Hazardous Air Pollutant Emissions for Miscellaneous Organic Chemical Manufacturing

Supplementary Information Document for Proposed Standards

Emission Standards Division

U. S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
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ALPHA-GAMMA
TECHNOLOGIES, INC.

MEMORANDUM

DATE: May 20, 1999

SUBJECT: Existing Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON

FROM: Chuck Zukor and Reese Howle
Alpha-Gamma Technologies, Inc.

To: Miscellaneous Organic NESHAP Project File

The purpose of this memorandum is to summarize the maximum achievable control technology (MACT) floor determinations for batch and continuous chemical manufacturing processes at existing sources which are covered by the Miscellaneous Organic NESHAP (MON). Material discussed in this memorandum includes:

1) Regulatory background including standard applicability, available information for MACT analyses, and MACT definitions;

2) Determination of the process vents MACT floor;

3) Determination of the storage tanks MACT floor;

4) Determination of the wastewater MACT floor; and

5) Determination of the equipment components MACT floor.

1.0 BACKGROUND

This section presents some background on the development of MACT floors for the MON. Section 1.1 summarizes the facility applicability criteria for the MON. Section 1.2 describes the available information used in the MACT floor determinations. Section 1.3 summarizes the required guidelines for determining MACT floors and a summary of the resulting MON MACT floor determinations.

1.1 MON Applicability Criteria

The MON will apply to facilities meeting all of the following criteria:

- Manufacture of organic chemicals in batch or continuous processes;

- Emit a hazardous air pollutant (HAP) and considered a major source;

- Are covered by one of the following Standard Industrial Classification (SIC) codes: 282, 284, 286, 287, 289, or 386; and

- Are not covered by any other MACT standard.

Additional details regarding applicability of the MON were published in the Federal Register on November 7, 1996 (61 FR 57602).

1.2 Available Information

The MACT floor analyses are based on information that was readily available to the EPA. The information was obtained from two general sources: (1) responses to Section 114 surveys, and (2) permit and emissions inventory data maintained by state and local regulatory agencies. A more detailed description of the type of data available for batch and continuous chemical processes is provided below.

1.2.1 Batch Processes

The Environmental Protection Agency (EPA), under the authority of Section 114 of the 1990 Clean Air Act Amendment, requested information from facilities which are subject to the MON and which have batch chemical manufacturing processes. The Section 114 requests were sent to 194 facilities in a letter from the EPA on January 28, 1997 with a clarification letter sent on March 10, 1997. The facilities which received the Section 114 questionnaires were identified from EPA's 1993 Toxic Release Inventory (TRI) database. First, facilities which had a SIC code of 282, 284, 286, 287, or 386 were identified. Then, facilities which had total actual HAP emissions greater than 12.5 tons/yr or actual emissions of one HAP greater than 5 tons/yr were identified. From this set, all facilities which may produce a MON product were identified using the list of chemical products produced in SRI International's "1996 Directory of Chemical Producers."

Data from the facilities for the 1995 calendar year were provided to the EPA on a computer disk or on paper (hard copy). Alpha-Gamma entered the data received from the facilities into a MS Access database. The MON batch processes database contains data from 160 facilities. Some of the data provided were not in the format requested in the Section 114 questionnaire. Alpha-Gamma made the necessary conversions before the MACT floor analyses were performed. The memorandum "Quality Assurance and

Quality Control of MON Batch Chemical Processes Database", October 7, 1997 describes the quality control procedures performed by Alpha-Gamma.

1.2.2 Continuous Process

Information contained in the MON continuous database primarily consists of electronic emission databases maintained by individual states. Alpha-Gamma obtained electronic emission databases from the following seven states: Texas, Louisiana, North Carolina, Illinois, Missouri, California, and New Jersey. For Texas, information contained in the database was supplemented by hard copies of air permits for facilities with at least one miscellaneous organic process. For Louisiana, additional information was obtained through hard copies of compliance plans, permit applications, and emissions inventory documentation. In the case of North Carolina, annual air emissions inventories were used as sources of additional information.

1.3 MACT Floor Determinations

According to the Clean Air Act, the MACT floor for existing sources is defined as "the average emission limitation achieved by the best performing 12 percent of sources (for which the Administrator has emissions information)." The EPA has interpreted the word "average" in 59 FR 29196 as a measure of the "central tendency of a data set." The central tendency may be represented by the arithmetic mean, median, or some other measure that is reasonable. The MACT floors for the MON are based on the central tendency for each emission type, using the available data. Table 1 provides a summary of the MACT floor determinations for batch and continuous chemical processes at existing sources. The MACT floors and the methodology used to determine these floors are described in the following sections.

2.0 PROCESS VENT MACT FLOOR DETERMINATION

A "process vent" is defined as the gaseous discharge from an individual unit operation (i.e., emission source) such as reactor or dryer. A process vent may discharge directly to the atmosphere, to another unit operation, or to an emission control device. A "product process" is defined as a group of unit operations and associated equipment required to manufacture a specific organic chemical product.

Table 1. MACT Floor Determinations for Chemical Processes at Existing Sources

Source Type	Required Control	Performance Level	
Process Vents	98 percent reduction	Each continuous vent within a facility with a TRE $\leq$ 2.8	All batch vents within a product process with total product process HAP emissions $\geq$ 10,000 lb/yr
Storage Tanks	IFR/EFR or 95 percent reduction	Tank with capacity $\geq$ 10,000 gal and HAP partial pressure $\geq$ 1.0 psia	
Wastewater	Same reductions as required by the HON	Wastewater streams with total VOHAP[a] concentration $\geq$ 10,000 ppmw, or Wastewater streams with flow rate $\geq$ 10 lpm and total VOHAP concentration $\geq$ 1,000 ppmw.	
Equipment Components	HON equivalent LDAR program	All affected product processes.	

[a] VOHAP is described in Table 9 of the HON rule (40 CFR 63, Appendix to Subpart G). Table 9 lists the volatile organic HAP (VOHAP) which volatilize readily from wastewater and are characterized by Henry's Law constants greater than or equal to 1.51 x 10^{-6} atm-m^3/mol.

A class distinction was established between process vents associated with continuous and batch chemical processes. Therefore, separate MACT floors were determined for continuous and batch chemical processes:

- The MACT floor for continuous process vents is a control device with a HAP reduction efficiency of 98 percent or greater for an individual vent with a total resource effectiveness (TRE) value of 2.8 or less.

- The MACT floor for batch process vents is a control device capable of reducing product process HAP emissions by 98 percent or greater for batch product processes with total HAP emissions of 10,000 lb/yr or more.

The affected process vent population used in the MACT floor determination is described in Section 2.1. In Section 2.2, the class distinction between continuous and batch vents is discussed. Section 2.3 describes the MACT floor level of performance. Section 2.4 discusses the performance criteria which defines the affected source. While, Section 2.5 describes the MACT floor determinations.

2.1 Affected Vent Population

All process vents associated with continuous and batch (dedicated and non-dedicated) product processes were considered. Vents releasing inorganic materials such as cobalt compounds, cyanide compounds, hydrogen chloride, hydrogen fluoride, chlorine, and manganese compounds were eliminated from the MACT floor determination. Typically, vents releasing inorganic materials require different control technologies than organic materials (e.g., filters versus flares). In addition, vents with dilute HAP concentrations were eliminated from the MACT floor analyses. A total HAP de minimis concentration of 50 ppmv was selected because it is consistent with de minimis concentrations used in other EPA standards, such as the Hazardous Organic NESHAP (HON).

The process vent population that results from the above exclusions is 3,599 vents located in 685 product processes. Where, batch (dedicated and non-dedicated) operations account for approximately 84 percent (3,009) of the process vent population and 87 percent (597) of the product processes.

2.2 Class Distinctions

A class distinction was established between vents associated with continuous and batch chemical processes. Factors considered in establishing the continuous-batch class distinction included the following:

- Hours of operation (hr/yr) for continuous vents are longer than batch vents (average of 8,100 vs 3,500 hr/yr),

- Volumetric flow rates (scfm) for continuous vents are higher than batch vents (average of 6,450 vs 415 scfm), and

- Annual emissions (lb/yr) for continuous vents are higher than batch vents.

The EPA already has several regulatory standards which have set a precedent for establishing a class distinction between continuous and batch chemical processes. Examples of these precedents include: the HON, Polymers & Resins (Group I & IV) NESHAP, and New Source Performance Standards for Distillation Units (Subpart NNN) and Reactor Processes (Subpart RRR).

2.3 MACT Floor Level of Performance

The selected MACT floor level of performance is a control device achieving a HAP emission reduction efficiency of 98 percent or more. Approximately, 14 percent of the continuous vents and 13 percent of the batch vents reported a control device achieving a HAP emission reduction efficiency of 98 percent or more, excluding scrubbers. Therefore, a MACT floor level of performance exists for the continuous and batch vents.

The MACT floor level of performance established for continuous and batch vents is consistent with the HON and other chemical industry MACT standards. Process vents equipped with scrubbers were not considered in the MACT floor determination. A review of responses to the Section 114 industry questionnaire indicated that scrubbers are typically used to remove water-soluble pollutants such as methanol from process vents. However, the pollutants may only be transferred from one media to another (i.e., absorbed from the process vent into the scrubbing media), rather than being destroyed or recovered. Due to a concern that these water-soluble pollutants may not be recovered or destroyed, scrubber controls were not considered.

2.4 Affected Source

2.4.1 Continuous Vents

The TRE for each continuous process vent was selected as the measure of performance to rank order vents controlled at a MACT floor level. Vents with MACT floor equivalent controls and a high TRE value are considered more stringent than similar vents with a lower TRE value.

All vents associated with continuous product processes at a facility are considered the affected source. All continuous vents within each facility were ranked by the corresponding TRE in ascending order (low-to-high) to determine the TRE "threshold" below which all vents are controlled at a MACT floor level of performance. Starting from the vent with the lowest TRE value, it was confirmed whether this vent is controlled at the MACT floor level. If the answer was "no," then there is no applicable threshold value for the facility. If the answer was "yes," the same procedure was applied to the vent with the next-to-lowest TRE value. The process was repeated until a vent was identified as not meeting the MACT floor performance level. At this point, the threshold value (or TRE performance level) for the facility was defined as the TRE value below which all vents are controlled at a MACT floor level.

2.4.2 Batch Vents

Total uncontrolled HAP emissions for a batch product process was selected as the measure of performance to rank order batch vents which are collectively controlled within a product process at the MACT floor level. This collective vent approach was selected because information in the MON database indicated that batch vents were commonly manifolded within a product process prior to control. Typically, the volumetric flow rates associated with batch vents are small. Thus, it is more cost effective to manifold like vent exhausts for destruction in a common control device.

Batch product processes with MACT floor equivalent controls and low total uncontrolled HAP emissions are considered more stringent than similar vents with higher uncontrolled HAP emissions. All batch product processes with MACT equivalent controls were ranked by the corresponding uncontrolled HAP emissions in ascending order (low-to-high) to determine the top performing 12 percent of batch product processes. All vents associated within a batch product process are considered the affected source.

2.5 MACT Floor Determinations

For continuous vents, the top performing 12 percent of sources were determined by rank ordering the respective facilities by the determined TRE performance level in descending order (high-to-low). Facilities with the highest TRE performance level are considered the best performing facilities. The top 12 percent of the 48 continuous facilities corresponds to the top 6 facilities. The median TRE performance level for the top facilities is a TRE of 2.2. The average TRE performance level for the top facilities is a TRE of 2.8. It was determined that the average TRE performance level of 2.8 represented the "central tendency" of the top facilities. Since the TRE values for the top performing facilities represented an even distribution over a limited value range, it was determined that the average TRE value best represented the central tendency of the data set. Attachment A provides a complete MACT floor ranking with corresponding TRE performance levels for continuous vents.

