SCRUBBER

YEAR: 1987

Q = Average vent stream flow rate (ft3/min)
C = HAP Concentration (ppmv)
h = Annual hours of operation (hrs)
T = Vent stream discharge temperature (F)
MW = HAP molecular weight (lb/lb-mole)
P = Pressure at point of discharge (psia)
FHR = HAP high risk weighting factor
eff = HAP control efficiency (%)
EU = Uncontrolled emissions (Mg/yr) ; EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP = Controlled emissions (Mg/yr) ; EHAP = EU x (1 - (eff/100))
EW = Weighted HAP emissions (Mg/yr) ; EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
VDC	16.56	14,737	8760	97	14.7	80	5.00	10	14.338	13.622	136.215
CCL4	16.56	22,105	8760	154	14.7	80	5.00	1	34.145	32.438	32.438
TRI	16.56	10,526	8760	131	14.7	80	5.00	1	13.831	13.140	13.140
PER	16.56	5,263	8760	166	14.7	80	5.00	1	8.763	8.325	8.325
								TOTAL	71.078	67.524	190.118

FILE: N29

F-71

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Vinylidene Chloride (VDC), Methylene Chloride ($MECl_2$), Vinyl Chloride (VC), 1,1-Dichloroethane (DCE), Carbon Tetrachloride (CCl_4), Trichloroethylene (Tri) .

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: 1,1-Dichloroethane (DCE) Date: April 1992

Year: 1987 Calculator: S.R.

Process Vent Identification: 340 (non-routine)

Description: Per/Tri DH System Vent Scrubber

Process Conditions/Sampling

Date of flow measurement	1987
Method of flow measurement	Helium injected as flow tracer
Date of concentration measurement	1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	16,372
Production rate during sampling (lbs/hr)	16,372
Average production rate during base year (lbs/hr)	16,372

Stream Characteristics

Average vent stream flow rate (ft^3/min)	3.53	= Q
HAP concentration (ppmv)	3,789	= C
Annual hours of operation (hrs)	9.75	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Incinerator

HAP control efficiency (%) 5.0 = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(3.53)(3,789)(9.75)(99)(14.7)}{(80) + 460}$$

$$= \boxed{0.001\ \text{Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 026015

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.001 (1 - 5.0/100)

= $\boxed{0.001 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.001) (1)

= $\boxed{0.001 \text{ Mg/yr}}$

Total HAP Emissions* = 0.095 Mg/yr
Total Weighted HAP Emissions = 0.901 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 026017

E-34

ATTACHMENT I

SUBUNIT:	PER/TRI
VENT ID:	340
SCENARIO:	NON-ROUTINE
DESCRIPTION:	PER/TRI DH SYSTEM VENT

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb-mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 - (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
VC	3.53	116,842	9.75	63	14.7	80	5.00	10	0.018	0.017	0.166
MECL2	3.53	211	9.75	85	14.7	80	5.00	1	0.000	0.000	0.000
VDC	3.53	332,632	9.75	97	14.7	80	5.00	10	0.077	0.073	0.729
DCE	3.53	3,789	9.75	99	14.7	80	5.00	1	0.001	0.001	0.001
CCL4	3.53	10,526	9.75	154	14.7	80	5.00	1	0.004	0.004	0.004
TRI	3.53	2,737	9.75	131	14.7	80	5.00	1	0.001	0.001	0.001
								TOTAL	0.100	0.095	0.901

FILE: N30

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Vinyl Chloride (VC), Vinylidene Chloride (VDC), Ethylene Dichloride (EDC), Chloroform, Methyl Chloroform (MC), Trichloroethylene (Tri), 1,1,2-Trichloroethane (TCE), Perchloroethylene (Per)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Vinyl Chloride (VC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 341
Description: Per/Tri Acid Tank Scrubber

Process Conditions/Sampling

Date of flow measurement	---
Method of flow measurement	Calculated
Date of concentration measurement	1979
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	not available
Production rate during sampling (lbs/hr)	not available
Average production rate during base year (lbs/hr)	not availabl

Stream Characteristics

Average vent stream flow rate (ft^3/min)	0.0374	= Q
HAP concentration (ppmv)	48,254	= C
Annual hours of operation (hrs)	8,760	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	63	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	10	= F_{HR}

Control

Control device	Scrubber	
HAP control efficiency (%)	5	= eff

Calculations[a]

Uncontrolled Emissions $(E_U) = \frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$

Uncontrolled Emissions $(E_U) = \frac{(2.54E-09)(0.0374)(48,254)(8,760)(63)(14.7)}{(80) + 460}$

$= \boxed{0.069\ Mg/yr}$

HAP Emissions $(E_{HAP}) = E_U\ (1 - eff/100)$

SL 026018

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.069 (1 - 5/100)

= $\boxed{0.065 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.037) (1)

= $\boxed{0.654 \text{ Mg/yr}}$

Total HAP Emissions* = 1.964 Mg/yr
Total Weighted HAPs Emissions = 5.956 Mg/yr

If the conditions during testing are not representative of base year peration, make the appropriate extrapolation below and explain:

Composition data are available (from CADY report to Schwarzauer "Acid Pit Vents" 2-22-79) for EIQ 341 (Lift Station No. 2). These are shown on the attached Table 1 in lb/day. (EIQ 341 was excluded from calculation of lift station emissions. See "Lift Station Emission Calculations" in Appendix J.)

The mole/hr values were calculated from mass emission rates and are shown on Table 1 below.

SL 026019

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

TABLE 1

Mass Emission Rates

Component	MW	M (lb/day)	M (lb/hr)	m (mole/hr)	C ppmv
VC	63	0.41	0.171	0.000271	48,254
VDC	97	2.37	0.0988	0.001018	181,161
EDC	99	2.13	0.0888	0.000896	159,526
CHCL3	119	5.19	0.2163	0.001817	323,376
MC	133	0.007	0.0003	0.000002	390
TRI	131	0.67	0.0279	0.000213	37,922
TCE	133	0.84	0.0350	0.000263	46,829
PER	166	0.69	0.0287	0.000173	30,820
TRANS*	97	2.4	0.1000	0.001031	183,454
CIS*	97	0.007	0.0003	0.000003	535
TOTAL MASS RATE		14.714	0.6131		
TOTAL MOLES				0.005688	

Total emissions as shown on Table 1 is 0.0057 mole/hr for the vent. The volumetric emission rate can be calculated as follows (at vent temperature of 80°F):

$$0.0057 \frac{\text{mole}}{\text{hr}} \times 359 \frac{\text{ft}^3}{\text{mole}} \times \frac{88 + 460}{32 + 460} = 2.247 \frac{\text{ft}^3}{\text{hr}}$$

or:
$$2.247 \frac{\text{ft}^3}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} = 0.0374 \frac{\text{ft}^3}{\text{min}}$$

Similarly for each vent the volumetric flow rate can be calculated using the above procedure, and the concentration of the HAP can be determined. Calculation for VC is shown below.

$$0.000271 \frac{mole}{hr} \times 359 \frac{ft^3}{mole} \times \frac{88 + 460}{32 + 460} = 0.10836 \frac{ft^3}{hr}$$

$$\frac{0.10836\ ft^3/hr\ VC}{2.247\ ft^3/hr\ total\ gas} \times 1{,}000{,}000 = 48{,}254\ ppmv$$

If the flow or concentration were not measured using an EPA referenc method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation results for other HAPs emitted.

SL 026021

SL 026022

ATTACHMENT I

SUBUNIT:	PER/TRI
VENT ID:	341
SCENARIO:	NORMAL
DESCRIPTION:	PER/TRI ACID TANK SCRUBBER

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb-mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 - (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

E-39

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
VC	0.0374	48,254	8,760	63	14.7	80	5	10	0.069	0.065	0.654
VDC	0.0374	181,181	8,760	97	14.7	80	5	10	0.398	0.378	3.782
EDC	0.0374	159,526	8,760	99	14.7	80	5	1	0.358	0.340	0.340
CHCL3	0.0374	323,376	8,760	119	14.7	80	5	1	0.872	0.828	0.828
MC	0.0374	390	8,760	133	14.7	80	5	1	0.001	0.001	0.001
TRI	0.0374	37,922	8,760	131	14.7	80	5	1	0.113	0.107	0.107
TCE	0.0374	46,829	8,760	133	14.7	80	5	1	0.141	0.134	0.134
PER	0.0374	30,820	8,760	166	14.7	80	5	1	0.116	0.110	0.110
								TOTAL	2.067	1.964	5.956

FILE: N341A

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

HAPs emitted: Perchloroethylene (Per), Trichloroethylene (Tri)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Trichloroethylene (Tri) Date: April 1992

Year: 1987 Calculator: S.R.

Process Vent Identification: 359

Description: Per/Tri Product Dryer Regeneration Vent

Process Conditions/Sampling

Date of flow measurement	not measured
Method of flow measurement	Calculated
Date of concentration measurement	not measured
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Calculated
Describe any problems encountered during testing	N/A
Production rate during flow determination (lbs/hr)	16,372
Production rate during sampling (lbs/hr)	16,372
Average production rate during base year (lbs/hr)	15,002

Stream Characteristics

Average vent stream flow rate (ft^3/min)	none measured	= Q
HAP concentration (ppmv)	none measured	= C
Annual hours of operation (hrs)	24 hr/regeneration	= h
Vent stream discharge temperature (°F)	not available	= T
HAP molecular weight (lb/lb-mole)	131	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber

HAP control efficiency (%) 5 = eff

Calculations[1]

$$= \boxed{61.46\ Mg/yr}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)

[1]See next page.

SL 026023

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 61.46 (1 - 5/100)

= $\boxed{58.40 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (58.40) (1)

= $\boxed{58.40 \text{ Mg/yr}}$

Total HAP Emissions = 87.14 Mg/yr
Total Weighted HAPs Emissions = 87.14 Mg/yr

If the conditions during testing are not representative of base year peration, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA referenc method, EPA conditional method or validated using Method 301, pr vide justification and supporting calculations:

These are emissions associated with Per and Tri regenerations. Defined by the process are the following:

2722.7 lb/regen. tri
734.3 lb/regen. per
24 hr/regen/

The emissions were calculated from the results of bench scale laboratory experiments. Emissions occur during the regeneration of activated alumina beds. Laboratory experiments were conducted to determine the amount of Per and Tri that could be absorbed by the beds during operation.

Source: HON subunit(s) Perchloroethylene/Trichloroethylene Process Units

Number of regenerations are not available for 1987, these data for 1990 were:

R_T = No. of Tri regeneration = 48
R_P = No. of per regeneration = 83

Annual emissions are:

$$TRI: \frac{R_T \times 2722.7 \frac{lb}{regen}}{2205 \frac{lb}{ton} (metric)} = 59 \ MG/YR$$

$$PER: \frac{R_P \times 734.3 \frac{lb}{regen}}{2205 \frac{lb}{ton} (metric)} = 27 \ MG/YR$$

Production figures for 1987 and 1990 are as follows:

	1990	1987
TRI:	24245	25254
PER:	41552	46551

Scale to 1987 level:

$$PER: 27 \times \frac{46551}{41552} = 30.25 \ MG/YR$$

$$TRI: 59 \times \frac{25254}{24245} = 61.46 \ MG/YR$$

TOTAL: 91.71 MG/YR

FHR is one for both TRI and PER.

At 5% scrubber efficiency, emissions are:

TRI: 58.40 PER: 28.74 TOTAL = 87.14

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

APPENDIX F
SHIPPING AND LOADING PROCESS UNIT (S/L)

APPENDIX F

SHIPPING AND LOADING PROCESS UNIT (S/L)

F.1 Process Description

Finished products, which primarily include ethyl chloride, Tri-Ethane® (methyl chloroform), transdichloroethylene, vinylidene chloride, vinyl chloride, perchloroethylene, trichloroethylene, and ethylene dichloride, are loaded and shipped for distribution via drums, railcars, tank trucks, barges, and ships. The emission losses from loading and shipping were calculated for transfer and handling operations at the point of transfer, and do not include emissions from storage tanks. With the exception of the ethyl chloride loading emissions that are routed to the incinerators, shipping and loading emissions are considered fugitive emissions.

F.2 1987 Base-Year Emissions

Table F-1 shows the total base-year emissions for the shipping and loading process unit. The total unweighted HAP emissions were 164.4 Mg/yr. Since none of the pollutants emitted are considered high-risk pollutants and subject to multiplication by a weighting factor, the total weighted HAP base-year emissions equal the total unweighted HAP base-year emissions.

F.3 Emissions Reduction Strategy

Table F-2 shows the control strategy that will be implemented to help achieve a plantwide reduction in emissions for all SOCMI sources at the facility. The general control strategy is as follows:

- Emissions from tank car and tank truck loading will be routed to the incinerator (99% control);
- Emissions from drum loading will be routed to a carbon adsorption system (98% control); and
- Ship and barge loading emissions of EDC (only) will be routed initially to a vent recovery unit comprised of refrigerated condensers (98% control) followed by carbon adsorption (98% control). Emissions from other chemicals will not be controlled.