For batch vents, the top performing 12 percent of sources were determined by rank ordering the respective product processes by the total uncontrolled HAP emissions in ascending order (low-to-high). Product processes with the lowest total uncontrolled HAP emissions are considered the best performing facilities. The top 12 percent of the 731 batch product processes corresponds to the top 44 product processes. The median performance level for the top product processes is total uncontrolled HAP emissions from the product process of 10,000 lb/yr (rounded up from 9,860 lb/yr). The average performance level for the top product processes is a total uncontrolled HAP emissions from the product process of 15,200 lb/yr. It was determined that the median performance level of 10,000 lb/yr of uncontrolled HAP emissions represented the "central tendency" of the top product processes. Since the HAP emission values for the top performing facilities represented a skewed distribution over a large value range, it was determined that the median value best represented the central tendency of the data set. Attachment B provides the batch vents MACT floor ranking including the corresponding HAP emission performance levels for batch product processes with an overall control efficiency of 98 percent or more.

3.0 STORAGE TANK MACT FLOOR DETERMINATION

The MACT floor for storage tanks was determined to be an internal or external floating roof (IFR or EFR), or a control device with a HAP reduction efficiency of 95 percent or greater for all tanks 10,000 gallons or greater and storing a material with a HAP partial pressure of 0.90 psia or greater.

The affected storage tank population used in the MACT floor determination is described in Section 3.1. In Section 3.2, the MACT floor level of performance is described.

Section 3.3 discusses the performance criteria which defines the affected source. While, Section 3.4 describes the MACT floor determinations.

3.1 Affected Tank Population

All storage tanks associated with continuous and batch (dedicated and non-dedicated) product processes were considered. Tanks storing inorganic materials such as hydrogen chloride, hydrogen fluoride, chlorine, and potassium compounds were eliminated from the MACT floor determination. Typically, tanks storing inorganic materials require different control technologies than organic materials (e.g., filters versus condensers). Although maleic and phthalic anhydrides are organic materials they sublime at ambient temperatures. Thus, tanks storing these compounds were also eliminated from the floor analysis.

The EPA did not request data on tanks with capacities less than 10,000 gal or tanks storing materials with a HAP content less than 5 percent by weight to be consistent with the classes of tanks covered by the HON.

The tank population that results after these exclusions is 1,458 tanks located in 150 facilities. Where, batch (dedicated and non-dedicated) account for approximately 86 percent (1,259) of the tank population.

3.2 MACT Floor Level of Performance

The selected MACT floor level of performance is a tank equipped with an internal or external floating roof (IFR or EFR), or another control device with a HAP emission reduction efficiency of 95 percent or more. Approximately 16 percent of storage tanks are reported as equipped with an IFR/EFR or a control device achieving a HAP emission reduction efficiency of 95 percent or more, excluding scrubbers. Therefore, a MACT floor level of performance exists for storage tanks.

This level of performance is consistent with the HON and other chemical industry MACT standards. Tanks equipped with scrubbers were not considered a MACT floor level of performance. A review of responses to the Section 114 industry questionnaire indicated that scrubbers are typically used to remove water-soluble pollutants such as methanol from storage tank vents. However, the pollutants may only be transferred from one media to another (i.e., absorbed from the storage tank vent into the scrubbing media), rather than being destroyed or recovered.

3.3 Affected Source

The HAP partial pressure (psia) of the stored material was selected as the measure of performance to rank order tanks controlled at a MACT floor level. Tanks with MACT floor equivalent controls and storing materials with a low HAP partial pressure are considered more stringent than similar tanks storing materials with a higher HAP partial pressure.

All tanks located in each facility operating continuous and/or batch product processes are considered the affected source. All tanks at each facility were ranked by the corresponding HAP partial pressure in descending order (high-to-low) to determine the partial pressure “threshold” above which all tanks are controlled at a MACT floor level of performance. Starting from the tank with the highest HAP partial pressure, it was confirmed whether this tank is controlled at the MACT floor level. If the answer was “no,” then there is no applicable threshold value for the facility. If the answer was “yes,” the same procedure was applied to the tank with the next-to-highest HAP partial pressure. The process was repeated until a tank was identified as not meeting the MACT floor performance level. At this point, the threshold value for the facility was defined as the HAP partial pressure above which all tanks are controlled at a MACT floor level.

A de minimis limit of 0.05 psia was selected for the HAP partial pressure. Many tanks in the affected tank population store ethylene glycol and/or glycol ethers (EG/GE) and have HAP partial pressures less than 0.05 psia. The Polymer and Resin II rule has excluded tanks storing EG/GE because the emission potential from these tanks is very low. For the MON, all tanks storing materials with a HAP partial pressure equal to or less than 0.05 psia account for approximately 0.5 percent of the total baseline emissions for storage tanks. For these reasons, the HAP partial pressure of 0.05 psia is considered de minimis.

3.4 MACT Floor Determinations

The top performing 12 percent of facilities were determined by rank ordering all facilities by the determined threshold value in ascending order (low-to-high). Facilities with the lowest threshold values are considered the best performing facilities. The top 12 percent of the 128 facilities corresponds to the top 16 facilities. The median threshold value for the top 12 percent of facilities is a HAP partial pressure of 0.14 psia. The average threshold value for the top 12 percent of facilities is a HAP partial pressure of 1.0 psia (rounded up from 0.88 psia). It was determined that the average performance level of 1.0 psia represented the “central tendency” of the top facilities. The HAP partial pressure values for the top performing facilities represented a skewed distribution towards the low value range. It was determined that the average HAP partial pressure value best represented the central tendency of the data set. Although the median HAP partial pressure value represents a more stringent option, a large number of facilities controlling tanks with extremely low HAP partial pressures (e.g. less than 0.1 psia) skewed the data set. A HAP partial pressure performance level of 0.14 psia is clearly not representative of the industry. Attachment C provides a complete MACT floor ranking with corresponding HAP partial pressure performance levels for all storage tanks.

4.0 WASTEWATER MACT FLOOR DETERMINATION

The MACT floor for wastewater streams was determined to be the same controls required by the HON (i.e., a steam stripper meeting minimum design specifications or other device capable of meeting HAP-specific mass fraction removal (Fr) efficiency) for an individual wastewater stream meeting any of the following characteristics:

1) All wastewater streams with a VOHAP concentration of 10,000 ppmw or more; and

2) All wastewater streams with a flow rate of 10 lpm or more and a VOHAP concentration of 1,000 ppmw or more.

The affected wastewater stream population used in the MACT floor determination is described in Section 4.1. In Section 4.2, the MACT floor level of performance is described. Section 4.3 discusses the performance criteria which defines the affected source. While, Section 4.4 describes the MACT floor determinations.

4.1 Affected Wastewater Stream Population

All wastewater streams generated from continuous and batch (dedicated and non-dedicated) product processes were considered. Wastewater streams containing formaldehyde and inorganic materials such as hydrogen chloride and hydrogen fluoride were eliminated from the MACT floor determination. Wastewater streams containing formaldehyde were eliminated from the analysis because formaldehyde is known to disassociate immediately and completely in water, thus eliminating any potential for emissions. Wastewater streams containing inorganic materials were eliminated from the analysis because inorganic compounds typically require different control technologies than organic materials (e.g., neutralization/chemical precipitation versus steam stripping). Although maleic and phthalic anhydrides are organic materials they sublime at ambient temperatures. Thus, wastewater streams containing these two anhydride compounds were also eliminated from the floor analysis.

The EPA did not request data on wastewater streams containing HAP concentrations less than 1,000 ppmw. Thus, wastewater streams reporting HAP concentrations less than 1,000 ppmw were also eliminated from the floor analysis. The wastewater stream population that results after these exclusions is 416 streams located in 68 facilities.

4.2 MACT Floor Level of Performance

The MACT floor level of performance is a wastewater stream treated with the same controls as required by the HON. In general, the HON performance level is that achieved by a steam stripper meeting minimum design specifications or other device capable of meeting HAP-specific mass fraction removal (Fr) efficiencies. Approximately 12 percent of all wastewater streams (50 of 416) are reported as being treated with a steam stripper, an air stripper followed by an incinerator, or a combustion device at an on-site or off-site location. The EPA did not request data on the efficiency of wastewater control devices. However, general engineering design knowledge of the listed technologies supports a VOHAP emissions reduction equivalent to the HON requirements. Since a steam stripper, an air stripper followed by an incinerator, or a combustion device are capable of achieving a HON equivalent VOHAP reduction, a MACT floor performance level of the HON exists for wastewater streams.

4.3 Affected Source

The measure of performance for wastewater streams is based on two characteristics: wastewater HAP concentration (ppmw), and wastewater flow rate (lpm). Wastewater streams with MACT floor equivalent controls and low HAP concentrations and low flow rates are considered more stringent than similar wastewater streams with higher HAP concentrations and higher flow rates. Wastewater HAP concentration and flow rate values consistent with other MACT standards (i.e., the HON) were selected to determine the existence of a MACT floor. All wastewater streams at each facility operating continuous and/or batch product processes are considered the affected source. Each wastewater stream was categorized as meeting or not meeting a combination of selected wastewater HAP concentration and flow rate criteria.

4.4 MACT Floor Determinations

The combination of wastewater HAP concentration and flow rate criteria used for determining the existence of a MACT floor is consistent with the HON wastewater performance criteria for existing sources:

1) All wastewater streams with a VOHAP concentration of 10,000 ppmw or more; and

2) All wastewater streams with a flow rate of 10 lpm or more and a VOHAP concentration of 1,000 ppmw or more.

A total of 228 of the 416 wastewater streams met the above HAP concentration and flow rate criteria. Approximately 18 percent (41 wastewater streams) of the 228 wastewater streams are also controlled at a HON equivalent MACT floor level. Therefore, a MACT floor can be established for this group of wastewater streams because more than 12 percent of the affected sources are controlled at a MACT floor level of performance.

The remaining 188 wastewater streams did not meet the above HAP concentration and flow rate criteria. Less than 5 percent (9 wastewater streams) of the 188 wastewater streams are controlled at a HON equivalent MACT floor level. Thus, a MACT floor does not exist for this group of wastewater streams because less than 12 percent of the sources are controlled at a MACT floor level of performance. Attachment D provides a complete MACT floor listing with corresponding wastewater HAP concentrations (ppmw) and flow rates (lpm).

5.0 EQUIPMENT COMPONENT FLOOR DETERMINATION

The MACT floor for equipment components was determined to be a HON equivalent leak detection and repair (LDAR) program for facilities with continuous and batch chemical operations. The affected source population used in the MACT floor determination is described in Section 5.1. In Section 5.2, the MACT floor level of performance is described. Section 5.3 discusses the performance criteria which defines the affected source. While, Section 5.4 describes the MACT floor determinations.

5.1 Affected Source Population

Equipment components associated with facilities operating continuous and batch chemical operations were considered as the affected source. Facilities with equipment components in contact with inorganic materials such as hydrogen chloride, hydrogen fluoride, and chlorine were eliminated from the MACT floor determination. Typically, equipment components in inorganic service require different leak detection technologies than organic materials. Thus, product processes with equipment components in contact with inorganic materials were eliminated from the floor analysis.

The affected source population that results from the above exclusions is 229 facilities. Where, batch processes (dedicated and non-dedicated) account for approximately 73 percent (168) of the facilities.

5.2 MACT Floor Level of Performance

The selected MACT floor level of performance is a leak detection and repair (LDAR) program for equipment components equivalent to the HON LDAR program. Alpha-Gamma evaluated the effectiveness of various LDAR programs using a set of model plants. The HON LDAR program is estimated to reduce HAP emissions by 63 to 75 percent for continuous chemical processes and 70 to 73 percent for batch chemical processes. Several LDAR programs implemented by Louisiana and Texas regulatory agencies were determined roughly equivalent to the HON LDAR program when applied to continuous chemical processes. The HON equivalent LDAR programs for continuous chemical processes include:

- State of Louisiana's non-HON LDAR program which is estimated to reduce HAP emissions up to 70 percent; and

- State of Texas' LDAR programs: TX28VHP, TX28MID, and TX28RCT which are all estimated to reduce HAP emissions up to 73 percent.

Approximately, 33 percent of facilities with continuous and batch chemical processes were reported as implementing some type of a structured LDAR program for equipment components. Therefore, a MACT floor level of performance exists for equipment components. The MON LDAR program data for continuous and batch facilities are summarized in Table 3.

5.3 Affected Source

The overall effectiveness of an LDAR program in reducing HAP emissions from a facility was selected as the measure of performance to rank order facilities controlled at a MACT floor level. Facilities implementing LDAR programs with the highest overall effectiveness in reducing HAP emissions are considered the best performing sources.

5.4 MACT Floor Determinations

The top performing 12 percent of facilities were determined by rank ordering all facilities by the LDAR program and overall effectiveness in descending order (high-to-low). Facilities implementing LDAR programs with the highest overall effectiveness are considered the best performing sources. The top 12 percent of the 229 facilities corresponds to the top 28 facilities. The LDAR program implemented at 30 facilities is the HON LDAR program or a program equivalent to the HON. A total of 16 batch facilities specifically use a HON LDAR program. While, a total of 14 continuous facilities use the HON or equivalent LDAR program. Therefore, the “central tendency” of the top facilities is the HON LDAR program for both batch and continuous chemical operations.

Table 3. Summary of MON Batch and Continuous LDAR Program Data

LDAR Program	LDAR Emission Reduction Ranges[a] (Percent)		Number of Facilities		
	Cont.	Batch	Cont.	Batch	Total
HON Subpart H	63-75	70-73	1	16	17
LA Non-HON	61-70	33-50	2	4	6
TX28VHP	48-73	25-53	2	1	3
TX28MID	48-73	25-53	7	1	8
TX28RCT	48-73	24-53	2	0	2
SOCMI NSPS Subpart VV	38-48	16-25	0	26	26
SOCMI CTG, Subpart V	41-46	16-24	0	4	4
TX28M	24	1-2	5	2	7
TX Reg 5	NA	NA	0	1	1
LA2122	NA	NA	1	0	1
None or AVO	0	0	41	113	154
TOTAL			61	168	229

[a] Range of anticipated emission reductions for aggregate LDAR programs based on vinyl acetate and cumene.

ATTACHMENT A

MACT FLOOR RANKING FOR CONTINUOUS PROCESS VENTS

Table A: Floor for Continuous Process Vents – Top 12% of Facilities

Total Sources:	48
12% of Sources:	5.76
6% of Sources:	2.88

Excluding scrubber controls; average flow where missing; only vents with est. concentration > 50ppm

	Plant	City	State	TRE Threshold	No. of Vents	No. of MACT Vents <= Threshold	Total No. MACT Vents	Running TRE Avg.
1	MOBIL CHEMICAL COMPANY/ JEFFERSON/JE0065M	BEAUMONT	TX	5.11	3	3	3	5.11
2	AMOCO PETROLEUM ADDITIVES CO./ WOOD RIVER	WOOD RIVER	IL	4.16	3	3	3	4.633
3	E.I. DU PONT DE NEMOURS AND COMPANY/VICTORIA/VC0008Q	VICTORIA	TX	2.2	5	3	3	3.821
4	MONSANTO AGRICULTURAL COMPANY	LULING	LA	2.12	7	3	3	3.395
5	HOECHST CELANESE CHEMICAL GROUP, INC/MATAGORDA/MH0009H	BAY CITY	TX	1.79	1	1	1	3.073
6	DOW U.S.A., PLAQUEMINE SITE	PLAQUEMINE	LA	1.42	7	2	2	2.797
7	CF INDUSTRIES, INC.	DONALDSONVILLE	LA	0.7	6	2	2	2.497
8	E.I. DU PONT DE NEMOURS & COMPANY/HARRIS/HG0218K	PASADENA	TX	0.62	14	2	3	2.263
9	CHEVRON CHEMICAL COMPANY/ORANGE/OC0012Q	ORANGE	TX	0.61	13	13	13	2.08
10	KOCH NITROGEN COMPANY	STERLINGTON	LA	0.53	4	2	2	1.925
11	BASF CORPORATION - FREEPORT WORKS	FREEPORT	TX	0.34	1	1	1	1.781
12	AMOCO CHEMICAL COMPANY/ BRAZORIA/BL0002S	ALVIN	TX	0.2	4	3	3	1.649
13	UNION CARBIDE CORPORATION/ CALHOUN/CB0028T	PORT LAVACA	TX	0.18	1	1	1	1.536
14	QUANTUM - USI DIVISION/TUSCOLA	TUSCOLA	IL	0.13	1	1	1	1.436
15	LYONDELL PETROLEUM COMPANY/MATAGORDA/MH0040N			0.12	3	1	1	1.348
16	PHILLIPS CHEMICAL COMPANY/ HARRIS/HG0566H	PASADENA	TX	0.11	20	4	4	1.271
17	LYONDELL PETROCHEMICAL COMPANY/VICTORIA/VC0065E			0.05	4	1	2	1.199
18	MONSANTO COMPANY/ BRAZORIA/BL0038U	ALVIN	TX	0	1	1	1	1.132
19	EXXON CHEMICAL AMERICAS/CHAMBERS/CI0009P			-0.49	2	2	2	1.047
20	ARISTECH CHEMICAL CORPORATION/HARRIS/HG0825G	PASADENA	TX	-0.64	3	3	3	0.963
21	SOLVAY POLYMERS, INC./ HARRIS/HG0665E	DEER PARK	TX	-0.82	1	1	1	0.878
22	PHILLIPS PETROLEUM COMPANY - PHILTEX/ RYTON COMPLEX	BORGER	TX	-1.07	2	1	1	0.789
23	HUNTSMAN CORPORATION/ JEFFERSON/JE0135Q			-3.12	6	2	3	0.619
24	DIXIE CHEMICAL COMPANY	PASADENA	TX	-12.71	5	1	1	0.064
25	DIXIE CHEMICAL COMPANY/ HARRIS/HG0199M	PASADENA	TX	-12.71	5	1	1	-0.45

	Plant	City	State	TRE Threshold	No. of Vents	No. of MACT Vents <= Threshold	Total No. MACT Vents	Running TRE Avg.
26	CHEVRON CHEMICAL COMPANY/ HARRIS/HG0310V	BAYTOWN	TX	NT	1	0	0	-
27	EXXON CHEMICAL AMERICAS - BATON ROUGE CHEMICAL PLANT	BATON ROUGE	LA	NT	4	0	0	-
28	STERLING CHEMICAL, INC. TEXAS CITY PLANT	TEXAS CITY	TX	NT	4	0	0	-
29	AIR PRODUCTS - NEW ORLEANS	NEW ORLEANS	LA	NT	1	0	0	-
30	ADVANCED AROMATICS CHEMICAL CO./HARRIS/HG0132V	BAYTOWN	TX	NT	2	0	0	-
31	DUPONT SABINE RIVER WORKS	ORANGE	TX	NT	5	0	0	-
32	AGRICO CHEMICAL COMPANY	SAINT JAMES	LA	NT	1	0	0	-
33	AMPRO FERTILIZER, INC.	DONALDSONVILLE	LA	NT	1	0	0	-
34	EASTMAN CHEMICAL COMPANY/ HARRISON/HH0042M			NT	7	0	1	-
35	EXXON CHEMICAL AMERICAS/ HARRIS/HG0229F	BAYTOWN	TX	NT	3	0	0	-
36	EXXON CHEMICAL CO. PLASTICS PL	BATON ROUGE	LA	NT	6	0	0	-
37	GOODYEAR TIRE AND RUBBER CO THE/JEFFERSON/JE0039N	BEAUMONT	TX	NT	2	0	1	-
38	HOECHST CELANESE ENGINEERING RESINS,/ NUECES/ NE0022I	CORPUS CHRISTI	TX	NT	3	0	0	-
39	HUNTSMAN CORPORATION/ MONTGOMERY/MQ0012Q			NT	8	0	0	-
40	QUANTUM CHEMICAL CORPORATION/HARRIS/HG0770G	LA PORTE	TX	NT	9	0	0	-
41	QUANTUM CHEMICAL CORPORATION/ JEFFERSON/JE0011M	PORT ARTHUR	TX	NT	1	0	0	-
42	REICHHOLD CHEMICALS INC/ OXNARD	OXNARD	CA	NT	1	0	0	-
43	REXENE CORPORATION/ ECTOR/ EB0108J	ODESSA	TX	NT	34	0	0	-
44	THE DOW CHEMICAL COMPANY/ HARRIS/HG0769O	LA PORTE	TX	NT	20	0	0	-
45	TRIAD CHEMICAL	DONALDSONVILLE	LA	NT	2	0	0	-
46	UNIROYAL CHEMICAL COMPANY, INC	GEISMAR	LA	NT	12	0	2	-
47	WESTVACO	DE RIDDER	LA	NT	1	0	0	-
48	FARMLAND INDUSTRIES, INC.	POLLOCK	LA	NT	1	0	0	-

ATTACHMENT B

MACT FLOOR RANKING FOR BATCH PROCESS VENTS

Table B. Floor for Batch Process Vents – Top 12% of Product Processes

Total Sources: 731

12% of Sources: 87.72

6% of Sources: 43.86

Excluding scrubber controls; average flow where missing; only vents with est. concentration > 50ppm

	Plant	City	State	Total Product Process HAP Emissions (lb/yr)	Running Avg. of Product Process HAP (lb/yr)	Overall Control Eff. (%)
1	BASF Corporation - Freeport Works	Freeport	TX	200	200	99.9
2	Ciba Specialty Chemicals Corp	McIntosh	AL	424	312	98
3	Ciba Specialty Chemicals Corp	McIntosh	AL	503	376	98
4	Morton International Inc. - Paterson Facility	Paterson	NJ	521	412	98
5	Ciba Specialty Chemicals Corp	McIntosh	AL	554	440	98
6	BASF Corporation - Freeport Works	Freeport	TX	600	467	99.9
7	CCP- Houston Facility	Houston	TX	620	489	99
8	Huls America, Inc.	Theodore	AL	758	523	99
9	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	765	549	98
10	Huls America, Inc.	Theodore	AL	902	585	99
11	Ciba Specialty Chemicals Corp	McIntosh	AL	1004	623	98
12	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1016	656	98
13	Witco Corporation - Gretna Plant	Harvey	LA	1100	690	99
14	Ciba Specialty Chemicals Corp	McIntosh	AL	1124	721	98
15	Ciba Specialty Chemicals Corp	McIntosh	AL	1242	756	98
16	Ciba Specialty Chemicals Corp	McIntosh	AL	1381	795	98
17	Dow Corning Corporation - Midland Plant	Midland	MI	1500	836	99
18	DIXIE CHEMICAL COMPANY	PASADENA	TX	1500	873	98
19	Ciba Specialty Chemicals Corp	McIntosh	AL	1881	926	98
20	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1893	974	99
21	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	1920	1019	98
22	Ciba Specialty Chemicals Corp	McIntosh	AL	1958	1062	98
23	Huls America, Inc.	Theodore	AL	2095	1107	99
24	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	2135	1150	98
25	Ciba Specialty Chemicals Corp	McIntosh	AL	2183	1191	98
26	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	2240	1232	99.99
27	Morton International Inc. - Paterson Facility	Paterson	NJ	2261	1270	98
28	Ciba Specialty Chemicals Corp	McIntosh	AL	2678	1320	99.9779
29	CCP-Marshall Facility	Marshall	TX	2880	1374	99
30	Morton International Inc. - Paterson Facility	Paterson	NJ	3041	1429	98
31	Ciba Specialty Chemicals Corp	McIntosh	AL	3207	1487	98
32	DIXIE CHEMICAL COMPANY	PASADENA	TX	3600	1553	98
33	Ciba Specialty Chemicals Corp	McIntosh	AL	3629	1616	98
34	BASF Corporation - Freeport Works	Freeport	TX	3800	1680	99.99
35	Morton International Inc. - Paterson Facility	Paterson	NJ	4167	1751	98
36	Morton International Inc. - Paterson Facility	Paterson	NJ	4333	1823	98
37	Morton International Inc. - Paterson Facility	Paterson	NJ	4763	1902	98
38	The Lubrizol Corporation	Painesville	OH	5918	2008	100
39	Ciba Specialty Chemicals Corp	McIntosh	AL	6578	2125	98