SL 026027

SL 026028

F-2

TABLE F-1

1987 BASE YEAR EMISSIONS
SHIPPING AND LOADING OPERATIONS (S/L)

UNIT	EIQ	DESCRIPTION	TYPE	BASE YEAR: CONTROL DEVICE TYPE	BASE YEAR: CONTROL DEVICE % CONTROL	BASE YEAR: HAP EMISSIONS UNWEIGHTED MG/YR	BASE YEAR: HAP EMISSIONS WEIGHTED MG/YR
S/L	308	VDCM Tank Car Vent	P	None	0.00	130.910	130.910
				Subtotal Process Vents		130.910	130.910
S/L	390	Ships *	F	None	0.00	4.850	4.850
S/L	391	Barges *	F	None	0.00	13.760	13.760
S/L	392	Rail Cars	F	None	0.00	8.890	8.890
S/L	393	Tank Trucks	F	None	0.00	5.580	5.580
S/L	394	Drums	F	None	0.00	0.412	0.412
				Subtotal Fugitive Sources		33.492	33.492
				Total Base Year Emissions		164.402	164.402

* EDC emissions from ships and barges loading operations are controlled at 99.96%, all other compounds are not controlled.

FILE: SLBASE

SL 026029

F-3

TABLE F-2

EMISSIONS REDUCTIONS STRATEGY AND POST REDUCTIONS EMISSIONS
SHIPPING AND LOADING OPERATIONS (S/L)

UNIT	EIQ	DESCRIPTION	TYPE	POST REDUCTION			
				ADDITIONAL CONTROL	1994 % CONTROL	HAP EMISSIONS UNWEIGHTED MG/YR	HAP EMISSIONS WEIGHTED MG/YR
S/L	308	VDCM Tank Car Vent	P	Incinerate	99.99	0.013	0.013
				Subtotal Process Vents		0.013	0.013
S/L	390	Ships *	F	Ref. Cond./Carbon Ad.	99.96	4.350	4.350
S/L	391	Barges *	F	Ref. Cond.	99.96	5.263	5.263
S/L	392	Rail Cars	F	Incinerate	99.99	0.001	0.001
S/L	393	Tank Trucks	F	Incinerate	99.99	0.001	0.001
S/L	394	Drums	F	Carbon Adsorption	98.00	0.008	0.008
				Subtotal Fugitive Sources		9.624	9.624
				Total Post Reduction Emissions		9.637	9.637

* EDC emissions from ships and barges loading operations are controlled at 99.96%, all other compounds are not controlled.

FILE: SLPOST

Ethyl chloride is emitted from the only shipping and loading process vent (EIQ 308) during loading of tank trucks and railcars. Nitrogen will be used to pad the tank trucks and tank cars and the pad pressure used to force the emissions into the incinerator header system.

F.4 Post-Reduction Emissions

Table F-3 shows the total weighted and unweighted HAP emissions for the shipping and loading unit. EDC emissions from barges and ships shipping and loading operations are controlled at 99.96%. The unweighted and weighted total emissions are equal since none of the compounds need to be multiplied by a weighting factor. The total post-reduction emissions of 9.637 Mg/yr represent a 154.765 Mg/yr decrease (94.14% reduction) in base-year emissions.

SL 026031

TABLE F-3

HAP EMISSIONS SUMMARY
SHIPPING AND LOADING OPERATIONS (S/L)

Type (Units)	Unweighted HAP Emissions Base Year (Mg/yr)	Unweighted HAP Emissions Post Reduction (Mg/yr)	Unweighted HAP Emissions Percent Reduction (%)	Weighted HAP Emissions Base Year (Mg/yr)	Weighted HAP Emissions Post Reduction (Mg/yr)	Weighted HAP Emissions Percent Reduction (%)
P	130.910	0.013	99.99	130.910	0.013	99.99
T						
F	33.492	9.6236		33.492	9.6236	
Total	164.402	9.637		164.402	9.637	
Total Percent Reduction (%)		94.14			94.14	

P-Process Vents
T-Tank Vents
F-Fugitive Emissions
S/L-Shipping & Loading Transfer Operation (loading ships, barges, tank cars, tank trucks, drums)

APPENDIX F-A
SHIPPING AND LOADING UNIT
PROCESS VENT CALCULATIONS

SL 026032

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Ethyl Chloride (EC)   Date: April 1992
Year: 1987   Calculator: D. Seifert

Loading Operation: Rail Car EIO 308

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Car	
Mode of operation (choose from Table 2-16)	Other	
Annual volume of liquid loaded (gallons)	5,452,482	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	20.37	= P
Molecular weight of the HAP (lb/lb-mole)	64.52	= M
Saturation factor (see Table 2-16)	Other	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss E_U* =

$$= \boxed{76.73 \text{ Mg/yr}}$$

HAP Emissions (E_{HAP}) $= E_U (1 - eff/100)$
$= 76.73 (1 - 0/100)$

$$= \boxed{76.73 \text{ Mg/yr}}$$

*See backup calculations on page F-11.

SL 026033

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} F_{HP}$
$= (76.73) \quad (1)$

$= \boxed{76.73 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026034

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Ethyl Chloride (EC) Date: April 1992
Year: 1987 Calculator: D. Seifert

Loading Operation: Tank Trucks EIO 308

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Trucks	
Mod of operation (choose from Table 2-16)	Other	
Annual volume of liquid loaded (gallons)	1,434,393	= G
T mperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	20.37	= P
Mol cular weight of the HAP (lb/lb-mole)	64.52	= M
Saturation factor (see Table 2-16)	Other	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss E_U* =

$$= \boxed{54.18 \text{ Mg/yr}}$$

HAP Emissions (E_{HAP}) $= E_U (1 - eff/100)$
$= 54.18 (1 - 0/100)$

$$= \boxed{54.18 \text{ Mg/yr}}$$

*See backup calculations on page F-12.

SL 026035

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $\approx E_{HAP}\ F_{HP}$

$= (54.18)\quad (1)$

$= \boxed{54.18 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Title: EC Loading	Date: 12/17/91	Dept: EPA	Project: PPG-EC	Proposal: 5510-016

EC Loading

1987 Production Data	No.	Total Shipped tpy
Rail Cars	278	20370.5
Tank Trucks	269	5358.9

Other Data:

Vapor Pressure = 5.7 psig @ 70°F (20.4 psia)
Molecular Weight = 64.52 lb/lb-mole
Specific Gravity = 0.897
Loading pressure = 14.7 psia

Railcar: 1987 Base Year

$$\text{Density} = 8.33 \frac{lb}{gal} \times .897 = 7.47\ lb/gal$$

$$\frac{20370.5\ ton}{yr} \left| \frac{2000 lb}{ton} \right| \frac{gal}{7.47\ lb} \left| \frac{ft^3}{7.48 gal} \right| = 729137.6\ ft^3/yr$$

@ Loading conditions 20 psig, 70°F

$$\frac{359\ ft^3}{lb\text{-}mole} \left| \frac{14.7}{20.4} \right| \frac{530}{492} \Bigg| = 278.67\ ft^3/lb\text{-}mol$$

$$\frac{729137.6\ ft^3}{yr} \times \left| \frac{lb\text{-}mol}{278.67\ ft^3} \right| \frac{64.52\ lb}{lb\ mol} \left| \frac{Mg}{2200\ lb} \right| = 76.73\ Mg/yr$$

SL 026037

Title | Date 12/17/91 | Dsg. EPA | Project | Proposal

EC Loading – Base Year – Tank trucks

Assume:

- Truck returned @ 80 psig (average)
- 400 lb heels
- Vapor is 2/3 saturated
- Tank truck volume 10,000 gal
- P_E – ~~partial press~~ vapor pressure EC = 5.7 psig (20.4,

$SCF_{vapor} = SCF_{EC} + SCF_{INERTS}$

$$EC + In = \frac{10000\,gal \mid ft^3 \mid P \mid \cancel{530}\ 492}{\mid 7.48\,gal \mid 14.7 \mid 530}$$

$EC + In = 84.42\,P$

Since no additional source of inert gases

$$\frac{dIn}{dP} = 84.42$$

$$\frac{dEC}{dIn} = \frac{P_{EC}}{P - P_{EC}} \quad \text{~~(mole fraction)~~} \qquad (1)$$

$$dEC = \frac{P_{EC}}{P - P_{EC}}\, dIn \qquad (2)$$

Sustituting (1) into (2)

$$dEC = \frac{P_{EC}}{P - P_{EC}} (84.42)\, dP$$

SL 026038

$$\int dEC = \int 84.42 \frac{P_{EC}}{P = P_{EC}} dP$$

$$EC = 84.42 \times (20.4)(2/3) \ln \left[\frac{(94.7 - (20.4)(2/3))}{(34.7 - (20.4)(2/3))}\right]$$

$$= 1546.9 \text{ scf}$$

$$= \frac{1546.9 \text{ scf}}{} \left| \frac{\text{lb-mol}}{359 \text{ scf}} \right| \frac{64.52 \text{ lb}}{\text{lb-mol}} \left| \frac{\text{Mg}}{2200 \text{ lb}} \right| \frac{269 \text{ car}}{\text{yr}}$$

$$= \underline{33.99 \text{ tpy}}$$

Amount vented during loading:

$$\frac{5358.9 \text{ ton}}{\text{yr}} \left| \frac{2000 \text{ lb}}{\text{ton}} \right| \frac{\text{gal}}{7.47 \text{ lb}} \left| \frac{\text{ft}^3}{7.48 \text{ gal}} \right| = 191{,}815.4 \text{ ft}^3/\text{yr}$$

$$\frac{359 \text{ ft}^3}{\text{lb-mol}} \left| \frac{530}{492} \right| \frac{14.7}{20.4} = 278.67 \text{ ft}^3$$

$$\frac{191815.4 \text{ ft}^3}{} \left| \frac{\text{lb-mol}}{278.67 \text{ ft}^3} \right| \frac{64.52 \text{ lb}}{\text{lb-mol}} \left| \frac{\text{Mg}}{2200 \text{ lb}} \right.$$

$$= 20.19 \text{ Mg/yr}$$

Tank truck total

$$= 20.19 + 33.99$$
$$= \underline{54.18}$$

SL 026039

APPENDIX F-B
SHIPPING AND LOADING UNIT
FUGITIVE EMISSIONS CALCULATIONS

SL 026040

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,2-Dichloroethane
Date: April 1992
Year: 1987
Calculator: D. Seifert

Loading Operation: Drums

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mode of operation (choose from Table 2-16)	submerged; clean	
Annual volume of liquid loaded (gallons)	2,677	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.32	= P
Molecular weight of the HAP (lb/lb-mole)	99	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06) \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06) \dfrac{(0.5)\ (1.32)\ (99)\ (2677)}{(70) + 460}$

$= \boxed{0.002 \text{ Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.002\ (1 - 0/100)$

$= \boxed{0.002 \text{ Mg/yr}}$

SL 026041

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.002) \quad (1)$$
$$= \boxed{0.002 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Methylene Chloride
Year: 1987

Date: April 1992
Calculator: D. Seifert

Loading Operation: Drums

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mod of operation (choose from Table 2-16)	submerged; clean	
Annual volume of liquid loaded (gallons)	1,629	= G
T mperature of liquid loaded (°F)	70	= T
W ight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	7.74	= P
Mol cular weight of the HAP (lb/lb-mole)	84.9	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{(0.6)\ (7.74)\ (84.9)\ (1629)}{(70) + 460}$

$= \boxed{0.007\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.007\ (1 - 0/100)$

$= \boxed{0.007\ \text{Mg/yr}}$

SL 026043

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (0.007) \quad (1)$

$= \boxed{0.007 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026044

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Tetrachloroethylene — Date: April 1992
Year: 1987 — Calculator: D. Seifert

Loading Operation: Drums

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mod of operation (choose from Table 2-16)	submerged; clean	
Annual volume of liquid loaded (gallons)	10,556	= G
T mperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	0.27	= P
Mol cular weight of the HAP (lb/lb-mole)	165.85	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1.0	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= ff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{(0.5)(0.27)(165.85)(10556)}{(70) + 460}$

$= \boxed{0.003\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.003\ (1 - 0/100)$
$= \boxed{0.003\ \text{Mg/yr}}$

SL 026045

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.003)\ (1)$$
$$= \boxed{0.003\ \text{Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Trichloroethylene
Year: 1987
Date: April 1992
Calculator: D. Seifert

Loading Operation: Drums

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mode of operation (choose from Table 2-16)	submerged; clean	
Annual volume of liquid loaded (gallons)	58,763	= G
T mperature of liquid loaded (°F)	70	= T
W ight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.45	= P
Mol cular weight of the HAP (lb/lb-mole)	131.4	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{(0.5)(1.45)(131.4)(58763)}{(70) + 460}$