	Plant	City	State	Total Product Process HAP Emissions (lb/yr)	Running Avg. of Product Process HAP (lb/yr)	Overall Control Eff. (%)
40	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	6610	2237	98
41	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	7460	2364	99.99
42	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	8000	2499	98
43	Rohm & Haas Texas, Rohm & Haas Lone Star, RohMax	Deer Park	TX	8900	2648	98
44	Ciba Specialty Chemicals Corp	McIntosh	AL	9860	2811	99
45	Kalama Chemical, Inc.	Kalama	WA	10000	2971	99.9
46	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	10300	3131	99
47	The Lubrizol Corporation	Painesville	OH	10480	3287	99
48	Albemarle Corporation - South Plant	Magnolia	AR	12508	3479	98
49	Velsicol Chemical Corporation	Chattanooga	TN	13100	3675	99
50	The Glidden Company	Huron	OH	13333	3869	98.5
51	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	13900	4065	98
52	Huntsman Petrochemical Corp. - Dayton Manufacturing Facility	Dayton	TX	13944.8	4255	98
53	Hilton Davis Co.	Cincinnati	OH	14100	4441	99
54	Huntsman Petrochemical Corp. - Dayton Manufacturing Facility	Dayton	TX	14987.2	4636	98
55	The Lubrizol Corporation	Painesville	OH	15800	4839	100
56	Ciba Specialty Chemicals Corp	McIntosh	AL	16000	5039	99.9
57	Flexsys Nitro Plant	Nitro	WV	16400	5238	99
58	The Lubrizol Corporation	Painesville	OH	17200	5444	100
59	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	17939	5656	99
60	Ciba Specialty Chemicals Corp	McIntosh	AL	18130	5864	98
61	Ciba Specialty Chemicals Corp	McIntosh	AL	21547	6121	98
62	CCP- Houston Facility	Houston	TX	21600	6371	99
63	Buffalo Color Company	Buffalo	NY	25000	6666	98
64	The Glidden Company	Huron	OH	26667	6979	98.5
65	The Glidden Company	Huron	OH	26667	7282	98.5
66	Ciba Specialty Chemicals Corp	McIntosh	AL	27006	7581	98.29082
67	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	27011	7871	99.99
68	CCP-North Kansas City Facility	N. Kansas City	MO	27760	8163	99
69	The Lubrizol Corporation	Painesville	OH	28200	8453	98
70	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	28800	8744	99.9
71	Ciba Specialty Chemicals Corp	McIntosh	AL	30914	9056	98
72	Morton International Inc. - Paterson Facility	Paterson	NJ	31713	9371	98
73	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	33116	9696	99.99
74	CCP-Chatham Facility	Chatham	VA	33312	10015	99
75	The Glidden Company	Huron	OH	33333	10326	98.5
76	Huntsman Petrochemical Corp. - Dayton Manufacturing Facility	Dayton	TX	34253.2	10641	98
77	DynaChem, Inc.	Georgetown	IL	35579	10965	98.59468
78	The Lubrizol Corporation	Painesville	OH	36040	11286	100
79	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	39269.8	11641	99.99
80	Henkel Corporation	Kankakee	IL	40400	12000	99.7
81	Ciba Specialty Chemicals Corp	McIntosh	AL	40960	12358	99.9
82	The Lubrizol Corporation	Painesville	OH	43280	12735	98.04991
83	Arkansas Eastman Division	Batesville	AR	45000	13124	98
84	Ciba Specialty Chemicals Corp	McIntosh	AL	47693	13535	99.97256

	Plant	City	State	Total Product Process HAP Emissions (lb/yr)	Running Avg. of Product Process HAP (lb/yr)	Overall Control Eff. (%)
85	BFG Henry Plant	Henry	IL	49200	13955	99
86	Ciba Specialty Chemicals Corp	McIntosh	AL	49238	14365	98
87	Air Products Manufacturing Corporation	Wichita	KS	50400	14779	98
88	Zeneca Specialties, Inc. - Mt. Pleasant Site	Mt. Pleasant	TN	51000	15191	99.9
89	Arkansas Eastman Division	Batesville	AR	55000	15638	98
90	Monsanto	Gonzalez	FL	55626	16082	99
91	Ashland Chemical Company - Petrochem Div. - Neville Isl. Plant	Pittsburgh	PA	60000	16565	99.5
92	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	60000	17037	99
93	BFGoodrich Co.	Akron	OH	65015	17553	99
94	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	75500	18169	99
95	CCP- Houston Facility	Houston	TX	78708	18807	99
96	Ashland Chemical Co. - Composite Polymers Div. - Colton Facility	Colton	CA	82040	19465	98
97	Abemarle Coporation	Orangeburg	SC	84000	20131	98
98	Para-Chem, Inc.- Simpsonville Plant	Simpsonville	SC	84000	20782	98
99	Ciba Specialty Chemicals Corp	McIntosh	AL	86657	21448	98
100	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	87200	22105	99
101	Velsicol Chemical Corporation	Chattanooga	TN	87600	22754	99
102	ARCO Chemical Co - Bayport Plant	Pasadena	TX	91200	23425	99
103	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	93000	24100	99
104	The Lubrizol Corporation	Painesville	OH	97840	24809	100
105	Ciba Specialty Chemicals Corp	McIntosh	AL	113305	25652	98.33856
106	Akzo Nobel Chemicals Inc.	Morris	IL	114370	26489	98.9
107	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	114905	27315	98
108	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	134500	28308	99.9
109	Arkansas Eastman Division	Batesville	AR	142500	29356	98
110	The Lubrizol Corporation	Painesville	OH	146680	30422	100
111	Arkansas Eastman Division	Batesville	AR	150000	31499	98
112	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	160000	32647	99.9
113	Ashland Chemical Company - Los Angeles - Composite Polymers	Los Angeles	CA	171400	33875	99.14527
114	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	176000	35121	99.975
115	The Lubrizol Corporation	Painesville	OH	178020	36364	98
116	Ciba Specialty Corp. Newport Plant	Newport	DE	186800	37661	98.4363
117	BFG Henry Plant	Henry	IL	189200	38956	99
118	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	209600	40402	99.9
119	Flexsys Nitro Plant	Nitro	WV	235944	42045	98.16185
120	DuPont Sabine River Works	Orange	TX	237634	43675	98
121	Abemarle Corporation	Orangeburg	SC	246000	45347	98
122	Keil Chemical Division	Hammond	IN	266667	47161	98.5
123	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	407922	50094	99
124	Ciba Specialty Chemicals Corp	McIntosh	AL	529213	53958	98.79512
125	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	746006	59495	98
126	BFGoodrich Co.	Akron	OH	819150	65524	99
127	Akzo Nobel Chemicals Inc.	Morris	IL	1558880	77282	99.1
128	Niacet Corporation	Niagara Falls	NY	1584000	89054	99.9
129	Novartis Crop Protection, Inc. - St. Gabriel Plant Site	St. Gabriel	LA	1740068	101852	99.5

	Plant	City	State	Total Product Process HAP Emissions (lb/yr)	Running Avg. of Product Process HAP (lb/yr)	Overall Control Eff. (%)
130	Elf Atochem North America, Inc. - Channelview Complex	Channelview	TX	2448885	119906	98
131	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	3700000	147235	99
132	Novartis Crop Protection, Inc. - St. Gabriel Plant Site	St. Gabriel	LA	4529306	180433	99.49147
133	Abemarle Corporation	Orangeburg	SC	5916531	223561	97.98706

ATTACHMENT C

MACT FLOOR RANKING FOR STORAGE TANKS

TABLE C. FLOOR FOR CONTINUOUS AND BATCH STORAGE TANKS - TOP 12% OF FACILITIES

Total Facilities:	128
12% of Facilities:	15.36
6% of Facilities:	7.68

Excluding Scrubber Controls and HAP Partial Pressures < 0.05 psia

Plant	City	State	PP Threshold (psia)	No. of Tank	No. of MACT Tanks <= Threshold	Total MACT Tanks	Running Avg.
1 Ashland Chemical C	Philadelphia	PA	.087	18	18	18	0.087
2 Cyro Industries - Wa	Wallingford	CT	.09	9	9	9	0.089
3 Ashland Chemical C	Jacksonville	AR	.093	7	7	7	0.09
4 Ashland Chemical C	Colton	CA	.093	15	15	15	0.091
5 CCP-Chatham Facili	Chatham	VA	.099	1	1	1	0.092
6 CCP-Marshall Facilit	Marshall	TX	.099	1	1	1	0.094
7 Morton International	Paterson	NJ	.11	1	1	1	0.096
8 Dow Joliet Site	Channahon	IL	.135	7	7	7	0.101
9 HERCULES FRANK	Courtland	VA	.66	4	4	4	0.163
10 Novartis Crop Protec	St. Gabriel	LA	1.02	2	2	2	0.249
11 Akzo Nobel Chemic	Morris	IL	1.63	3	3	3	0.374
12 Ciba Specialty Corp.	Newport	DE	1.86	6	6	6	0.498
13 Troy Chemical Corp	Newark	NJ	1.87	1	1	1	0.604
14 AMOCO CHEMICAL	ALVIN	TX	1.93421	2	2	2	0.699
15 AIR PRODUCTS, IN	LA PORTE	TX	1.93421	5	5	5	0.781
16 Monsanto	Gonzalez	FL	2.4	1	1	1	0.882
17 ARISTECH CHEMIC	PASADENA	TX	2.92916	2	2	2	1.003
18 CHEVRON CHEMIC	BAYTOWN	TX	2.92916	3	1	1	1.11
19 FORMOSA PLASTI	POINT COMFO	TX	2.92916	5	5	5	1.205
20 HUNTSMAN CORP			2.92916	5	1	1	1.292
21 EXXON CHEMICAL			2.92916	2	2	2	1.37
22 BASF Corporation -	Geismar	LA	3.2	1	1	1	1.453
23 The Lubrizol Corpor	Pasadena	TX	3.391	15	1	13	1.537
24 DuPont Mt. Clemens	Mt. Clemens	MI	NT	10	0	0	-
25 Amerchol-Edison	Edison	NJ	NT	1	0	0	-
26 Henkel Corporation -	Cincinnati	OH	NT	1	0	0	-
27 Great Lakes Chemic	El Dorado	AR	NT	5	0	0	-
28 Arkansas Eastman	Batesville	AR	NT	11	0	0	-
29 Hercules, Inc. - Hatti	Hattiesburg	MS	NT	5	0	0	-
30 DynaChem, Inc.	Georgetown	IL	NT	1	0	0	-
31 CCP- Houston Facili	Houston	TX	NT	2	0	1	-

Plant	City	State	PP Threshold (psia)	No. of Tank	No. of MACT Tanks <= Threshold	Total MACT Tanks	Running Avg.
32 CCP-North Kansas	North Kansas C	MO	NT	4	0	0	-
33 CCP-Saukville Facili	Saukville	WI	NT	4	0	0	-
34 Morton International	Ringwood	IL	NT	5	0	0	-
35 ISP Chemicals Inc.	Calvert City	KY	NT	10	0	0	-
36 DIXIE CHEMICAL C	PASADENA	TX	NT	35	0	6	-
37 Franklin International	Columbus	OH	NT	5	0	0	-
38 Henkel Corporation	Kankakee	IL	NT	6	0	0	-
39 Union Camp Corpor	Dover	OH	NT	8	0	0	-
40 Akzo Nobel Resins	Louisville	KY	NT	2	0	0	-
41 Elf Atochem North A	Channelview	TX	NT	1	0	0	-
42 Henkel Corporation -	Charlotte	NC	NT	3	0	0	-
43 HENKEL CORPORA	LOS ANGELES	CA	NT	1	0	0	-
44 Ciba Specialty Che	McIntosh	AL	NT	60	0	43	-
45 PPG Industries, Inc.	Oak Creek	WI	NT	18	0	0	-
46 PPG - Circleville Re	Circleville	OH	NT	27	0	0	-
47 PPG - Delaware Res	Delaware	OH	NT	5	0	0	-
48 DUPONT FRONT R	FRONT ROYAL	VA	NT	26	0	0	-
49 Witco Corp. - Sisters	Friendly	WV	NT	7	0	0	-
50 The NutraSweet Kel	Augusta	GA	NT	3	0	0	-
51 BFGoodrich Co.	Akron	OH	NT	2	0	0	-
52 Albemarle Corporati	Magnolia	AR	NT	8	0	4	-
53 Du Pont - Fort Madis	Fort Madison	IA	NT	15	0	0	-
54 Kodak Park - Synthe	Rochester	NY	NT	4	0	0	-
55 Flexsys Nitro Plant	Nitro	WV	NT	4	0	0	-
56 Para-Chem, Inc.- Si	Simpsonville	SC	NT	3	0	0	-
57 Exxon Chemical Am	Linden	NJ	NT	4	0	0	-
58 BPCI - Sand Springs	Sand Springs	OK	NT	11	0	0	-
59 The Lubrizol Corpor	Painesville	OH	NT	16	0	3	-
60 Albright & Wilson A	Charleston	SC	NT	2	0	0	-
61 Arizona Chemical	Panama City	FL	NT	6	0	0	-
62 Huntsman Petroche	Dayton	TX	NT	129	0	0	-
63 National Starch and	Meredosia	IL	NT	8	0	1	-
64 Cytec Industries	Wallingford	CT	NT	1	0	0	-
65 The Euclid Chemical	Cleveland	OH	NT	1	0	0	-
66 Chemol Co.,Inc.	Greensboro	NC	NT	3	0	0	-
67 The Glidden Compa	Huron	OH	NT	4	0	0	-
68 Evans Chemetics	Waterloo	NY	NT	1	0	0	-
69 THE GOODYEAR TI	NIAGARA FALL	NY	NT	6	0	0	-
70 Tennessee Eastman	Kingsport	TN	NT	27	0	0	-
71 E. I. Du Pont de Ne	Parkersburg	WV	NT	5	0	2	-
72 Hickson DanChem C	Danville	VA	NT	2	0	0	-
73 Abemarle Coporatio	Orangeburg	SC	NT	12	0	1	-
74 Schenectady Interna	Freeport	TX	NT	3	0	0	-
75 Rohm and Haas Co	Bristol	PA	NT	25	0	0	-
76 Sartomer Company,	West Chester	PA	NT	6	0	0	-

Plant	City	State	PP Threshold (psia)	No. of Tank	No. of MACT Tanks <= Threshold	Total MACT Tanks	Running Avg.
77 Neville Chemical Co	Pittsburgh	PA	NT	5	0	0	-
78 Union Carbide Corp	South Charlesto	WV	NT	9	0	1	-
79 Huls America, Inc.	Theodore	AL	NT	4	0	2	-
80 Sigma Chemical Co	St. Louis	MO	NT	11	0	0	-
81 BASF Corporation -	Freeport	TX	NT	2	0	0	-
82 E. I. DuPont de Nem	Deepwater	NJ	NT	3	0	0	-
83 ANGUS - STERLIN	STERLINGTON	LA	NT	16	0	0	-
84 Rohm & Haas Texas	Deer Park	TX	NT	1	0	0	-
85 3M Decatur	Decatur	AL	NT	4	0	0	-
86 The C. P. Hall Comp	Bedford Park	IL	NT	3	0	0	-
87 3M Company - Cotta	Cottage Grove	MN	NT	8	0	0	-
88 Witco Corporation	Mapleton	IL.	NT	1	0	0	-
89 Uniroyal Chemical C	Naugatuck	CT	NT	4	0	0	-
90 Buffalo Color Compa	Buffalo	NY	NT	3	0	0	-
91 BAYER CORPORAT	BAYTOWN	TX	NT	3	0	0	-
92 DIXIE CHEMICAL C	PASADENA	TX	NT	35	0	6	-
93 E.I. DU PONT DE N	PASADENA	TX	NT	18	0	0	-
94 E.I. DU PONT DE N	VICTORIA	TX	NT	17	0	2	-
95 EASTMAN CHEMIC			NT	13	0	0	-
96 GOODYEAR TIRE A	BEAUMONT	TX	NT	2	0	0	-
97 Henkel Corp./Kanka	KANKAKEE	IL	NT	6	0	0	-
98 LYONDELL PETRO			NT	3	0	0	-
99 REXENE CORPOR	ODESSA	TX	NT	1	0	0	-
100 Stepan Millsdale Pla	Elwood	IL	NT	15	0	0	-
101 Allco Chemical Corp	Galena	KS	NT	2	0	0	-
102 Blue Ash Polymer/W	Blue Ash	OH	NT	2	0	0	-
103 Cincinnati Specialtie	Cincinnati	OH	NT	1	0	0	-
104 Zeeland Chemicals,	Zeeland	MI	NT	4	0	0	-
105 Kalama Chemical, In	Kalama	WA	NT	1	0	0	-
106 Akzo Nobel Resins	E. St. Louis	IL	NT	1	0	0	-
107 Reilly Industries, Inc.	Indianapolis	IN	NT	117	0	1	-
108 WESTVACO	DE RIDDER	LA	NT	9	0	0	-
109 Dow Corning Corpor	Midland	MI	NT	3	0	0	-
110 Hercules Incorporate	West Elizabeth	PA	NT	9	0	0	-
111 Salsbury Chemicals,	Charles City	IA	NT	1	0	0	-
112 Ashland Chemical C	Los Angeles	CA	NT	6	0	0	-
113 W.G. Krummrich Pla	Sauget	IL	NT	7	0	0	-
114 Unitex Chemical Cor	Greensboro	NC	NT	6	0	0	-
115 Hercules - Brunswic	Brunswick	GA	NT	1	0	0	-
116 The Procter & Gamb	Sacramento	CA	NT	2	0	0	-
117 Akzo Nobel Chemic	Gallipolis Ferry	WV	NT	5	0	0	-
118 3V Inc.	Georgetown	SC	NT	22	0	0	-
119 Ashland Chemical C	Bartow	FL	NT	6	0	0	-
120 Ashland Chemical C	Ashtabula	OH	NT	12	0	0	-
121 Ashland Chemical C	Pittsburgh	PA	NT	26	0	0	-

Plant	City	State	PP Threshold (psia)	No. of Tank	No. of MACT Tanks <= Threshold	Total MACT Tanks	Running Avg.
122 Ashland Chemical C	Calumet City	IL	NT	3	0	0	-
123 Olin Corporation	Rochester	NY	NT	4	0	0	-
124 BFG Henry Plant	Henry	IL	NT	2	0	0	-
125 Niacet Corporation	Niagara Falls	NY	NT	2	0	0	-
126 Zeneca Specialties, I	Mt. Pleasant	TN	NT	4	0	0	-
127 DuPont Sabine River	Orange	TX	NT	11	0	8	-
128 3M Company - Cord	Cordova	IL	NT	11	0	0	-
129 Hilton Davis Co.	Cincinnati	OH	NT	5	0	0	-

ATTACHMENT D

MACT FLOOR RANKING FOR WASTEWATER STREAMS

TABLE D. FLOOR FOR CONTINUOUS AND BATCH WASTEWATER STREAMS - TOP 12% OF WASTEWATER STREAMS

Total Sources: 416

12% of Sources: 50

6% of Sources: 25

Flow rate >= 10 lpm and HAP concentration >= 1,000 ppmw; and HAP concentration >= 10,000 ppmw

	Plant	City	State	Flow Rate (lpm)	Total HAP Concentration (ppmw)	Wastewater Treatment Codes
1	Morton International Inc. - P	Paterson	NJ	144.04	2,101	SS, DP
2	Akzo Nobel Resins	Louisville	KY	10.08	3,400	SS
3	Albright & Wilson Americas I	Charleston	SC	435.31	4,500	Equalization Tank, AS (incin),
4	Keil Chemical Division	Hammond	IN	94.63	8,000	SS, DP
5	Akzo Nobel Chemicals Inc.	Morris	IL	48.25	8,240	0 (after burner)
6	Reilly Industries, Inc.	Indianapolis	IN	0.07	10,000	HT,CL,SS,DP
7	Reilly Industries, Inc.	Indianapolis	IN	0.29	10,000	HT,CL,SS,DP
8	Reilly Industries, Inc.	Indianapolis	IN	0.43	10,000	HT,CL,SS,DP
9	Reilly Industries, Inc.	Indianapolis	IN	0.50	10,000	HT,CL,SS,DP
10	Sartomer Company, Inc.	West Chester	PA	23.05	10,000	TT, OF (off-site trash-to-steam
11	Reilly Industries, Inc.	Indianapolis	IN	1.44	13,000	HT,CL,SS,DP
12	Reilly Industries, Inc.	Indianapolis	IN	2.88	16,000	HT,CL,SS,DP
13	Hilton Davis Co.	Cincinnati	OH	7.76	16,400	TT, AS (incin), DP
14	Hilton Davis Co.	Cincinnati	OH	7.76	16,400	TT, AS (incin), DP
15	Reilly Industries, Inc.	Indianapolis	IN	0.29	19,000	HT,CL,SS,DP
16	Reilly Industries, Inc.	Indianapolis	IN	0.65	19,000	HT,CL,SS,DP
17	Novartis Crop Protection, Inc	St. Gabriel	LA	5.36	25,000	O-Onsite incineratio
18	Henkel Corporation - Cincinn	Cincinnati	OH	0.05	30,000	O-Onsite Distruct
19	Henkel Corporation - Cincinn	Cincinnati	OH	1.26	30,000	O-Onsite Distruct
20	Novartis Crop Protection, Inc	St. Gabriel	LA	5.90	30,000	O-Onsite incineratio
21	Reilly Industries, Inc.	Indianapolis	IN	1.44	31,000	HT,CL,SS,DP
22	Hilton Davis Co.	Cincinnati	OH	0.98	39,000	TT, AS (incin), DP

Wastewater Treatment Codes:

HT=Holding Tank
BI=Biological Treatment
CL=Clarifier
SS=Steam stripper
OP=Open pond
EQ=Equalization pond
TT=Treatment tank
OF=Offsite destruction
AS=Air stripper
DP=Discharge to a POTW
O=Other