$= \boxed{0.06\ Mg/yr}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 0.06\ (1 - 0/100)$

$= \boxed{0.06\ Mg/yr}$

SL 026047

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.06) \quad (1)$$
$$= \boxed{0.06 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,1,1-Trichloroethane Date: April 1992
Year: 1987 Calculator: D. Seifert

Loading Operation: Drums

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mode of operation (choose from Table 2-16)	submerged; normal	
Annual volume of liquid loaded (gallons)	237,734.7	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	2.02	= P
Molecular weight of the HAP (lb/lb-mole)	133.415	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\dfrac{(0.5)(2.02)(133.415)(237734.7)}{(70) + 460}$

$= \boxed{.34\ \mathrm{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= .34\ (1 - 0/100)$

$= \boxed{.34\ \mathrm{Mg/yr}}$

SL 026049

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (.34) \quad (1)$$
$$= \boxed{0.34\ \text{Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026050

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Methylene Chloride Date: April 1992
Y ar: 1987 Calculator: D. Seifert

Loading Operation: Tank Trucks

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Trucks	
Mode of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	145,810	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	7.74	= P
Mol cular weight of the HAP (lb/lb-mole)	84.9	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{(0.6)(7.74)(84.9)\ (145810)}{(70) + 460}$

$= \boxed{0.61\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.002\ (1 - 0/100)$

$= \boxed{0.61\ \text{Mg/yr}}$

SL 026051

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.61) \quad (1)$$
$$= \boxed{0.61\ \text{Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026052

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,2-Dichloroethane
Y ar: 1987
Date: April 1992
Calculator: D. Seifert

Loading Operation: Tank Truck

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Drum	
Mod of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	706,883	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.32	= P
Mol cular weight of the HAP (lb/lb-mole)	99	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\dfrac{(0.6)\ (1.32)\ (99)\ (706883)}{(70) + 460}$

$= \boxed{0.59\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.002\ (1 - 0/100)$

$= \boxed{0.59\ \text{Mg/yr}}$

SL 026053

Source: <u>Shipping and Loading</u>

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (0.59) \quad (1)$

$= \boxed{0.59 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026054

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Tetrachloroethylene
Year: 1987

Date: April 1992
Calculator: D. Seifert

Loading Operation: Tank Trucks

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Truck	
Mod of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	618,706	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	0.27	= P
Mol cular weight of the HAP (lb/lb-mole)	165.85	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{(0.6)(0.27)(165.85)(618706)}{(70) + 460}$

$= \boxed{0.18\ Mg/yr}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 0.18\ (1 - 0/100)$

$= \boxed{0.18\ Mg/yr}$

SL 026055

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.18) \quad (1)$$
$$= \boxed{0.18 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026056

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Trichloroethylene
Date: April 1992
Year: 1987
Calculator: D. Seifert

Loading Operation: Tank Trucks

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Truck	
Mode of operation (choose from Table 2-16)	submerged:dedicated normal	
Annual volume of liquid loaded (gallons)	796,673	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.45	= P
Molecular weight of the HAP (lb/lb-mole)	131.4	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{(0.6)(1.45)(131.4)(796673)}{(70) + 460}$

$= \boxed{0.97\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.97\ (1 - 0/100)$

$= \boxed{0.97\ \text{Mg/yr}}$

SL 026057

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (0.18) \quad (1)$

$= \boxed{0.97 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,1,1-Trichloroethane Date: April 1992
Y ar: 1987 Calculator: D. Seifert

Loading Operation: Tank Truck

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Truck	
Mode of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	1,872,179.9	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	2.02	= P
Molecular weight of the HAP (lb/lb-mole)	133.415	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U =$

$$(5.65E-06)\ \frac{(0.6)(2.02)(133.415)(1872179.9)}{(70) + 460}$$

$$= \boxed{3.23\ \text{Mg/yr}}$$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 3.23\ (1 - 0/100)$

$$= \boxed{3.23\ \text{Mg/yr}}$$

SL 026059

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (3.23) \quad (1)$$
$$= \boxed{3.23\ \text{Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedur is consistent with AP-42.

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS

HAP: 1,2-Dichloroethane

Date: April 1992

Year: 1987

Calculator: D. Seifert

Loading Operation: Tank Cars

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Car	
Mode of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	187,686	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.32	= P
Molecular weight of the HAP (lb/lb-mole)	99	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \frac{(0.6)(1.32)(99)(187686)}{(70) + 460}$

$= \boxed{0.16\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$

$= 0.16\ (1 - 0/100)$

$= \boxed{0.16\ \text{Mg/yr}}$

SL 026061

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.16) \quad (1)$$
$$= \boxed{0.16\ \text{Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Tetrachloroethylene Date: April 1992
Year: 1987 Calculator: D. Seifert

Loading Operation: Tank Cars

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Car	
Mod of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	2,117,044	= G
T mperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	0.27	= P
Mol cular weight of the HAP (lb/lb-mole)	165.85	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= ff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06) \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06) \frac{(0.6)(0.27)(165.85)(117044)}{(70) + 460}$

$= \boxed{0.61\ Mg/yr}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 0.61- 0/100)$

$= \boxed{0.61\ Mg/yr}$

SL 026063

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.61) \quad (1)$$
$$= \boxed{0.61 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS

HAP: Trichloroethylene
Year: 1987
Date: April 1992
Calculator: D. Seifert

Loading Operation: Tank Cars

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Tank Car	
Mode of operation (choose from Table 2-16)	submerged;dedicated normal	
Annual volume of liquid loaded (gallons)	1,683,653	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.45	= P
Molecular weight of the HAP (lb/lb-mole)	131.4	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	10	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06) \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06) \dfrac{(0.6)(1.45)(131.4)(1683653)}{(70) + 460}$

$= \boxed{2.05 \text{ Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U (1 - \text{eff}/100)$
$= 2.05 (1 - 0/100)$

$= \boxed{2.05 \text{ Mg/yr}}$

SL 026065

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (2.05) \quad (1)$

$= \boxed{2.05 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026066

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS

HAP: 1,1,1-Trichloroethane
Year: 1987

Date: April 1992
Calculator: D. Seifert

Loading Operation: Tank Cars

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Rail Tank	
Mode of operation (choose from Table 2-16)	submerged; dedicated normal	
Annual volume of liquid loaded (gallons)	3,520,965.6	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pr ssure]	2.02	= P
Molecular weight of the HAP (lb/lb-mole)	133.415	= M
Saturation factor (see Table 2-16)	0.6	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\,\dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U =$

$$(5.65E\text{-}06)\,\frac{(0.6)(2.02)(133.415)(3520965.6)}{(70) + 460}$$

$$= \boxed{6.07\ \text{Mg/yr}}$$

HAP Emissions (E_{HAP}) $= E_U\,(1 - eff/100)$

$= 6.07\,(1 - 0/100)$

$$= \boxed{6.07\ \text{Mg/yr}}$$

SL 026067

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (6.07) \quad (1)$$
$$= \boxed{6.07 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026068

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,2-Dichloroethane | Date: April 1992

Year: 1987 | Calculator: D. Seifert

Loading Operation: Barges

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Barge	
Mode of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	12,219,254	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.32	= P
Mol cular weight of the HAP (lb/lb-mole)	99	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{(0.5)(1.32)(99)(12,219,254)}{(70) + 460}$

$= \boxed{8.5\ Mg/yr}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 8.5\ (1 - 0/100)$

$= \boxed{8.5\ Mg/yr}$

SL 026069

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (8.5) \quad (1)$$
$$= \boxed{8.5 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Tetrachloroethylene　　Date: April 1992
Year: 1987　　Calculator: D. Seifert

Loading Operation: Barges

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Barge	
Mode of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	2,125,293	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	0.2	= P
Molecular weight of the HAP (lb/lb-mole)	165.85	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06) \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06) \frac{(0.5)(0.27)(165.85)(2125293)}{(70) + 460}$

$= \boxed{0.51\ Mg/yr}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 0.51\ (1 - 0/100)$

$= \boxed{0.51\ Mg/yr}$

SL 026071

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.51) \quad (1)$$
$$= \boxed{0.51 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026072

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Trichloroethylene
Year: 1987
Date: April 1992
Calculator: D. Seifert

Loading Operation: Barges

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Barge	
Mode of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	583,519	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.45	= P
Molecular weight of the HAP (lb/lb-mole)	131.4	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \dfrac{(0.5)(1.45)(131.4)(583519)}{(70) + 460}$

$= \boxed{0.59 \text{ Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.59\ (1 - 0/100)$

$= \boxed{0.59 \text{ Mg/yr}}$

SL 026073

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.59) \quad (1)$$
$$= \boxed{0.59 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026074

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,1,1-Trichloroethane   Date: April 1992
Year: 1987   Calculator: D. Seifert

Loading Operation: Barges

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Barges	
Mode of operation (choose from Table 2-16)	submerged; loading	
Annual volume of liquid loaded (gallons)	2,897,367.7	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	2.02	= P
Molecular weight of the HAP (lb/lb-mole)	133.415	= M
Saturation factor (see Table 2-16)	0.5	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U =$

$$(5.65E-06)\frac{(0.5)(2.02)(133.415)(2897367.7)}{(70) + 460}$$

$$= \boxed{4.16\ Mg/yr}$$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 4.16\ (1 - 0/100)$

$$= \boxed{4.16\ Mg/yr}$$

SL 026075

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (4.16) \quad (1)$$
$$= \boxed{4.16 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,2-Dichloroethane
Date: April 1992
Year: 1987
Calculator: D. Seifert

Loading Operation: Ships

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Ship	
Mode of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	1,777,361	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.32	= P
Mol cular weight of the HAP (lb/lb-mole)	99	= M
Saturation factor (see Table 2-16)	0.2	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E{-}06)\ \frac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E{-}06)\ \frac{(0.2)\ (1.32)\ (99)\ (1777361)}{(70) + 460}$

$= \boxed{0.50\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.50\ (1 - 0/100)$

$= \boxed{0.50\ \text{Mg/yr}}$

SL 026077

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (0.50) \quad (1)$

$= \boxed{0.50 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Tetrachloroethylene
Date: April 1992
Year: 1987
Calculator: D. Seifert

Loading Operation: Ships

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Ship	
Mode of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	1,994,353	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	0.27	= P
Molecular weight of the HAP (lb/lb-mole)	165.85	= M
Saturation factor (see Table 2-16)	0.2	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06)\ \dfrac{(0.2)(0.27)(165.85)(1994353)}{(70) + 460}$

$= \boxed{0.19\ \text{Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.19\ (1 - 0/100)$

$= \boxed{0.19\ \text{Mg/yr}}$

SL 026079

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

Weighted HAP Emissions $= E_{HAP} \quad F_{HR}$

$= (0.19) \quad (1)$

$= \boxed{0.19 \text{ Mg/yr}}$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

Sourc : Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: Trichloroethylene
Y ar: 1987
Date: April 1992
Calculator: D. Seifert

Loading Operation: Ships

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Ships	
Mod of operation (choose from Table 2-16)	submerged	
Annual volume of liquid loaded (gallons)	1,328,619	= G
Temperature of liquid loaded (°F)	70	= T
W ight percent HAP in the loaded material	100	
Tru vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	1.45	= P
Molecular weight of the HAP (lb/lb-mole)	131.4	= M
Saturation factor (see Table 2-16)	0.2	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06) \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U = (5.65E\text{-}06) \dfrac{(0.2)(1.45)(131.4)(1328619)}{(70) + 460}$

$= \boxed{0.54 \text{ Mg/yr}}$

HAP Emissions (E_{HAP}) $= E_U\ (1 - \text{eff}/100)$
$= 0.54\ (1 - 0/100)$

$= \boxed{0.54 \text{ Mg/yr}}$

SL 026081

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (0.54) \quad (1)$$
$$= \boxed{0.54 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Bas Year and Post-reduction HAP Emissions." This procedur is consistent with AP-42.

SL 026082

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS

HAP: 1,1,1-Trichloroethane
Date: April 1992
Year: 1987
Calculator: D. Seifert

Loading Operation: Ships

Loading Parameters

Cargo carrier (tank truck, rail car, etc.)	Ship	
Mode of operation (choose from Table 2-16)	submerged; loading	
Annual volume of liquid loaded (gallons)	6,297,957.2	= G
Temperature of liquid loaded (°F)	70	= T
Weight percent HAP in the loaded material	100	
True vapor pressure of the HAP loaded (psia) [Note: For mixtures, use the HAP partial pressure]	2.02	= P
Molecular weight of the HAP (lb/lb-mole)	133.415	= M
Saturation factor (see Table 2-16)	0.2	= S
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device	None	
HAP control efficiency (%)	0.0	= eff

Calculation[a]

Uncontrolled Loading Loss $E_U = (5.65E-06) \dfrac{S\ P\ M\ G}{T + 460}$

Uncontrolled Loading Loss $E_U =$

$$(5.65E-06) \frac{(0.2)(2.02)(133.415)(6297957.2)}{(70) + 460}$$

$$= \boxed{3.62\ \text{Mg/yr}}$$

HAP Emissions (E_{HAP}) $= E_U\ (1 - eff/100)$
$= 3.62\ (1 - 0/100)$

$$= \boxed{3.62\ \text{Mg/yr}}$$

SL 026083

Source: Shipping and Loading

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM LOADING OPERATIONS (CONCLUDED)

Calculation (continued)

$$\text{Weighted HAP Emissions} = E_{HAP} \quad F_{HR}$$
$$= (3.62) \quad (1)$$
$$= \boxed{3.62 \text{ Mg/yr}}$$

[a]Calculation worksheet and procedure from "Procedures for Establishing Base Year and Post-reduction HAP Emissions." This procedure is consistent with AP-42.