Plant	City	State	Flow Rate (lpm)	Total HAP Concentration (ppmw)	Wastewater Treatment Codes
23 Rhone-Poulenc Inc.	New Brunswick	NJ	26.50	40,000	SS/DP
24 Hilton Davis Co.	Cincinnati	OH	8.78	62,500	TT, AS (incin), DP
25 Air Products Manufacturing	Wichita	KS	0.17	63,063	SS
26 Hilton Davis Co.	Cincinnati	OH	0.13	102,000	TT, AS (incin), DP
27 Hilton Davis Co.	Cincinnati	OH	0.17	102,000	TT, AS (incin), DP
28 Hilton Davis Co.	Cincinnati	OH	0.01	132,000	TT, AS (incin), DP
29 Air Products Manufacturing	Wichita	KS	0.01	150,000	SS
30 Air Products Manufacturing	Wichita	KS	0.05	150,000	SS
31 Air Products Manufacturing	Wichita	KS	0.22	150,000	SS
32 Novartis Crop Protection, Inc	St. Gabriel	LA	2.37	150,000	O-Onsite incineratio
33 Air Products Manufacturing	Wichita	KS	1.10	200,000	SS
34 Rhone-Poulenc Inc.	New Brunswick	NJ	44.69	200,000	SS/DP
35 Morton International Inc. - W	West Alexandria	OH	0.43	300,000	O (Thermal oxidizer) or OF
36 Zeneca Specialties, Inc. - Mt	Mt. Pleasant	TN	11.36	360,000	AS, TT, HT, O (Off-site treat a
37 Novartis Crop Protection, Inc	St. Gabriel	LA	0.68	460,000	O-Onsite incineratio
38 Novartis Crop Protection, Inc	St. Gabriel	LA	0.98	600,000	O-Onsite incineratio
39 DUPONT FRONT ROYAL SI	FRONT ROYAL	VA	0.04	740,000	OF (incin)
40 Evans Chemetics	Waterloo	NY	0.00	1,000,000	OF (incin)
41 Evans Chemetics	Waterloo	NY	0.00	1,000,000	OF (incin)

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ALPHA-GAMMA
TECHNOLOGIES, INC.

MEMORANDUM

DATE: June 7, 1999

SUBJECT: New Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON

FROM: Chuck Zukor and Reese Howle
Alpha-Gamma Technologies, Inc.

To: Miscellaneous Organic NESHAP Project File

The purpose of this memorandum is to summarize the maximum achievable control technology (MACT) floor determinations for batch and continuous chemical manufacturing processes at new sources which are covered by the Miscellaneous Organic NESHAP (MON). Material discussed in this memorandum includes:

1) Background information and the new source MACT definition;
2) Determination of the new source MACT floor for process vents;
3) Determination of the new source MACT floor for storage tanks;
4) Determination of the new source MACT floor for wastewater; and
5) Determination of the new source MACT floor for equipment components.

1.0 BACKGROUND

This section presents background information on development of MACT floors for the MON. Section 1.1 describes the available information used in the new source MACT floor determinations. While, Section 1.2 discusses the required guidelines for determining new source MACT floors and provides a summary of the resulting MON new source MACT floor determinations.

1.1 Available Information

The MACT floor determinations for new sources are based on the same information used for the MACT floor determinations for existing sources. In general, information on batch chemical processes was obtained from responses to Section 114 surveys. While, information on continuous chemical processes was obtained from permit and emissions inventory data maintained by state and local regulatory agencies. A more detailed description of the type of data available for batch and continuous chemical processes is provided in the May 20, 1999 memorandum, “MACT Floors for Batch and Continuous Chemical Manufacturing Processes at Existing Sources Covered by the MON.”

1.2 New Source MACT Floor Determinations

The Clean Air Act as amended in 1990 requires EPA to promulgate emission standards to reflect the maximum degree of reduction in HAP emissions that EPA determines is achievable for new or existing sources. This control level is referred to as MACT. The Act also prescribes a method for determining the least stringent level allowed for a MACT standard, which is known as the "MACT floor."

For new sources, the standards for a source category or subcategory "shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source, as determined by the Administrator" [section 112(d)(3)]. New source MACT floors for the MON are based on the best controlled similar source for each emission type, using the available data. Table 1 provides a summary of the new source MACT floor determinations for batch and continuous chemical processes. The new source MACT floors and the methodology used to determine these floors are described in the following sections.

2.0 PROCESS VENT NEW SOURCE MACT FLOOR DETERMINATION

As with existing process vents, a class distinction was established between new process vents associated with continuous and batch chemical processes. Therefore, separate new source MACT floors were determined for continuous and batch chemical processes:

- The new source MACT floor for continuous process vents is a control device with a HAP reduction efficiency of 98 percent or greater for an individual vent with a total resource effectiveness (TRE) value of 5.1 or less.

- The new source MACT floor for batch process vents is a control device capable of reducing product process HAP emissions by 98 percent or greater for batch product processes with total HAP emissions of 3,000 lb/yr or more.

The class distinction between continuous and batch vents is discussed in Section 2.1. In Section 2.2, the MACT floor level of performance is discussed. Section 2.3 describes the top performing process vent population used in the new source MACT floor determination.

Table 1. New Source MACT Floor Determinations for Chemical Processes

Source Type	Required Control	Performance Level	
Process Vents	98 percent reduction	Each continuous vent within a facility with a TRE $\leq$ 5.1	All batch vents within a product process with total product process HAP emissions $\geq$ 3,000 lb/yr
Storage Tanks	IFR/EFR or 95 percent reduction	Tank with capacity $\geq$ 10,000 gal and HAP partial pressure $\geq$ 0.1 psia	
Wastewater	Same reductions as required by the HON	Wastewater streams with total VOHAP[a] concentration $\geq$ 10,000 ppmw, or Wastewater streams with flow rate $\geq$ 10 lpm and total VOHAP concentration $\geq$ 1,000 ppmw, or Wastewater streams with flow rate $\geq$ 0.02 lpm and total VVHAP[b] concentration $\geq$ 10 ppmw.	
Equipment Components	HON equivalent LDAR program	All affected product processes.	

[a] VOHAP is described in Table 9 of the HON rule (40 CFR 63, Appendix to Subpart G). Table 9 lists the volatile organic HAP (VOHAP) which volatilize readily from wastewater and are characterized by Henry's Law constants greater than or equal to 1.51×10^{-6} atm-m^3/mol.

[b] VVHAP is described in Table 8 of the HON rule (40 CFR 63, Appendix to Subpart G). Table 8 lists the very volatile HAP (VVHAP) which volatilize very easily from wastewater and are characterized by Henry's Law constants greater than or equal to 5.55×10^{-3} atm-m^3/mol (i.e., the Henry's Law constant for benzene). Table 8 compounds are a subset of Table 9 compounds.

2.1 Class Distinctions

As with the MACT floor for existing sources, a class distinction was established between vents associated with continuous and batch chemical processes. Factors considered in establishing the continuous-batch class distinction included the following:

- Hours of operation (hr/yr) for continuous vents are longer than batch vents (average of 8,100 vs 3,500 hr/yr),

- Volumetric flow rates (scfm) for continuous vents are higher than batch vents (average of 6,450 vs 415 scfm), and

- Annual emissions (lb/yr) for continuous vents are higher than batch vents.

The EPA already has several regulatory standards which have set a precedent for establishing a class distinction between continuous and batch chemical processes. Examples of these precedents include: the HON, Polymers & Resins (Group I & IV) NESHAP, and New Source Performance Standards for Distillation Units (Subpart NNN) and Reactor Processes (Subpart RRR).

2.2 New Source MACT Floor Level of Performance

The level of performance determined for the new source MACT floor is a control device achieving a HAP emission reduction efficiency of 98 percent or more, excluding scrubbers. Some continuous and batch process vents were reported as achieving HAP emission reductions in excess of 98 percent. These higher HAP emission reductions were typically obtained through the use of combustion control devices such as thermal oxidizers. However, source test data necessary to support and validate HAP emission reductions in excess of 98 percent were not available. In addition, diverse process vent characteristics such as varying flow rates, types of pollutants, and pollutant concentrations make it difficult to conclude an efficiency greater than 98 percent can be achieved for all process vents. Therefore, the best demonstrated performance level is a HAP emission reduction of 98 percent, which is consistent with the performance level determined for existing sources. The MACT floor level of performance established for new continuous and batch vents is also consistent with the HON and other chemical industry MACT standards.

2.3 Top Performing Process Vents

The new source MACT floors for both continuous and batch process vents are established with the same performance criteria used for determining the existing source MACT floors. Criteria used for continuous vents was the TRE value. While, criteria used for batch product process vents was uncontrolled organic HAP emissions.

2.3.1 Continuous Vents

The new source MACT floor for continuous vents was established by considering all vents located within each facility operating continuous product processes. The TRE “threshold” for each facility was selected as the measure of performance to rank order and determine the best performing facility. The TRE “threshold” is the value below which all continuous vents at a facility are controlled at a 98 percent MACT floor performance level. This same approach was used for determining the existing source MACT floor for storage tanks.

The performance criteria corresponding to the best facility was a TRE “threshold” value of 5.1. The Mobil Chemical Company in Beaumont, TX is currently controlling all continuous vents with a TRE value of 5.1 or less at a level of 98 percent. Attachment A provides the top MACT floor rankings for continuous vents with corresponding TRE threshold values.

2.3.2 Batch Vents

Total uncontrolled HAP emissions from a batch product process was selected as the measure of performance to rank order batch vents which are collectively controlled at a 98 percent MACT floor level. This collective vent approach was selected because information in the MON database indicated that batch vents are commonly manifolded within a product process prior to control. All vents associated with a batch product process are considered.

Some of the best performing MON batch sources have common control systems capable of achieving 98 percent reductions in emissions. Many of these sources with common control systems also have extensive waste gas header systems which collect and route compatible process emissions to the common control system. Sources with this type of header and control system are capable and likely to control most if not all process emissions regardless of emission potential. Since the average volumetric flow rate for a batch process vent is 415 scfm, existing 98 percent control devices typically have available capacity to add vent streams of this magnitude to the header system.

Many MON facilities already have a 98 percent control device or will be required to install a 98 percent control device for the existing sources through implementation of this rule. The remaining MON facilities are those that would not otherwise be required by this rule to install a 98 percent control. Therefore, the best performing MON batch source, that is representative of all batch processes, will meet the following criteria:

- Located at a facility that would not otherwise be required to install a 98 percent control device to meet the existing source MACT floor (i.e., no continuous vents with a TRE value of 2.8 or less and no batch product processes with uncontrolled organic HAP emissions of 10,000 lb/yr or more);

- Already equipped with a 98 percent control device; and

- The sole MON product process with the lowest uncontrolled HAP emissions.

Applying the above criteria, the best performing batch source is a product process located at the CCP facility in Marshall, TX which has total uncontrolled HAP emissions of approximately 3,000 lb/yr (actual value is 2,880 lb/yr) and is controlled by thermal incineration. This particular product process located at CCP is the sole MON product process and would not otherwise be required to install a 98 percent control, but yet, is controlled to a MACT floor level. Attachment B provides the top MACT floor rankings for batch vents with corresponding total product process HAP emissions.

3.0 STORAGE TANK NEW SOURCE MACT FLOOR DETERMINATION

The new source MACT floor for storage tanks was determined to be an internal or external floating roof (IFR or EFR), or a control device with a HAP reduction efficiency of 95 percent or greater for all tanks with a capacity of 10,000 gallons or greater and storing a material with a HAP partial pressure of 0.10 psia or greater.

The performance level for the new source MACT floor is discussed in Section 3.1. While, Section 3.2 describes the top performing storage tank population used in the new source MACT floor determination.

3.1 New Source Performance Level

The level of performance determined for the new source MACT floor is a tank equipped with an internal or external floating roof (IFR or EFR), or another control device with a HAP emission reduction efficiency of 95 percent or more, excluding scrubbers. The top facility, Ashland Chemical Company in Philadelphia, PA, reported storage tank control efficiencies of 95 percent. Thus, the best demonstrated performance level is a HAP emission reduction of 95 percent, which is consistent with the performance level determined for MON existing sources. The 95 percent performance level is also consistent with the HON and other chemical industry MACT standards.

3.2 Top Performing Storage Tanks

The new source MACT floor for storage tanks was established by considering all tanks located in each facility operating continuous and/or batch product processes as the affected source. The HAP partial pressure “threshold” for each facility was selected as the measure of performance to rank order and determine the best performing facility. The HAP partial pressure “threshold” is the value above which all tanks at a facility are controlled at a MACT floor level of performance. This same approach was used for determining the existing source MACT floor for storage tanks.

The performance criteria corresponding to the best facility was a HAP partial pressure “threshold” value of 0.1 psia. The top facility has applied controls with the MACT floor level of performance to all tanks storing materials with a HAP partial pressure at or above 0.10 psia. The HAP partial pressure “threshold” for the top facility is actually 0.087 psia, but the value was rounded up to the first significant digit (i.e., 0.1 psia). The most predominate HAP stored in the top performing tanks is styrene. However, one of the top performing tanks also stored methyl methacrylate. Attachment C provides the top MACT floor rankings for storage tanks with corresponding HAP partial pressure threshold values.

4.0 WASTEWATER NEW SOURCE MACT FLOOR DETERMINATION

The new source MACT floor for MON batch and continuous wastewater streams was determined to be the same as the HON new source MACT floor for wastewater. Control requirements to meet the HON new source floor includes several options. Floor control requirements can be met using a steam stripper meeting a minimum set of design specifications. Another option is to use a control device capable of meeting HAP-specific mass fraction removal (Fr) efficiency as specified in Table 9 of the HON rule (40 CFR 63, Subpart G). Therefore, HON control requirements apply to each individual wastewater stream meeting any of the following characteristics:

1) Flow rate $\geq$ 0.02 lpm and total VVHAP concentration $\geq$ 10 ppmw,

2) Flow rate $\geq$ 10 lpm and total VOHAP concentration $\geq$ 1,000 ppmw, or

3) Total VOHAP concentration $\geq$ 10,000 ppmw.

Because information on the techniques used to control wastewater was not reported consistently by the surveyed facilities, it was necessary to consider applicable regulations at the best performing facilities to determine the MACT floor control level. A new source MACT floor can be derived from two applicable wastewater regulations: the Benzene Waste Operations NESHAP (BWON) and the HON. It has been determined that the Benzene Waste Operations NESHAP applies to wastewater streams generated by MON chemical processes. For example, a wastewater stream generated by Zeneca Specialties, Inc. in Mt Pleasant, TN contains a benzene concentration of approximately 360,000 ppmw prior to entering an air stripper which vents to a combustion device. The Zeneca wastewater stream has an approximate uncontrolled benzene loading of more than 2,300 tons/yr. Based on the stream characteristics, the Zeneca wastewater stream is subject to the BWON.

Wastewater streams at MON facilities containing benzene may also contain other VOHAP. Control measures used to reduce benzene under the BWON would also reduce VOHAP present in the wastewater, particularly those as volatile or more volatile than benzene. The HAP compounds that are at least as volatile as benzene are listed in Table 8 of Subpart G of the HON, and are referred to as VVHAP.

During the HON new source MACT floor determination, the EPA faced a similar situation and the HON new source MACT floor for wastewater was determined to be the BWON. The EPA reasoned that since compliance with the BWON also controlled VOHAP -- at least those as volatile or more volatile than benzene -- the HON new source MACT floor was control of benzene and other VVHAP. This rationale is described in the preamble of the proposed HON (57 FR 62608).

The HON new source MACT standard, in its final form, is applicable to other wastewater streams in addition to those containing Table 8 HAP, but the MACT floor for new sources included only the Table 8 component of what is now the HON new source MACT standard. The requirements of the Table 8 component of the HON wastewater provisions and the requirements of the BWON are very similar. In fact, the HON provisions for Table 8 HAP are the same as the BWON requirements with the exception that benzene concentration levels are replaced with Table 8 HAP concentration levels. However, an advantage of the HON is that it allows more flexibility by providing additional compliance methods while requiring the same level of control.

Using rationale similar to that used for the HON new source MACT floor, the MON new source MACT floor for wastewater can be expressed as the HON new source MACT floor. This requires HON equivalent HAP reductions for wastewater streams meeting any of the following characteristics:

1) Flow rate $\geq$ 0.02 lpm and total VVHAP concentration $\geq$ 10 ppmw,

2) Flow rate $\geq$ 10 lpm and total VOHAP concentration $\geq$ 1,000 ppmw, or

3) Total VOHAP concentration $\geq$ 10,000 ppmw.

5.0 EQUIPMENT COMPONENT NEW SOURCE FLOOR DETERMINATION

The new source MACT floor for equipment components was determined to be a HON equivalent leak detection and repair (LDAR) program for facilities with continuous and batch chemical operations.

The new source MACT floor for equipment components was established by considering LDAR programs implemented at each facility operating continuous and/or batch product processes. The overall effectiveness of an LDAR program in reducing HAP emissions from a facility was used as the measure of performance to rank order and determine the best performing facility. This same approach was used for determining the existing source MACT floor for equipment components.

The performance criteria corresponding to the best facility was a LDAR program equivalent to the HON. The HON LDAR program is the most effective overall program compared to other federal and state LDAR programs. Thus, there are no other LDAR programs with a higher level of effectiveness. The HON LDAR program was determined most effective through a comparative analysis of ten LDAR programs. The top 16 batch facilities and top 14 continuous facilities have implemented a HON equivalent LDAR program.

ATTACHMENT A

MACT FLOOR RANKING FOR CONTINUOUS PROCESS VENTS

Table A: Floor for Continuous Process Vents – Top 12% of Facilities

Total Sources:	48
12% of Sources:	5.76
6% of Sources:	2.88

Excluding scrubber controls; average flow where missing; only vents with est. concentration > 50ppm

	Plant	City	State	TRE Threshold	No. of Vents	No. of MACT Vents <= Threshold	Total No. MACT Vents	Running TRE Avg.
1	MOBIL CHEMICAL COMPANY/ JEFFERSON/JE0065M	BEAUMONT	TX	5.11	3	3	3	5.110
2	AMOCO PETROLEUM ADDITIVES CO./ WOOD RIVER	WOOD RIVER	IL	4.16	3	3	3	4.633
3	E.I. DU PONT DE NEMOURS AND COMPANY/VICTORIA/VC0008Q	VICTORIA	TX	2.2	5	3	3	3.821
4	MONSANTO AGRICULTURAL COMPANY	LULING	LA	2.12	7	3	3	3.395
5	HOECHST CELANESE CHEMICAL GROUP, INC/MATAGORDA/MH0009H	BAY CITY	TX	1.79	1	1	1	3.073
6	DOW U.S.A., PLAQUEMINE SITE	PLAQUEMINE	LA	1.42	7	2	2	2.797
7	CF INDUSTRIES, INC.	DONALDSONVILLE	LA	0.7	6	2	2	2.497
8	E.I. DU PONT DE NEMOURS & COMPANY/HARRIS/HG0218K	PASADENA	TX	0.62	14	2	3	2.263
9	CHEVRON CHEMICAL COMPANY/ORANGE/OC0012Q	ORANGE	TX	0.61	13	13	13	2.08
10	KOCH NITROGEN COMPANY	STERLINGTON	LA	0.53	4	2	2	1.925
11	BASF CORPORATION - FREEPORT WORKS	FREEPORT	TX	0.34	1	1	1	1.781
12	AMOCO CHEMICAL COMPANY/ BRAZORIA/BL0002S	ALVIN	TX	0.2	4	3	3	1.649
13	UNION CARBIDE CORPORATION/ CALHOUN/CB0028T	PORT LAVACA	TX	0.18	1	1	1	1.536
14	QUANTUM - USI DIVISION/TUSCOLA	TUSCOLA	IL	0.13	1	1	1	1.436
15	LYONDELL PETROLEUM COMPANY/MATAGORDA/MH0040N			0.12	3	1	1	1.348
16	PHILLIPS CHEMICAL COMPANY/ HARRIS/HG0566H	PASADENA	TX	0.11	20	4	4	1.271
17	LYONDELL PETROCHEMICAL COMPANY/VICTORIA/VC0065E			0.05	4	1	2	1.199
18	MONSANTO COMPANY/ BRAZORIA/BL0038U	ALVIN	TX	0	1	1	1	1.132
19	EXXON CHEMICAL AMERICAS/CHAMBERS/CI0009P			-0.49	2	2	2	1.047
20	ARISTECH CHEMICAL CORPORATION/HARRIS/HG0825G	PASADENA	TX	-0.64	3	3	3	0.963
21	SOLVAY POLYMERS, INC./ HARRIS/HG0665E	DEER PARK	TX	-0.82	1	1	1	0.878
22	PHILLIPS PETROLEUM COMPANY - PHILTEX/ RYTON COMPLEX	BORGER	TX	-1.07	2	1	1	0.789
23	HUNTSMAN CORPORATION/ JEFFERSON/JE0135Q			-3.12	6	2	3	0.619

ATTACHMENT B

MACT FLOOR RANKING FOR BATCH PROCESS VENTS

Table B. Floor for Batch Process Vents – Top 12% of Product Processes

Total Sources: 731

12% of Sources: 87.72

6% of Sources: 43.86

Excluding scrubber controls; average flow where missing; only vents with est. concentration > 50ppm

	Plant	*City*	*State*	*Total Product Process HAP Emissions (lb/yr)*	*Running Avg. of Product Process HAP (lb/yr)*	*Overall Control Eff. (%)*
1	BASF Corporation - Freeport Works	Freeport	TX	200	200	99.9
2	Ciba Specialty Chemicals Corp	McIntosh	AL	424	312	98
3	Ciba Specialty Chemicals Corp	McIntosh	AL	503	376	98
4	Morton International Inc. - Paterson Facility	Paterson	NJ	521	412	98
5	Ciba Specialty Chemicals Corp	McIntosh	AL	554	440	98
6	BASF Corporation - Freeport Works	Freeport	TX	600	467	99.9
7	CCP- Houston Facility	Houston	TX	620	489	99
8	Huls America, Inc.	Theodore	AL	758	523	99
9	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	765	549	98
10	Huls America, Inc.	Theodore	AL	902	585	99
11	Ciba Specialty Chemicals Corp	McIntosh	AL	1004	623	98
12	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1016	656	98
13	Witco Corporation - Gretna Plant	Harvey	LA	1100	690	99
14	Ciba Specialty Chemicals Corp	McIntosh	AL	1124	721	98
15	Ciba Specialty Chemicals Corp	McIntosh	AL	1242	756	98
16	Ciba Specialty Chemicals Corp	McIntosh	AL	1381	795	98
17	Dow Corning Corporation - Midland Plant	Midland	MI	1500	836	99
18	DIXIE CHEMICAL COMPANY	PASADENA	TX	1500	873	98
19	Ciba Specialty Chemicals Corp	McIntosh	AL	1881	926	98
20	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1893	974	99
21	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	1920	1019	98
22	Ciba Specialty Chemicals Corp	McIntosh	AL	1958	1062	98
23	Huls America, Inc.	Theodore	AL	2095	1107	99
24	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	2135	1150	98
25	Ciba Specialty Chemicals Corp	McIntosh	AL	2183	1191	98
26	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	2240	1232	99.99
27	Morton International Inc. - Paterson Facility	Paterson	NJ	2261	1270	98
28	Ciba Specialty Chemicals Corp	McIntosh	AL	2678	1320	99.9779
29	CCP-Marshall Facility	Marshall	TX	2880	1374	99
30	Morton International Inc. - Paterson Facility	Paterson	NJ	3041	1429	98
31	Ciba Specialty Chemicals Corp	McIntosh	AL	3207	1487	98
32	DIXIE CHEMICAL COMPANY	PASADENA	TX	3600	1553	98
33	Ciba Specialty Chemicals Corp	McIntosh	AL	3629	1616	98
34	BASF Corporation - Freeport Works	Freeport	TX	3800	1680	99.99