SL 026084

APPENDIX G
TRI-ETHANE® II PROCESS UNIT (TE-II)

APPENDIX G

TRI-ETHANE® II PROCESS UNIT (TE-II)

G.1 Process Description

Tri-Ethane® production involves the following:

- Vinyl chloride Section (VC);
- 1,1-Dichloroethane Section (DCE);
- Methyl chloroform Section (MC); and
- Oxyhydrochlorination EDC Unit.

Methyl chloroform (MC) is manufactured in the Tri-Ethane® II (TE-II) Unit in three reaction steps. The process begins by cracking ethylene dichloride (EDC) to vinyl chloride (VC) and hydrogen chloride (HCl). VC and HCl are then recombined to form 1,1-dichloroethane (DCE) which in turn is chlorinated as the final step to form MC and HCl. The TE-II Unit also includes an OHC-EDC section (OHC-II) which converts by-product HCl and ethylene into EDC. Figure G-1 outlines the major production steps that occur in the Tri-Ethane® unit.

<u>VC Section</u>

In the VC section, vinyl chloride and HCl are produced as co-products by thermally cracking 1,2-EDC at high temperatures in a direct fired natural draft furnace. The chemical reaction occurs as follows:

$$\underset{(C_2H_4Cl_2)}{\text{Ethylene Dichloride}} \xrightarrow[\text{Heat}]{} \underset{(C_2H_3Cl)}{\text{Vinyl Chloride}} + \underset{(HCl)}{\text{Hydrogen Chloride}}$$

Figure G-2 shows the major equipment used in VC section. VC is used as a raw material in the 1,1-DCE section, and is transferred to VCM-II for further processing into VCM product.

SL 026086

Figure G-1: Tri-Ethane® II Process Schematic
See Volume II - Confidential

Figure G-2: TE-II VCM Section
See Volume II - Confidential

DCE Section

This process uses VC and HCl from the VC section to form 1,1-dichloroethane (DCE). The reaction is catalyzed in a liquid bed reactor. The general chemical reaction for DCE is:

Vinyl Chloride	+	Hydrogen Chloride	$\xrightarrow[\text{Catalyst}]{}$	1,1-Dichloroethane
(C_2H_3Cl)		(HCl)		($C_2H_4Cl_2$)

Figure G-3 shows the major equipment and location of air emissions from the TE-II DCE section.

Methyl Chloroform (MC) Section

The final chemical reaction step in methyl chloroform production is:

1,1-Dichloroethane	+	Chlorine	$\longrightarrow$	Methylchloroform	+	Hydrogen Chloride
($C_2H_4Cl_2$)		(Cl_2)		($C_2H_3Cl_3$)		(HCl)

Figure G-4 shows the major equipment used in the production of MC products from the TE-II unit.

Liquid chlorine from Plant A is vaporized and fed to the MC reactor along with liquid DCE. HCl vapor exits the top of the reactor and flows to an absorber system for removal of contaminating organics. This purified HCl is sent to the high pressure HCl system for use in the OHC section.

MC, by-products, and unreacted DCE are drawn off the reactor and fed to the DCE Recycle Still. This column separates DCE from the remainder of the mixture. DCE is recycled back to the reactor while MC and other organics are fed to the Product Still. This still separates MC from the heavier by-products. The heavy material is cooled and stored prior to being transferred to the VDCM and Per/Tri units. Pure MC is neutralized to remove HCl and then moved to stabilizing tanks where chemicals are added to make the desired grade of Tri-Ethane® solvent. From here the finished product is pumped to Day Tanks, or Shipping Tanks to await shipment by drum, truck, railcar, barge or ship.

Figure G-3: TE-II 1,1-Dichloroethane Section (DCE)
See Volume II - Confidential

Figure G-4: TE-II Methyl Chloroform (MC) Section
See Volume II - Confidential

Oxyhydrochlorination (OHC) - EDC Section

EDC is produced in a vapor phase reaction of HCl and Ethylene in the presence of a catalyst. This process is known as oxyhydrochlorination. The chemical reaction is as follows:

$$\underset{(C_2H_4)}{\text{Ethylene}} + 2HCl + \tfrac{1}{2}O_2 \xrightarrow[\text{Catalyst}]{} \underset{(C_2H_4Cl_2)}{\text{EDC}} + H_2O$$

Figure G-5 shows a flow diagram of the OHC-EDC production process.

The OHC-EDC section of TE-II is an independent process capable of running while TE-II is down. Likewise TE-II can operate without OHC-II because EDC can be obtained from other units (EDC, VCM-II). HCl generated by the MC section is discharged into the HCl distribution system. Figure G-6 outlines the major steps and equipment used in OHC-EDC production.

In the OHC-EDC section, EDC is made by the oxyhydrochlorination process. Oxygen, hydrogen chloride, and ethylene are fed to a fluid bed reactor and form EDC and water. A small purge from the condenser is removed and incinerated to eliminate impurities. Following condensation, the EDC and water are phase separated. The EDC is chemically purified, dried and furth r processed in a lights still. This still removes light impurities, which are sent to the Per/Tri Unit. EDC is drawn from the bottom of the lights still and stored.

Use of OHC-EDC is limited to internal usage since the EDC is not pure enough for shipment.

G.2 1987 Base-Year Emissions

Table G-1 shows the total base-year emissions for the TE-II process unit. The total unweighted HAP emissions were 46.266 Mg/yr. Emissions from storage tank EIQ 353 required using weighting factors. The total base-year weighted HAP emissions for the TE-II unit were 48.187 Mg/yr.

SL 026092

Figure G-5: OHC-II Process Schematic
See Volume II - Confidential

SL 026093

Figure G-6: TE-II OHC Section (EDC Production)
See Volume II - Confidential

SL 026094

TABLE G-1

1987 BASE YEAR EMISSIONS
TRIETHANE PROCESS UNIT (TE-II)

UNIT	EIQ	DESCRIPTION	TYPE	BASE YEAR			
				CONTROL DEVICE		HAP EMISSIONS	
				TYPE	% CONTROL*	UNWEIGHTED MG/YR	WEIGHTED MG/YR
TE-II	305	MC/DCE Startup Scrubber	P	Scrubber	5.00	3.004	3.004
TE-II	306	No.2 OHC Startup Scrubber	P	Scrubber	5.00	3.935	3.935
				Subtotal Process Vents		6.939	6.939
TE-II	310	DCE Tank Vents	T	Ref. Cond	88.10	6.045	6.045
TE-II	315	EDC Crude and Storage	T	Ref. Cond.	88.00	4.065	4.065
TE-II	316	MC Process Storage	T	None	0.00	0.298	0.298
TE-II	317	MC Process Storage	T	None	0.00	0.759	0.759
TE-II	318	MC Process Storage	T	None	0.00	0.759	0.759
TE-II	319	MC Process Storage	T	None	0.00	3.042	3.042
TE-II	320	MC Process Storage	T	None	0.00	3.038	3.038
TE-II	321	MC Process Storage	T	None	0.00	0.913	0.913
TE-II	322	MC Process Storage	T	None	0.00	1.941	1.941
TE-II	323	MC Process Storage	T	None	0.00	2.082	2.082
TE-II	324	MC Process Storage	T	Ref. Cond.	84.00	7.113	7.113
TE-II	325	MC Dock Storage	T	Ref. Cond.	88.40	4.748	4.748
TE-II	326	TE Shipping Tank	T	None	0.00	2.610	2.610
TE-II	353	TCE/Tetra Tank	T	Scrubber	5.00	1.529	3.450
TE-II	355	No.1 BLM Storage Tank	T	None	0.00	0.097	0.097
TE-II	358	TBL/MC Tank	T	None	0.00	0.288	0.288
				Subtotal Tank Vents		39.3273	41.2483
				Total Base Year Emissions		46.266	48.187

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

FILE: TEBASE

G-3 Emissions Reduction Strategy

Table G-2 shows the control strategy for the TE-II unit that will be implemented to help achieve a plantwide reduction in emissions for all SOCMI sources at the facility. The general control strategy is as follows:

- Emissions from ten storage tanks, EIQ 316 through EIQ 323, EIQ 326, and EIQ 358 will be incinerated.

With the inclusion of these controls, the total overall control level for the TE-II unit is estimated to be equal to or greater than 34.00% for unweighted HAPs and 32.64% for weighted HAPs.

G-4 Post-Reduction Emissions

Table G-3 shows the total unweighted and weighted HAP emissions for the TE-II process unit. The total post-reduction unweighted emissions of 30.5 Mg/yr represent a 15.7 Mg/yr decrease (34.00% reduction) in unweighted HAP base-year emissions. The total post-reduction weighted emissions of 32.5 Mg/yr represent a 15.7 Mg/yr decrease (32.64% reduction) in weighted HAP base-year emissions.

TABLE G-2

EMISSIONS REDUCTIONS STRATEGY AND POST REDUCTION EMISSIONS
TRIETHANE PROCESS UNIT (TE-II)

UNIT	EIQ	DESCRIPTION	TYPE	POST REDUCTION			
				ADDITIONAL CONTROL	1994 % CONTROL*	HAP EMISSIONS UNWEIGHTED MG/YR	HAP EMISSIONS WEIGHTED MG/YR
TE-II	305	MC/DCE Startup Scrubber	P	None	5.00	3.004	3.004
TE-II	306	No.2 OHC Startup Scrubber	P	None	5.00	3.935	3.935
				Subtotal Process Vents		6.939	6.939
TE-II	310	DCE Tank Vents	T	None	88.10	6.045	6.045
TE-II	315	EDC Crude and Storage	T	None	88.00	4.065	4.065
TE-II	316	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	317	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	318	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	319	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	320	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	321	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	322	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	323	MC Process Storage	T	Incinerator	99.99	0.000	0.000
TE-II	324	MC Process Storage	T	None	84.00	7.113	7.113
TE-II	325	MC Dock Storage	T	None	88.40	4.748	4.748
TE-II	326	TE Shipping Tank	T	Incinerator	99.99	0.000	0.000
TE-II	353	TCE/Tetra Tank	T	None	5.00	1.529	3.450
TE-II	355	No. 1 BLM Storage Tank	T	None	0.00	0.097	0.097
TE-II	358	TBL/MC Tank	T	Incinerator	99.99	0.000	0.000
				Subtotal Tank Vents		23.5973	25.5183
				Total Post Reduction Emissions		30.536	32.457

* Control efficiencies for scrubbers represent efficiencies for hydrocarbons, these scrubbers have 99% efficiency for HCl.

FILE: TEPOST

SL 026098

TABLE G-3

HAP EMISSIONS SUMMARY
TRI-ETHANE PROCESS UNIT (TE-II)

Type (Units)	Unweighted HAP Emissions Base Year (Mg/yr)	Unweighted HAP Emissions Post Reduction (Mg/yr)	Unweighted HAP Emissions Percent Reduction (%)	Weighted HAP Emissions Base Year (Mg/yr)	Weighted HAP Emissions Post Reduction (Mg/yr)	Weighted HAP Emissions Percent Reduction (%)
P	6.939	6.939	0.00	6.939	6.939	0.00
T	39.327	23.597	40.00	41.248	25.518	38.14
F						
Total	46.266	30.536		48.187	32.457	
Total Percent Reduction (%)		34.00			32.64	

P – Process Vents
T – Tank Vents
F – Fugitive Emissions

APPENDIX G-A
TRI-ETHANE® II PROCESS UNIT
STORAGE TANK CALCULATIONS

SL 026099

Sourc : HON subunit(s) Tri-Ethane (TE-II)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE)

HAP: 1,1-Dichloroethane (DCE) Date: 05/13/92
Year: 1987 Calculator: J. Greer

Tank Designation: EIQ 310, No. 1 DCE Storage Tank (60-1467)
Product: 1,1-Dichloroethane

Tank Characteristics

Inside diameter, (ft)	26	$= D$
Height, (ft)	36	$= H_T$
Capacity, (gal) $= \pi \frac{D^2 h}{4} * 7.48 \frac{gal}{ft^3}$, if not known	144,000	$= V$
Roof color White		
Shell color White		
Vapor space height, (ft)[a]	18	$= H$

Ambient Conditions

Average atmospheric pressure (psia) (defaults 14.7 psia)	14.7	$= P_A$
Average ambient diurnal temperature (°F)[b]	18	$= dT$
Average annual ambient temperature (°F)	70	$= T_A$

Bulk Liquid Characteristics

Stored liquid temperature (°F)[c]	70	$= T_S$
Total throughput per year (gal)	8,339,470	$= A_N$
Number of turnovers per year[d]	61.385	$= N$
Molecular weight of HAP (lb/lb mole)	98.97	$= M_v$
Mole percent of HAP	100	$= \%$
Partial pressure of the HAP at liquid conditions (psia)	3.670	$= P$

Adjustment Factors

Paint factor	1.0	$= F_P$
Small diameter tank factor[e]	0.9924	$= C$
Turnover factor[f]	0.655	$= K_N$
Product factor[g]	1.0	$= K_C$

SL 026100

Source: HON subunit(s) TE-II

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Baseline Control

Control device Refrigerator Condenser

HAP control efficiency (%) 88.10 = eff

Calculations[h]

Breathing Loss (Mg/yr) =

$$L_B = 1.02E\text{-}05\,(M_V)\left[\frac{(P)}{(P_A)-(P)}\right]^{0.68}(D)^{1.73}(H)^{0.51}(dT)^{0.50}(F_P)(C)(K_C)$$

$$= 1.02E\text{-}05\,(98.97)\left[\frac{3.67}{14.7-3.67}\right]^{0.68}(26)^{1.73}(18)^{0.51}(18)^{0.50}(1)(0.9924)(1.0)$$

= $\boxed{2.46 \text{ Mg/yr}}$

Working Loss (Mg/yr)

= $L_W = 1.09E\text{-}08\ M_V PVNK_N K_C$

= 1.09E-08(98.97)(3.67)(144,000)(61.385)(0.655)(1)

= $\boxed{22.94 \text{ Mg/yr}}$

Total Loss (Mg/yr) =

$T_L = L_B + L_W = (2.46) + (22.94)$

= $\boxed{25.40 \text{ Mg/yr}}$

If a control device is employed,

HAP Emissions (E_{HAP}) = Total Loss (1 - eff/100)

= 25.4 (1 - 88.1/100)

= $\boxed{3.02 \text{ Mg/yr}}$

SL 026101

Source: HON subunit(s) TE-II

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM FIXED ROOF STORAGE TANKS (SAMPLE) (CONTINUED)

Calculation (Continued)

Weighted HAP Emissions[i] $= E_{HAP} \quad F_{HR}$
$= (3.02) \quad (1)$
$= \boxed{3.02 \text{ Mg/yr}}$

---

[a]If vapor space height is unknown for shell, assume H equals one half tank height. If tank has a cone roof, adjust vapor space height by adding 1/3 of height of cone.

[b]If average ambient diurnal temperature change is unknown, assume 20°F.

[c]Stored liquid temperature may be approximated from average annual ambient temperature.

[d]$N = \frac{AN}{V}$ where N = number of turnovers per year
AN = total throughput per year (gal)
V = tank capacity (gal)

[e]For $D \geq 30$ft, C=1; For $6 \leq D < 30$ ft, C = 0.0771D-0.0013D2-0.1334.

[f]For turnovers > 36, $K_N = (180 + N)/(6 * N)$
where K_N = turnover factor (dimensionless)
N = number of turnovers per year
For turnovers ≤ 36, $K_N = 1$

[g]$K_C = 1.0$ for volatile organic liquids

[h]Expression for computing HAP emissions are from "Procedures for Establishing Base Year and Post-Reduction HAP Emissions." The calculation procedure is consistent with AP-42.

[i]For emissions of other HAPs from this EIQ, see summary of calculated emissions from fixed roof storage tanks.

SL 026102

SL 026103

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRI ETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
310	60-1467	No. 1 DCE Storage Tank	DCE	100.00	White	26.00	144000	18.00	70.00	61.39	98.970	3.670	1.00	0.9924	0.66
310	60-1468	No. 2 DCE Storage Tank	DCE	100.00	White	26.00	144000	18.00	70.00	61.39	98.970	3.670	1.00	0.9924	0.66
315	60-1482	No. 1 OHC Product Tank	EDC	100.00	White	24.00	101500	15.00	70.00	140.18	98.970	1.330	1.00	0.9682	0.38
315	60-1483	No. 2 OHC Product Tank	EDC	100.00	White	24.00	101500	15.00	70.00	140.18	98.970	1.330	1.00	0.9682	0.38
315	60-1484	N . 1 OHC Crude Storage Tank	EDC	100.00	White	24.00	101500	15.00	70.00	128.58	98.970	1.330	1.00	0.9682	0.40
315	60-1485	No. 2 OHC Crude Storage Tank	EDC	100.00	White	24.00	101500	15.00	70.00	128.58	98.970	1.330	1.00	0.9682	0.40
316	60-0396	Spec. Tank No. 12	BLM	0.11	Beige	12.00	13500	7.00	70.00	1.00	72.100	0.003	1.30	0.6046	1.00
316	60-0396	Spec. Tank No. 12	MC	99.29	Beige	12.00	13500	7.00	70.00	1.00	133.420	2.007	1.30	0.6046	1.00
316	60-0398	Spec. Tank No. 12	NTE	0.60	Beige	12.00	13500	7.00	70.00	1.00	89.090	0.002	1.30	0.6046	1.00
317	60-0539	Spec. Tank No. 6	MC	99.40	Beige	14.00	18000	12.00	70.00	4.78	133.420	2.009	1.30	0.6912	1.00
317	60-0539	Spec. Tank No. 6	NTE	0.60	Beige	14.00	18000	12.00	70.00	4.78	89.090	0.002	1.30	0.6912	1.00
318	60-0540	Spec. Tank No. 7	MC	99.40	Beige	14.00	18000	12.00	70.00	4.78	133.420	2.009	1.30	0.6912	1.00
318	60-0540	Spec. Tank No. 7	NTE	0.60	Beige	14.00	18000	12.00	70.00	4.78	89.090	0.002	1.30	0.6912	1.00
319	60-1028	Spec. Tank No. 8	BLM	0.90	White	18.00	42000	10.00	70.00	20.75	72.100	0.026	1.00	0.8332	1.00
319	60-1028	Spec. Tank No. 8	DME*	2.46	White	18.00	42000	10.00	70.00	20.75	90.100	0.157	1.00	0.8332	1.00
319	60-1028	Spec. Tank No. 8	MC	93.94	White	18.00	42000	10.00	70.00	20.75	133.420	1.899	1.00	0.8332	1.00
319	60-1028	Spec. Tank No. 8	NTE	0.58	White	18.00	42000	10.00	70.00	20.75	89.090	0.001	1.00	0.8332	1.00
319	60-1028	Spec. Tank No. 8	TBL*	2.11	White	18.00	42000	10.00	70.00	20.75	74.120	0.013	1.00	0.8332	1.00
320	60-1029	Spec. Tank No. 9	BLM	0.90	White	18.00	42000	10.00	70.00	20.75	72.100	0.026	1.00	0.8332	1.00
320	60-1029	Spec. Tank No. 9	DME*	2.46	White	18.00	42000	10.00	70.00	20.75	90.100	0.157	1.00	0.8332	1.00
320	60-1029	Spec. Tank No. 9	MC	93.94	White	18.00	42000	10.00	70.00	20.75	133.420	1.899	1.00	0.8332	1.00
320	60-1029	Spec. Tank No. 9	NTE	0.58	White	18.00	42000	10.00	70.00	20.75	89.090	0.001	1.00	0.8332	1.00
320	60-1029	Spec. Tank No. 9	TBL*	2.11	White	18.00	42000	10.00	70.00	20.75	74.120	0.013	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	BLM	0.53	White	18.00	42000	10.00	70.00	2.56	72.100	0.015	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	BTE*	1.13	White	18.00	42000	10.00	70.00	2.56	90.000	0.022	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	DOL*	2.75	White	18.00	42000	10.00	70.00	2.56	74.080	0.037	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	MC	89.36	White	18.00	42000	10.00	70.00	2.56	133.420	1.806	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	NRE	3.33	White	18.00	42000	10.00	70.00	2.56	61.040	0.018	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	NTE	0.57	White	18.00	42000	10.00	70.00	2.56	89.090	0.001	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	TBL*	1.37	White	18.00	42000	10.00	70.00	2.56	74.120	0.009	1.00	0.8332	1.00
321	60-1030	Spec. Tank No. 10	TLE	0.97	White	18.00	42000	10.00	70.00	2.56	92.130	0.005	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	BLM	0.53	White	18.00	42000	10.00	70.00	11.56	72.100	0.015	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	BTE*	1.13	White	18.00	42000	10.00	70.00	11.56	90.000	0.022	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	DOL*	2.75	White	18.00	42000	10.00	70.00	11.56	74.080	0.037	1.00	0.8332	1.00

* = NON HAP, Emission is not included as a HAP emission.

SL 026104

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRIETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg/yr)	LW Working Loss (Mg/yr)	LT Total Loss (Mg/yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg/yr)	1987 Weighted HAP Emissions (Mg/yr)
310	60-1467	No. 1 DCE Storage Tank	DCE	2.46344	22.93602	25.39945	RVR	88.10	3.02254	3.02254
310	60-1468	No. 2 DCE Storage Tank	DCE	2.46344	22.93602	25.39945	RVR	88.10	3.02254	3.02254
315	60-1482	No. 1 OHC Product Tank	EDC	0.83893	7.77118	8.61011	RVR	88.00	1.03321	1.03321
315	60-1483	No. 2 OHC Product Tank	EDC	0.83893	7.77118	8.61011	RVR	88.00	1.03321	1.03321
315	60-1484	No. 1 OHC Crude Storage Tank	EDC	0.83893	7.48961	8.32854	RVR	88.00	0.99942	0.99942
315	60-1485	No. 2 OHC Crude Storage Tank	EDC	0.83893	7.48961	8.32854	RVR	88.00	0.99942	0.99942
316	60-0396	Spec. Tank No. 12	BLM	0.00157	0.00003	0.00160	None	0.00	0.00160	0.00160
316	60-0396	Spec. Tank No. 12	MC	0.25710	0.03940	0.29650	None	0.00	0.29650	0.29650
316	60-0396	Spec. Tank No. 12	NTE	0.00116	0.00002	0.00118	None	0.00	0.00118	0.00118
317	60-0539	Spec. Tank No. 6	MC	0.50561	0.25140	0.75701	None	0.00	0.75701	0.75701
317	60-0539	Spec. Tank No. 6	NTE	0.00229	0.00013	0.00242	None	0.00	0.00242	0.00242
318	60-0540	Spec. Tank No. 7	MC	0.50561	0.25140	0.75701	None	0.00	0.75701	0.75701
318	60-0540	Spec. Tank No. 7	NTE	0.00229	0.00013	0.00242	None	0.00	0.00242	0.00242
319	60-1028	Spec. Tank No. 8	BLM	0.01678	0.01776	0.03454	None	0.00	0.03454	0.03454
319	60-1028	Spec. Tank No. 8	DME*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
319	60-1028	Spec. Tank No. 8	MC	0.63129	2.40679	3.03808	None	0.00	3.03808	3.03808
319	60-1028	Spec. Tank No. 8	NTE	0.00294	0.00124	0.00418	None	0.00	0.00418	0.00418
319	60-1028	Spec. Tank No. 8	TBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
320	60-1029	Spec. Tank No. 9	BLM	0.01678	0.01776	0.03454	None	0.00	0.03454	0.03454
320	60-1029	Spec. Tank No. 9	DME*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
320	60-1029	Spec. Tank No. 9	MC	0.63129	2.40679	3.03808	None	0.00	3.03808	3.03808
320	60-1029	Spec. Tank No. 9	NTE	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
320	60-1029	Spec. Tank No. 9	TBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
321	60-1030	Spec. Tank No. 10	BLM	0.01165	0.00128	0.01293	None	0.00	0.01293	0.01293
321	60-1030	Spec. Tank No. 10	BTE*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
321	60-1030	Spec. Tank No. 10	DOL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
321	60-1030	Spec. Tank No. 10	MC	0.60717	0.28289	0.89006	None	0.00	0.89006	0.89006
321	60-1030	Spec. Tank No. 10	NRE	0.01104	0.00128	0.01232	None	0.00	0.01232	0.01232
321	60-1030	Spec. Tank No. 10	NTE	0.00289	0.00015	0.00304	None	0.00	0.00304	0.00304
321	60-1030	Spec. Tank No. 10	TBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
321	60-1030	Spec. Tank No. 10	TLE	0.00667	0.00050	0.00718	None	0.00	0.00718	0.00718
322	60-1031	Spec. Tank No. 11	BLM	0.01165	0.00579	0.01744	None	0.00	0.01744	0.01744
322	60-1031	Spec. Tank No. 11	BTE*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
322	60-1031	Spec. Tank No. 11	DOL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000

* = NON HAPS, emission is not included as a HAP emission

PPG 05/20/92

SL 026105

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRI ETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (oF)	N Number of Turnovers per Year	Mv Molecular Weight (lb/lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
322	60-1031	Spec. Tank No. 11	MC	89.36	White	18.00	42000	10.00	70.00	11.56	133.420	1.806	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	NRE	3.33	White	18.00	42000	10.00	70.00	11.56	61.040	0.018	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	NTE	0.57	White	18.00	42000	10.00	70.00	11.56	89.090	0.001	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	TBL*	1.37	White	18.00	42000	10.00	70.00	11.56	74.120	0.009	1.00	0.8332	1.00
322	60-1031	Spec. Tank No. 11	TLE	0.97	White	18.00	42000	10.00	70.00	11.56	92.130	0.005	1.00	0.8332	1.00
323	60-1168	Spec. Tank No. 12	MC	99.40	White	18.00	42000	10.00	70.00	11.56	133.420	2.009	1.00	0.8332	1.00
323	60-1168	Spec. Tank No. 12	NTE	0.60	White	18.00	42000	10.00	70.00	11.56	89.090	0.002	1.00	0.8332	1.00
324	60-1470	No. 1 DOL/SBL Tank	DOX	67.85	Beige	13.00	19000	9.00	70.00	0.74	88.100	0.373	1.30	0.6492	1.00
324	60-1470	No. 1 DOL/SBL Tank	SBL*	32.15	Beige	13.00	19000	9.00	70.00	0.74	74.120	0.062	1.30	0.6492	1.00
324	60-1471	No. 2 DOL/SBL Tank	DOX	67.85	Beige	13.00	19000	9.00	70.00	0.49	88.100	0.373	1.30	0.6492	1.00
324	60-1471	No. 2 DOL/SBL Tank	SBL*	32.15	Beige	13.00	19000	9.00	70.00	0.49	74.120	0.062	1.30	0.6492	1.00
324	60-1472	No. 2 BLM Storage Tank	Butylene Ox	100.00	Tan	13.00	17800	9.00	70.00	1.57	72.120	2.708	1.30	0.6492	1.00
324	60-1473	DOL/DOX SBL Tank	DOL*	54.32	Beige	16.00	28600	9.00	70.00	10.80	74.080	0.735	1.30	0.7674	1.00
324	60-1473	DOL/DOX SBL Tank	DOX	45.68	Beige	16.00	28600	9.00	70.00	10.80	88.100	0.251	1.30	0.7674	1.00
324	60-1475	S-4 Tank	DOL*	1.75	Aqua Green	24.00	101500	15.00	70.00	28.51	74.080	0.024	1.30	0.9682	1.00
324	60-1475	S-4 Tank	DOX	1.47	Aqua Green	24.00	101500	15.00	70.00	28.51	88.100	0.008	1.30	0.9682	1.00
324	60-1475	S-4 Tank	MC	93.45	Aqua Green	24.00	101500	15.00	70.00	28.51	133.420	1.889	1.30	0.9682	1.00
324	60-1475	S-4 Tank	NRE	1.06	Aqua Green	24.00	101500	15.00	70.00	28.51	61.040	0.006	1.30	0.9682	1.00
324	60-1475	S-4 Tank	NTE	0.51	Aqua Green	24.00	101500	15.00	70.00	28.51	89.090	0.001	1.30	0.9682	1.00
324	60-1475	S-4 Tank	SBL*	1.75	Aqua Green	24.00	101500	15.00	70.00	28.51	74.120	0.003	1.30	0.9682	1.00
324	60-1476	S-3 Tank	DOL*	1.75	Aqua Green	24.00	101500	15.00	70.00	28.51	74.080	0.024	1.30	0.9682	1.00
324	60-1476	S-3 Tank	DOX	1.47	Aqua Green	24.00	101500	15.00	70.00	28.51	88.100	0.008	1.30	0.9682	1.00
324	60-1476	S-3 Tank	MC	93.45	Aqua Green	24.00	101500	15.00	70.00	28.51	133.420	1.889	1.30	0.9682	1.00
324	60-1476	S-3 Tank	NRE	1.06	Aqua Green	24.00	101500	15.00	70.00	28.51	61.040	0.006	1.30	0.9682	1.00
324	60-1476	S-3 Tank	NTE	0.51	Aqua Green	24.00	101500	15.00	70.00	28.51	89.090	0.001	1.30	0.9682	1.00
324	60-1476	S-3 Tank	SBL*	1.75	Aqua Green	24.00	101500	15.00	70.00	28.51	74.120	0.003	1.30	0.9682	1.00
324	60-1477	S-2 Tank	DOL*	1.75	Aqua Green	24.00	101500	12.00	70.00	28.51	74.080	0.024	1.30	0.9682	1.00
324	60-1477	S-2 Tank	DOX	1.47	Aqua Green	24.00	101500	12.00	70.00	28.51	88.100	0.008	1.30	0.9682	1.00
324	60-1477	S-2 Tank	MC	93.45	Aqua Green	24.00	101500	12.00	70.00	28.51	133.420	1.889	1.30	0.9682	1.00
324	60-1477	S-2 Tank	NRE	1.06	Aqua Green	24.00	101500	12.00	70.00	28.51	61.040	0.006	1.30	0.9682	1.00
324	60-1477	S-2 Tank	NTE	0.51	Aqua Green	24.00	101500	12.00	70.00	28.51	89.090	0.001	1.30	0.9682	1.00
324	60-1477	S-2 Tank	SBL*	1.75	Aqua Green	24.00	101500	12.00	70.00	28.51	74.120	0.003	1.30	0.9682	1.00
324	60-1478	No. 3 Day Tank	MC	99.47	White	24.00	101500	15.00	70.00	3.19	133.420	2.010	1.00	0.9682	1.00
324	60-1478	No. 3 Day Tank	NTE	0.53	White	24.00	101500	15.00	70.00	3.19	89.090	0.001	1.00	0.9682	1.00

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRIETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg/yr)	LW Working Loss (Mg/yr)	LT Total Loss (Mg/yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg/yr)	1987 Weighted HAP Emissions (Mg/yr)
322	60-1031	Spec. Tank No. 11	MC	0.60717	1.27529	1.88246	None	0.00	1.88246	1.88246
322	60-1031	Spec. Tank No. 11	NRE	0.01104	0.00579	0.01683	None	0.00	0.01683	0.01683
322	60-1031	Spec. Tank No. 11	NTE	0.00289	0.00068	0.00357	None	0.00	0.00357	0.00357
322	60-1031	Spec. Tank No. 11	TBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
322	60-1031	Spec. Tank No. 11	TLE	0.00667	0.00228	0.00895	None	0.00	0.00895	0.00895
323	60-1168	Spec. Tank No. 12	MC	0.65986	1.41863	2.07849	None	0.00	2.07849	2.07849
323	60-1168	Spec. Tank No. 12	NTE	0.00299	0.00071	0.00370	None	0.00	0.00370	0.00370
324	60-1470	No. 1 DOL/SBL Tank	DOX	0.06983	0.00501	0.07484	RVR	84.00	0.01197	0.01197
324	60-1470	No. 1 DOL/SBL Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1471	No. 2 DOL/SBL Tank	DOX	0.06983	0.00334	0.07317	RVR	84.00	0.01171	0.01171
324	60-1471	No. 2 DOL/SBL Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1472	No. 2 BLM Storage Tank	Butylene Oxide	0.24827	0.05964	0.30791	RVR	84.00	0.04927	0.04927
324	60-1473	DOL/DOX SBL Tank	DOL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1473	DOL/DOX SBL Tank	DOX	0.08981	0.07451	0.16432	RVR	84.00	0.02629	0.02629
324	60-1475	S-4 Tank	DOL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1475	S-4 Tank	DOX	0.02839	0.02253	0.05091	RVR	84.00	0.00815	0.00815
324	60-1475	S-4 Tank	MC	1.92105	7.94661	9.86766	RVR	84.00	1.57883	1.57883
324	60-1475	S-4 Tank	NRE	0.01551	0.01101	0.02653	RVR	84.00	0.00424	0.00424
324	60-1475	S-4 Tank	NTE	0.00819	0.00360	0.01179	RVR	84.00	0.00189	0.00189
324	60-1475	S-4 Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1476	S-3 Tank	DOL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1476	S-3 Tank	DOX	0.02839	0.02253	0.05091	RVR	84.00	0.00815	0.00815
324	60-1476	S-3 Tank	MC	1.92105	7.94661	9.86766	RVR	84.00	1.57883	1.57883
324	60-1476	S-3 Tank	NRE	0.01551	0.01101	0.02653	RVR	84.00	0.00424	0.00424
324	60-1476	S-3 Tank	NTE	0.00819	0.00360	0.01179	RVR	84.00	0.00189	0.00189
324	60-1476	S-3 Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1477	S-2 Tank	DOL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1477	S-2 Tank	DOX	0.02533	0.02253	0.04786	RVR	84.00	0.00766	0.00766
324	60-1477	S-2 Tank	MC	1.71441	7.94661	9.66102	RVR	84.00	1.54576	1.54576
324	60-1477	S-2 Tank	NRE	0.01384	0.01101	0.02486	RVR	84.00	0.00398	0.00398
324	60-1477	S-2 Tank	NTE	0.00731	0.00360	0.01091	RVR	84.00	0.00175	0.00175
324	60-1477	S-2 Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1478	No. 3 Day Tank	MC	1.55194	0.94647	2.49841	RVR	84.00	0.39975	0.39975
324	60-1478	No. 3 Day Tank	NTE	0.00643	0.00042	0.00685	RVR	84.00	0.00110	0.00110

* = NON HAPS, emission is not included as a HAP emission

PPG 05/20/92

SL 026107

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRI ETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb/lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
324	60-1479	No. 2 Day Tank	MC	99.47	White	24.00	101500	15.00	70.00	3.19	133.420	2.010	1.00	0.9682	1.00
324	60-1479	No. 2 Day Tank	NTE	0.53	White	24.00	101500	15.00	70.00	3.19	89.090	0.001	1.00	0.9682	1.00
324	60-1480	No. 1 Day Tank	MC	99.47	White	24.00	101500	15.00	70.00	3.19	133.420	2.010	1.00	0.9682	1.00
324	60-1480	No. 1 Day Tank	NTE	0.53	White	24.00	101500	15.00	70.00	3.19	89.090	0.001	1.00	0.9682	1.00
324	60-1481	S-1 Tank	DOL*	1.75	Aqua Green	18.00	46660	12.00	70.00	62.01	74.080	0.024	1.30	0.8332	0.65
324	60-1481	S-1 Tank	DOX	1.47	Aqua Green	18.00	46660	12.00	70.00	62.01	88.100	0.008	1.30	0.8332	0.65
324	60-1481	S-1 Tank	MC	93.45	Aqua Green	18.00	46660	12.00	70.00	62.01	133.420	1.889	1.30	0.8332	0.65
324	60-1481	S-1 Tank	NRE	1.06	Aqua Green	18.00	46660	12.00	70.00	62.01	61.040	0.006	1.30	0.8332	0.65
324	60-1481	S-1 Tank	NTE	0.51	Aqua Green	18.00	46660	12.00	70.00	62.01	89.090	0.001	1.30	0.8332	0.65
324	60-1481	S-1 Tank	SBL*	1.75	Aqua Green	18.00	46660	12.00	70.00	62.01	74.120	0.003	1.30	0.8332	0.65
324	60-1896	No. 4 NRE Tank	MC	31.39	Beige	21.00	62200	12.00	70.00	1.43	133.420	0.634	1.30	0.9124	1.00
324	60-1896	No. 4 NRE Tank	NRE	68.61	Beige	21.00	62200	12.00	70.00	1.43	61.040	0.369	1.30	0.9124	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	DOL*	1.75	White	32.00	420000	24.00	70.00	7.11	74.080	0.024	1.00	1.0000	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	DOX	1.47	White	32.00	420000	24.00	70.00	7.11	88.100	0.008	1.00	1.0000	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	MC	93.18	White	32.00	420000	24.00	70.00	7.11	133.420	1.883	1.00	1.0000	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	NRE	1.27	White	32.00	420000	24.00	70.00	7.11	61.040	0.007	1.00	1.0000	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	NTE	0.58	White	32.00	420000	24.00	70.00	7.11	89.090	0.001	1.00	1.0000	1.00
325	60-0413	No. 2 Triethane Dock Storage Tank	SBL*	1.75	White	32.00	420000	24.00	70.00	7.11	74.120	0.003	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	DOL*	1.75	White	32.00	420000	24.00	70.00	7.11	74.080	0.024	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	DOX	1.47	White	32.00	420000	24.00	70.00	7.11	88.100	0.008	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	MC	93.18	White	32.00	420000	24.00	70.00	7.11	133.420	1.883	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	NRE	1.27	White	32.00	420000	24.00	70.00	7.11	61.040	0.007	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	NTE	0.58	White	32.00	420000	24.00	70.00	7.11	89.090	0.001	1.00	1.0000	1.00
325	60-0530	No. 1 Triethane Dock Storage Tank	SBL*	1.75	White	32.00	420000	24.00	70.00	7.11	74.120	0.003	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	DOL*	1.75	White	60.00	1008000	24.00	70.00	2.96	74.080	0.024	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	DOX	1.47	White	60.00	1008000	24.00	70.00	2.96	88.100	0.008	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	MC	93.18	White	60.00	1008000	24.00	70.00	2.96	133.420	1.883	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	NRE	1.27	White	60.00	1008000	24.00	70.00	2.96	61.040	0.007	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	NTE	0.58	White	60.00	1008000	24.00	70.00	2.96	89.090	0.001	1.00	1.0000	1.00
325	60-1465	No. 3 Triethane Dock Storage Tank	SBL*	1.75	White	60.00	1008000	24.00	70.00	2.96	74.120	0.003	1.00	1.0000	1.00
326	60-1133	TE-II Shipping Tank	DOL*	1.75	White	12.00	25200	17.00	70.00	33.15	74.080	0.024	1.00	0.6046	1.00
326	60-1133	TE-II Shipping Tank	DOX	1.47	White	12.00	25200	17.00	70.00	33.15	88.100	0.008	1.00	0.6046	1.00
326	60-1133	TE-II Shipping Tank	MC	93.45	White	12.00	25200	17.00	70.00	33.15	133.420	1.889	1.00	0.6046	1.00
326	60-1133	TE-II Shipping Tank	NRE	1.06	White	12.00	25200	17.00	70.00	33.15	61.040	0.006	1.00	0.6046	1.00

* = NON HAP. Emission is not included as a HAP emission.

PPG 05/20/92

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRIETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg/yr)	LW Working Loss (Mg/yr)	LT Total Loss (Mg/yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg/yr)	1987 W ighted HAP Emissions (Mg/yr)
324	60-1479	No. 2 Day Tank	MC	1.55194	0.94647	2.49841	RVR	84.00	0.39975	0.39975
324	60-1479	No. 2 Day Tank	NTE	0.00643	0.00042	0.00685	RVR	84.00	0.00110	0.00110
324	60-1480	No. 1 Day Tank	MC	1.55194	0.94647	2.49841	RVR	84.00	0.39975	0.39975
324	60-1480	No. 1 Day Tank	NTE	0.00643	0.00042	0.00685	RVR	84.00	0.00110	0.00110
324	60-1481	S-1 Tank	DOL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1481	S-1 Tank	DOX	0.01325	0.01465	0.02791	RVR	84.00	0.00447	0.00447
324	60-1481	S-1 Tank	MC	0.89692	5.16896	6.06588	RVR	84.00	0.97054	0.97054
324	60-1481	S-1 Tank	NRE	0.00724	0.00716	0.01441	RVR	84.00	0.00230	0.00230
324	60-1481	S-1 Tank	NTE	0.00382	0.00234	0.00616	RVR	84.00	0.00099	0.00099
324	60-1481	S-1 Tank	SBL*	0.00000	0.00000	0.00000	RVR	84.00	0.00000	0.00000
324	60-1896	No. 4 NRE Tank	MC	0.57314	0.08210	0.65523	RVR	84.00	0.10484	0.10484
324	60-1896	No. 4 NRE Tank	NRE	0.17908	0.02184	0.20092	RVR	84.00	0.03215	0.03215
325	60-0413	No. 2 Triethane Dock Storage Tank	DOL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
325	60-0413	No. 2 Triethane Dock Storage Tank	DOX	0.04706	0.02319	0.07025	RVR	88.40	0.00815	0.00815
325	60-0413	No. 2 Triethane Dock Storage Tank	MC	3.18353	8.18106	11.36460	RVR	88.40	1.31829	1.31829
325	60-0413	No. 2 Triethane Dock Storage Tank	NRE	0.02911	0.01360	0.04272	RVR	88.40	0.00496	0.00496
325	60-0413	No. 2 Triethane Dock Storage Tank	NTE	0.01486	0.00424	0.01910	RVR	88.40	0.00222	0.00222
325	60-0413	No. 2 Triethane Dock Storage Tank	SBL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
325	60-0530	No. 1 Triethane Dock Storage Tank	DOL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
325	60-0530	No. 1 Triethane Dock Storage Tank	DOX	0.04706	0.02319	0.07025	RVR	88.40	0.00815	0.00815
325	60-0530	No. 1 Triethane Dock Storage Tank	MC	3.18353	8.18106	11.36460	RVR	88.40	1.31829	1.31829
325	60-0530	No. 1 Triethane Dock Storage Tank	NRE	0.02911	0.01360	0.04272	RVR	88.40	0.00496	0.00496
325	60-0530	No. 1 Triethane Dock Storage Tank	NTE	0.01486	0.00424	0.01910	RVR	88.40	0.00222	0.00222
325	60-0530	No. 1 Triethane Dock Storage Tank	SBL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
325	60-1465	No. 3 Triethane Dock Storage Tank	DOL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
325	60-1465	No. 3 Triethane Dock Storage Tank	DOX	0.13961	0.02319	0.16280	RVR	88.40	0.01889	0.01889
325	60-1465	No. 3 Triethane Dock Storage Tank	MC	9.44500	8.18106	17.62606	RVR	88.40	2.04462	2.04462
325	60-1465	No. 3 Triethane Dock Storage Tank	NRE	0.08637	0.01360	0.09997	RVR	88.40	0.01160	0.01160
325	60-1465	No. 3 Triethane Dock Storage Tank	NTE	0.04409	0.00424	0.04832	RVR	88.40	0.00561	0.00561
325	60-1465	No. 3 Triethane Dock Storage Tank	SBL*	0.00000	0.00000	0.00000	RVR	88.40	0.00000	0.00000
326	60-1133	TE-II Shipping Tank	DOL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
326	60-1133	TE-II Shipping Tank	DOX	0.00438	0.00651	0.01089	None	0.00	0.01089	0.01089
326	60-1133	TE-II Shipping Tank	MC	0.29651	2.29469	2.59120	None	0.00	2.59120	2.59120
326	60-1133	TE-II Shipping Tank	NRE	0.00239	0.00318	0.00557	None	0.00	0.00557	0.00557

* = NON HAPS, emission is not included as a HAP emission

SL 026108

SL 026109

PPG 05/20/92

SUMMARY OF THE CALCULATION INPUTS FOR FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRI ETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	Mole Percent	Tank Color	D Inside Diameter (ft.)	V Capacity (gal.)	H Vapor Space Height (ft.)	Ts Stored Liquid Temp. (o F)	N Number of Turnovers per Year	Mv Molecular Weight (lb / lb mole)	P Partial Pressure (psia)	Fp Paint Factor	C Small Diameter Factor	KN Turnover Factor
326	60-1133	TE-II Shipping Tank	NTE	0.51	White	12.00	25200	17.00	70.00	33.15	89.090	0.001	1.00	0.6046	1.00
326	60-1133	TE-II Shipping Tank	SBL*	1.75	White	12.00	25200	17.00	70.00	33.15	74.120	0.003	1.00	0.6046	1.00
353	60-1469	TCE-Tetra Storage Tank	PENTA*	4.16	Green	42.00	435300	21.00	70.00	0.11	202.290	0.003	1.30	1.0000	1.00
353	60-1469	TCE-Tetra Storage Tank	SYM	12.47	Green	42.00	435300	21.00	70.00	0.11	167.864	0.012	1.30	1.0000	1.00
353	60-1469	TCE-Tetra Storage Tank	TCE	60.16	Green	42.00	435300	21.00	70.00	0.11	133.410	0.229	1.30	1.0000	1.00
353	60-1469	TCE-Tetra Storage Tank	UNSYM*	23.22	Green	42.00	435300	21.00	70.00	0.11	167.864	0.050	1.30	1.0000	1.00
355	60-403	No. 1 BLM Storage Tank	Butylene Ox	100.00	White	8.00	4115	5.00	70.00	6.61	72.120	2.708	1.00	0.4002	1.00
358	60-1032	TBL/MC Storage Tank	MC	35.71	White	12.00	15000	10.00	100.00	3.17	133.420	1.466	1.00	0.6046	1.00
358	60-1032	TBL/MC Storage Tank	TBL*	64.29	White	12.00	15000	10.00	100.00	3.17	74.120	0.771	1.00	0.6046	1.00

* = NON HAP, Emission is not included as a HAP emission.

PPG 05/20/92

SL 026110

SUMMARY OF CALCULATED EMISSIONS FROM FIXED-ROOF STORAGE TANKS ASSOCIATED WITH THE TRIETHANE-II PROCESS UNIT (TE-II)

EIQ NO.	Tank ID	Tank Description	HAP	LB Breathing Loss (Mg / yr)	LW Working Loss (Mg / yr)	LT Total Loss (Mg / yr)	Control Device	Control Efficiency (%)	1987 Unweighted HAP Emissions (Mg / yr)	1987 Weighted HAP Emissions (Mg / yr)
326	60-1133	TE-II Shipping Tank	NTE	0.00126	0.00104	0.00230	None	0.00	0.00230	0.00230
326	60-1133	TE-II Shipping Tank	SBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000
353	60-1469	TCE-Tetra Storage Tank	PENTA*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
353	60-1469	TCE-Tetra Storage Tank	SYM	0.23402	0.00112	0.23515	Scrubber	5.00	0.22339	2.23391
353	60-1469	TCE-Tetra Storage Tank	TCE	1.35813	0.01639	1.37452	Scrubber	5.00	1.30579	1.30579
353	60-1469	TCE-Tetra Storage Tank	UNSYM*	0.00000	0.00000	0.00000	Scrubber	5.00	0.00000	0.00000
355	60-403	No. 1 BLM Storage Tank	Butylene Oxide	0.03766	0.05964	0.09730	None	0.00	0.09730	0.09730
358	60-1032	TBL/MC Storage Tank	MC	0.18630	0.10155	0.28785	None	0.00	0.28785	0.28785
358	60-1032	TBL/MC Storage Tank	TBL*	0.00000	0.00000	0.00000	None	0.00	0.00000	0.00000

G-25

* = NON HAPS, emission is not included as a HAP emission

APPENDIX G-B
TRI-ETHANE® II PROCESS UNIT
PROCESS VENT CALCULATIONS

SL 026111

Source: HON subunit(s) Tri-Ethane II Process Unit
HAPs emitted: 1,1-Dichloroethane (DCE), Methyl Chlorform (MC), HCl

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE)

HAP: None — Date: April 1992
Year: 1987 — Calculator: S.R.

Process Vent Identification: 305 (non-routine)
Description: MC/DCE Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	[1]
Method of flow measurement	N/A
Date of concentration measurement	---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	N/A
Describe any problems encountered during testing	N/A
Production rate during flow determination (lbs/hr)	---
Production rate during sampling (lbs/hr)	---
Average production rate during base year (lbs/hr)	---

Stream Characteristics

Average vent stream flow rate (ft^3/min)	---	= Q
HAP concentration (ppmv)	---	= C
Annual hours of operation (hrs)	---	= h
Vent stream discharge temperature (°F)	---	= T
HAP molecular weight (lb/lb-mole)	---	= MW
Pressure at point of discharge (psia)	---	= P
HAP high-risk weighting factor	---	= F_{HR}

Control

Control device		
HAP control efficiency (%)	---	= eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)(0)(0)(0)(0)}{(0) + 460}$$

$$= \boxed{0 \text{ Mg/yr}}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

[1]There were no non-routine releases in 1987, 1988 and 1989.

SL 026112

Sourc : HON subunit(s) Tri-Ethane II Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0 (1 - 0/100)

= $\boxed{0 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0) (--)

= $\boxed{0 \text{ Mg/yr}}$

If the conditions during testing are not representative of bas year operation, make the appropriate extrapolation below and xplain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using Method 301, provide justification and supporting calculations:

N/A

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

SL 026113

Source: HON subunit(s) Tri-Ethane II Process Unit
HAPs emitted: 1,1-Dichloroethane (DCE), Methyl Chloroform (MC), Hydrochloric Acid (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: 1,1-Dichloroethane (DCE) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 305 (startup)
Description: MC/DCE Startup Scrubber

Process Conditions/Sampling
Date of flow measurement ---
Method of flow measurement Calculated
Date of concentration measurement ---
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol) Calculated[1]

Describe any problems encountered during testing N/A
Production rate during flow determination (lbs/hr) 19,086
Production rate during sampling (lbs/hr) 19,086
Average production rate during base year (lbs/hr) 19,086

Stream Characteristics

Average vent stream flow rate (ft^3/min)	3,619	= Q
HAP concentration (ppmv)	22,227	= C
Annual hours of operation (hrs)	4	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control
Control device Scrubber
HAP control efficiency (%) 99% for HCl = eff
5% for hydrocarbons

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(3,619)(22,227)(4)(99)(14.7)}{(80) + 460}$$

$$= \boxed{2.205 \text{ Mg/yr}}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)
[1]S e next pag .

SL 026114

Source: HON subunit(s) Tri-Ethane II Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS
FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 2.205 (1 - 5/100)

= $\boxed{1.948 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (1.948) (1)

= $\boxed{1.948 \text{ Mg/yr}}$

Total HAPs Emissions* = 3.004 Mg/yr
Total Weighted HAPs Emissions = 3.004 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M th d 301, provide justification and supporting calculations:

During startup the following emissions will occur:

Component	lb/lb-mole	lb/hr	% wt	mole	% mole	Avg. lb/lb-mole
DCE	99	2,556	11.4	25.82	4.7	4.653
MC	133	1,179	5.3	8.865	1.6	2.128
HCl	36	18,620	83.3	517.23	93.7	33.732
		22,355	100	551.915	100	40.513

SL 026115

Source: HON subunit(s) Tri-Ethane II Process Unit

These rates are determined for a production of 450 tpd in 1987. The production was 214 tpd at 0.5 hr/startup, 1987 emissions = $22,355 \times 0.5 \frac{hr}{su} \times \frac{214}{450} = 5315.53$ lb/su

$$\rightarrow 5315.53 \times \frac{8\ su}{yr} = 42524.24\ lb/yr$$

$$= \frac{42524.24}{4} = 10631.1\ lb/yr$$

$$DCE\ emissions = 10631.1\ lb/hr \times \frac{11.4}{100} = 1212\ lb/hr$$

$$MC\ emissions = 10631.1\ lb/hr \times \frac{5.3}{100} = 563.45\ lb/hr$$

$$HCl\ emissions = 10631.1\ lb/hr \times \frac{83.3}{100} = 8855.7\ lb/hr$$

Stack gas flow rate = $22355 \frac{lb}{hr} \times \frac{lb\text{-}mole}{40.513\ lb} \times \frac{379\ ft^3}{lb\text{-}mole} \times \frac{540\ °R}{520\ °R}$

= 217,175 ft^3/hr

= 3,619 ft^3/min

Concentration calculation of DCE;

DCE emission = 1212 lb/hr (uncontrolled)

Flow Rate = 3619 ft^3/min = 217,175 ft^3/hr

amount of DCE in vent, $1212 \frac{lb}{hr} \times \frac{lb\text{-}mole}{99\ lb} = 12.24 \frac{lb\text{-}mole}{hr}$

$$\rightarrow \frac{12.24\ lb\text{-}mole/hr}{217,175\ ft^3/hr} = 0.000056 \frac{lb\text{-}mole}{ft^3}$$

SL 026116

Source: HON subunit(s) Tri-Ethane II Process Unit

DCE concentration, $C = (0.000056\ lb\text{-}mole/ft^3)\ (0.7302\ ft^3\ atm/lb\text{-}mole\ {}^\circ R)$

$$\times \frac{(80 + 460)^\circ\ R}{atm} \times 10^6$$

$$= 22227\ ppm$$

MC concentrations;

emissions = 563.45 *lb/hr* (*uncontrolled*)

$$C = \frac{(563.45)\ (0.7302)\ (80 + 460)}{(133)\ (217{,}175)} \times 10^6$$

$$= 7692\ ppm$$

HCl concentrations;

HCl emissions = 8855.7 *lb/hr* (*uncontrolled*)

$$C = \frac{(8855.7)\ (0.7302)\ (80 + 460)}{(36)\ (217{,}175)} \times 10^6 = 446628\ ppm$$

---

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation.

SL 026117

SL 026118

G-33

ATTACHMENT I

SUBUNIT:	TE-II
VENT ID:	305
SCENARIO:	STARTUP
DESCRIPTION:	MC/DCE STARTUP SCRUBBER

YEAR: 1987

Q = Average vent stream flow rate (ft3/min)
C = HAP Concentration (ppmv)
h = Annual hours of operation (hrs)
T = Vent stream discharge temperature (F)
MW = HAP molecular weight (lb/lb-mole)
P = Pressure at point of discharge (psia)
FHR = HAP high risk weighting factor
eff = HAP control efficiency (%)
EU = Uncontrolled emissions (Mg/yr) ; EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP = Controlled emissions (Mg/yr) ; EHAP = EU x (1 - (eff/100))
EW = Weighted HAP emissions (Mg/yr) ; EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
DCE	3619	22,227	4.00	99	14.7	120	5.00	1	2.051	1.948	1.948
MC	3619	7,692	4.00	133	14.7	120	5.00	1	0.953	0.906	0.906
HCL	3619	446,628	4.00	36	14.7	120	99.00	1	14.984	0.150	0.150
								TOTAL	17.988	3.004	3.004

FILE: N16

Source: HON subunit(s) Tri-Ethane II Process Unit
HAPs emitted: Ethylene Dichloride (EDC), Hydrochloric Acid (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethylene Dichloride (EDC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 306 (non-routine)
Description: No. 2 OHC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	1987
Method of flow measurement	Calculated[1]
Date of concentration measurement	1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TCD
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	19,086
Production rate during sampling (lbs/hr)	19,086
Average production rate during base year (lbs/hr)	19,086

Stream Characteristics

Average vent stream flow rate (ft^3/min)	17.4	= Q
HAP concentration (ppmv)	996,384	= C
Annual hours of operation (hrs)	7.42	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device: Scrubber
HAP control efficiency (%): 99% for HCl, 5% EDC = eff

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E-09)(17.4)(996{,}384)(7.42)(99)(14.7)}{(80) + 460}$$

$$= \boxed{0.881\ Mg/yr}$$

$$\text{HAP Emissions } (E_{HAP}) = E_U\ (1 - eff/100)$$

SL 026119

Source: HON subunit(s) Tri-Ethane II Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 0.881 (1 - 5/100)

= $\boxed{0.837 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (0.837) (1)

= $\boxed{0.837 \text{ Mg/yr}}$

Total HAPs Emissions* = 0.837 Mg/yr
Total Weighted HAPs Emissions = 0.837 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M thod 301, provide justification and supporting calculations:

Concentration of gas was determined using a gas chromatograph with a thermal conductivity detector. Sample was taken from the vent into a syringe. The flow rate of the gas can be calculated as follows:

Components	Uncontrolled Concentrations Mole/Hr	PPMV
EDC	2.64	996,384
HCL	.0069	2,604

SL 026120

Source: HON subunit(s) Tri-Ethane II Process Unit

$$\left(2.65\ \frac{mole}{hr}\right) x \left(359\ \frac{ft^3}{mole}\right)\left(\frac{540\ ^\circ R}{492\ ^\circ R}\right) = 1044\ \frac{ft^3}{hr}$$

$$= 17.4\ \frac{ft^3}{min}$$

Vent temperature is 80°F.

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation.

SL 026121

ATTACHMENT I

SUBUNIT:	TE-II
VENT ID:	306
SCENARIO:	NON-ROUTINE
DESCRIPTION:	NO. 2 OHC STARTUP SCRUBBER

YEAR: 1987

Q = Average vent stream flow rate (ft3/min)
C = HAP Concentration (ppmv)
h = Annual hours of operation (hrs)
T = Vent stream discharge temperature (F)
MW = HAP molecular weight (lb/lb-mole)
P = Pressure at point of discharge (psia)
FHR = HAP high risk weighting factor
eff = HAP control efficiency (%)
EU = Uncontrolled emissions (Mg/yr) ; EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP = Controlled emissions (Mg/yr) ; EHAP = EU x (1 - (eff/100))
EW = Weighted HAP emissions (Mg/yr) ; EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EDC	17.4	996,384	7.42	99	14.7	80	5.00	1	0.881	0.837	0.837
HCL	17.4	2604	7.42	36	14.7	80	99.00	1	0.001	0.000	0.000
								TOTAL	0.881	0.837	0.837

FILE: N17

Source: HON subunit(s) Tri-Ethane II Process Unit
HAPs emitted: Ethylene Dichloride (EDC), Hydrochloric Acid (HCl)

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE)

HAP: Ethylene Dichloride (EDC) Date: April 1992
Year: 1987 Calculator: S.R.

Process Vent Identification: 306 (startup)
Description: No. 2 OHC Startup Scrubber

Process Conditions/Sampling

Date of flow measurement	1987
Method of flow measurement	calculated[1]
Date of concentration measurement	1987
Method of concentration measurement (if not an EPA Method give a brief description and attach protocol)	Syringe Sample, GC/TC
Describe any problems encountered during testing	None Identified
Production rate during flow determination (lbs/hr)	19,086
Production rate during sampling (lbs/hr)	19,086
Average production rate during base year (lbs/hr)	19,086

Stream Characteristics

Average vent stream flow rate (ft^3/min)	60.7	= Q
HAP concentration (ppmv)	999,578	= C
Annual hours of operation (hrs)	5.5	= h
Vent stream discharge temperature (°F)	80	= T
HAP molecular weight (lb/lb-mole)	99	= MW
Pressure at point of discharge (psia)	14.7	= P
HAP high-risk weighting factor	1	= F_{HR}

Control

Control device Scrubber
HAP control efficiency (%) 99% for HCl = eff
5% EDC

Calculations[a]

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)\ Q\ C\ h\ MW\ P}{T + 460}$$

$$\text{Uncontrolled Emissions } (E_U) = \frac{(2.54E\text{-}09)(60.7)(999{,}578)(5.5)(99)(14.7)}{(80) + 460}$$

$$= \boxed{2.283\ \text{Mg/yr}}$$

HAP Emissions (E_{HAP}) = E_U (1 - eff/100)
[1]See next page.

SL 026123

Source: HON subunit(s) Tri-Ethane II Process Unit

CALCULATION WORKSHEET FOR ESTABLISHING HAP EMISSIONS FROM PROCESS VENTS (SAMPLE) (CONCLUDED)

HAP Emissions (E_{HAP}) = 2.283 (1 - 5/100)

= $\boxed{2.169 \text{ Mg/yr}}$

Weighted HAP Emissions = E_{HAP} F_{HR}
Weighted HAP Emissions = (2.169) (1)

= $\boxed{2.169 \text{ Mg/yr}}$

Total HAPs Emissions* = 2.169 Mg/yr
Total Weighted HAPs Emissions = 2.169 Mg/yr

If the conditions during testing are not representative of base year operation, make the appropriate extrapolation below and explain:

N/A

If the flow or concentration were not measured using an EPA reference method, EPA conditional method or validated using M thod 301, provide justification and supporting calculations:

Concentration of gas was determined using a gas chromatograph with a thermal conductivity detector. Sample was taken from the vent into a syringe. Flow rate of the vent can be calculated as follows:

Components	Uncontrolled Mole/Hr	Uncontrolled PPMV
EDC	9.23	998,859
HCL	.012	1,299

SL 026124

Source: HON subunit(s) Tri-Ethane II Process Unit

$$\left(9.24\ \frac{mole}{hr}\right) x \left(359\ \frac{ft^3}{mole}\right)\left(\frac{540\ ^\circ R}{492\ ^\circ R}\right) = 3641\ \frac{ft^3}{hr}$$
$$= 60.7\ \frac{ft^3}{min}$$

Vent temperature is 80°F.

[a]Expression provided in "Procedures for Establishing Base Year and Post-Reduction HAP Emission" to convert flow and concentration into an annual mass rate; the 2.54E-09 constant is based on the ideal gas law.

*See Attachment I for calculation.

SL 026125

SL 026126

G-41

ATTACHMENT I

SUBUNIT:	TE-II
VENT ID:	306
SCENARIO:	STARTUP
DESCRIPTION:	NO. 2 OHC STARTUP SCRUBBER

YEAR: 1987

Q	=	Average vent stream flow rate (ft3/min)		
C	=	HAP Concentration (ppmv)		
h	=	Annual hours of operation (hrs)		
T	=	Vent stream discharge temperature (F)		
MW	=	HAP molecular weight (lb/lb-mole)		
P	=	Pressure at point of discharge (psia)		
FHR	=	HAP high risk weighting factor		
eff	=	HAP control efficiency (%)		
EU	=	Uncontrolled emissions (Mg/yr)	;	EU = (2.54E-09 x Q x C x h x MW x P) / (T + 460)
EHAP	=	Controlled emissions (Mg/yr)	;	EHAP = EU x (1 - (eff/100))
EW	=	Weighted HAP emissions (Mg/yr)	;	EW = EHAP x FHR

COMPONENT	Q	C	h	MW	P	T	eff	FHR	EU	EHAP	EW
EDC	60.7	998,859	5.50	99	14.7	80	5.00	1	2.283	2.169	2.169
HCL	60.7	1,299	5.50	36	14.7	80	99.00	1	0.001	0.000	0.000
								TOTAL	2.284	2.169	2.169

FILE: N18