ATTACHMENT C

MACT FLOOR RANKING FOR STORAGE TANKS

TABLE C. FLOOR FOR CONTINUOUS AND BATCH STORAGE TANKS - TOP 12% OF FACILITIES

Total Facilities:	128
12% of Facilities:	15.36
6% of Facilities:	7.68

Excluding Scrubber Controls and HAP Partial Pressures < 0.05 psia

Plant	City	State	PP Threshold (psia)	No. of Tank	No. of MACT Tanks <= Threshold	Total MACT Tanks	Running Avg.
1 Ashland Chemical C	Philadelphia	PA	.087	18	18	18	0.087
2 Cyro Industries - Wa	Wallingford	CT	.09	9	9	9	0.089
3 Ashland Chemical C	Jacksonville	AR	.093	7	7	7	0.09
4 Ashland Chemical C	Colton	CA	.093	15	15	15	0.091
5 CCP-Chatham Facili	Chatham	VA	.099	1	1	1	0.092
6 CCP-Marshall Facilit	Marshall	TX	.099	1	1	1	0.094
7 Morton International	Paterson	NJ	.11	1	1	1	0.096
8 Dow Joliet Site	Channahon	IL	.135	7	7	7	0.101
9 HERCULES FRANK	Courtland	VA	.66	4	4	4	0.163
10 Novartis Crop Protec	St. Gabriel	LA	1.02	2	2	2	0.249
11 Akzo Nobel Chemic	Morris	IL	1.63	3	3	3	0.374
12 Ciba Specialty Corp.	Newport	DE	1.86	6	6	6	0.498
13 Troy Chemical Corp	Newark	NJ	1.87	1	1	1	0.604
14 AMOCO CHEMICAL	ALVIN	TX	1.93421	2	2	2	0.699
15 AIR PRODUCTS, IN	LA PORTE	TX	1.93421	5	5	5	0.781
16 Monsanto	Gonzalez	FL	2.4	1	1	1	0.882
17 ARISTECH CHEMIC	PASADENA	TX	2.92916	2	2	2	1.003
18 CHEVRON CHEMIC	BAYTOWN	TX	2.92916	3	1	1	1.11
19 FORMOSA PLASTI	POINT COMFO	TX	2.92916	5	5	5	1.205
20 HUNTSMAN CORP			2.92916	5	1	1	1.292
21 EXXON CHEMICAL			2.92916	2	2	2	1.37
22 BASF Corporation -	Geismar	LA	3.2	1	1	1	1.453
23 The Lubrizol Corpor	Pasadena	TX	3.391	15	1	13	1.537
24 DuPont Mt. Clemens	Mt. Clemens	MI	NT	10	0	0	-
25 Amerchol-Edison	Edison	NJ	NT	1	0	0	-
26 Henkel Corporation -	Cincinnati	OH	NT	1	0	0	-
27 Great Lakes Chemic	El Dorado	AR	NT	5	0	0	-
28 Arkansas Eastman	Batesville	AR	NT	11	0	0	-
29 Hercules, Inc. - Hatti	Hattiesburg	MS	NT	5	0	0	-
30 DynaChem, Inc.	Georgetown	IL	NT	1	0	0	-
31 CCP- Houston Facili	Houston	TX	NT	2	0	1	-

MEMORANDUM

DATE: July 27, 1999

SUBJECT: National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes

FROM: Chuck Zukor
Alpha-Gamma Technologies, Inc.

To: Miscellaneous Organic NESHAP Project File

The purpose of this memorandum is to summarize national impacts associated with regulatory options for MON chemical manufacturing processes. Impacts discussed in this memorandum include HAP emission reductions and control costs associated with each regulatory option. Additional information provided in this memorandum include:

1) Descriptions of the regulatory options,

2) Summary of national impacts resulting from applying each option,

3) Identification of emission control measures selected to meet the required performance level of each regulatory option,

4) Identification of the procedures used to estimate the control costs, and

5) Summary of estimated control costs and emission reductions for each individual affected emission source.

The regulatory option recommended as MACT is the MACT floor for each emission source type. The MACT floor option is estimated to reduce nationwide HAP emissions by approximately 38,800 tons/yr at a total annual cost of $59.1 million/yr. The overall cost effectiveness of the MACT floor regulatory option is approximately $1,500/ton of HAP. The most cost effective regulatory option above-the-floor, Option 1, includes the above-the-floor option for wastewater and the MACT floor options for process vents, storage tanks, and equipment components. Option 1 obtains an additional HAP emission reduction of 296 tons/yr at an additional total annual cost of $1.3 million/yr which corresponds to an incremental cost effectiveness of $4,500/ton

1.0 REGULATORY OPTIONS

A total of five regulatory options were developed to reduce HAP emissions from MON chemical manufacturing processes. The first regulatory option represents the MACT floor level of performance and corresponding applicability criteria for each emission source type (i.e., process vent, storage tank, equipment components, and wastewater). Table 1 provides a summary of the MACT floor performance levels and control applicability criteria for each emission source type. Table 1 also includes a more stringent, above-the-floor option for each emission source type, with the exception of equipment components. A more stringent option was not identified for equipment components. The required performance level (e.g., 98 percent control) for each emission source type is the same for each option. However, the applicability criteria for above-the-floor options are more stringent, requiring the installation of controls on a larger group of affected sources.

Four additional regulatory options were developed by cumulatively replacing the MACT floor control requirement of an emission source type with the more stringent, above-the-floor requirement. For example, Option 1 includes the above-the-floor control requirement for wastewater and the MACT floor control requirements for the remaining emission source types. Option 2 includes the above-the-floor requirements for both wastewater and storage tanks, and the MACT floor requirements for the remaining emission source types. Option 3 includes the above floor requirements for wastewater, storage tanks, and continuous process vents; and the MACT floor requirements for the remaining emission source types. Finally, Option 4 includes the above floor requirements for all the emission source types.

Table 2 presents a summary of the national impacts associated with the five regulatory options for MON chemical manufacturing processes. National impacts include the following primary air impacts and corresponding control costs:

- Baseline HAP emissions (tons/yr) which represent the current emission level for the source category in the absence of any additional regulations,
- Controlled HAP emissions (tons/yr) resulting after applying a regulatory option,
- HAP emission reductions (tons/yr) achieved with each option,
- HAP percent reduction (percent) corresponding to each option,
- Total capital investment of required controls (1999 dollars),
- Total annual costs of operating the required controls (1999 dollars/yr),
- Cost effectiveness ($/ton) of each option, and
- Incremental cost effectiveness ($/ton) between regulatory options.

Table 1. Regulatory Options by Emission Source Type for Chemical Manufacturing Sources Covered Under the MON

Emission Source Type	Performance Level	Applicability Criteria Requiring the Installation of Controls	
		MACT Floor	Above-the-Floor
Continuous Process Vents	98 percent reduction	Each continuous vent within a facility with a TRE $\leq$ 2.8[a]	Each continuous vent within a facility with a TRE $\leq$ 6.0
Batch Process Vents	98 percent reduction	All batch vents within a product process with total product process HAP emissions $\geq$ 10,000 lb/yr	All batch vents within a product process with total product process HAP emissions $\geq$ 5,000 lb/yr
Storage Tanks	IFR/EFR or 95 percent reduction[b]	Tank with capacity $\geq$ 10,000 gal and HAP partial pressure $\geq$ 1.0 psia	Tank with capacity $\geq$ 10,000 gal and HAP partial pressure $\geq$ 0.5 psia
Wastewater	Same reductions as required by the HON	Wastewater total VOHAP[c] $\geq$ 10,000 ppmw, or Wastewater flow rate $\geq$ 10 lpm and total VOHAP $\geq$ 1,000 ppmw.	Wastewater total VOHAP $\geq$ 10,000 ppmw, or Wastewater flow rate $\geq$ 5 lpm and total VOHAP $\geq$ 1,000 ppmw.
Equipment Components	HON equivalent LDAR program[d]	All affected product processes.	There is no other option more stringent.

[a] TRE: Total Resource Effectiveness.
[b] IFR/EFR: Internal floating roof or external floating roof.
[c] VOHAP is described in Table 9 of the HON rule (40 CFR 63, Appendix to Subpart G). Table 9 lists the volatile organic HAP (VOHAP) which volatilize readily from wastewater and are characterized by Henry's Law constants greater than or equal to 1.51 x 10^{-6} atm-m^3/mol.
[d] LDAR: leak detection and repair.

Table 2. Impacts Associated with Regulatory Options for Chemical Manufacturing Sources Covered Under the MON

Regulatory Option	Baseline HAP Emissions (tons/yr)	Controlled HAP Emissions (tons/yr)	HAP Emission Reduction (tons/yr)	Percent Reduction (%)	Total Capital Investment ($1,000)	Total Annualized Costs ($1,000/yr)	Cost Effectiveness ($/ton)	Incremental Cost Effectiveness ($/ton)
Baseline	57,595	57,595	0	0	0	0	N/A	N/A
MACT Floor		18,815	38,780	67.3	103,678	59,094	1,524	1,524
Option 1		18,519	39,076	67.8	107,677	60,429	1,546	4,510
Option 2		18,489	39,106	67.9	108,768	60,749	1,553	50,032
Option 3		18,458	39,137	68.0	109,101	62,300	1,592	10,667
Option 4		18,287	39,308	68.2	110,695	64,572	1,643	13,287

MACT Floor: MACT floor option for all emission source types.

Option 1: MACT floor option plus above-the-floor option for wastewater.

Option 2: MACT floor option plus above-the-floor option for wastewater and storage tanks.

Option 3: MACT floor option plus above-the-floor option for wastewater, storage tanks, and continuous process vents.

Option 4: Above-the-floor option for all emission source types.

2.0 NATIONWIDE IMPACTS

Nationwide impacts for MON chemical manufacturing processes are presented relative to a baseline reflecting the current level of control in the absence of any additional regulations. The national impacts for existing sources were estimated by applying the controls necessary to bring each facility into compliance with the proposed regulatory option. For emission points already in compliance with the proposed regulatory option, no impacts were estimated.

2.1 Nationwide Extrapolation of Impacts

Information used in development of the MON was obtained from two primary sources:

1) For batch processes, detailed information was obtained from responses to a Section 114 survey.

2) For continuous processes, detailed information was obtained from electronic emission inventories, air permits, and regulatory compliance plans maintained by local regulatory agencies in the following states: California, Texas, Louisiana, New Jersey, Illinois, Missouri, and North Carolina.

The Section 114 surveys were distributed to all known sources with MON batch processes. Thus, the estimated impacts for batch processes in the MON database are considered fully representative of the nationwide impacts. However, information on MON continuous processes operating only in a portion of the U.S. was obtained through electronic emission inventories maintained by state regulatory agencies. Since the state information was obtained from only a portion of sources with MON continuous processes, the estimated impacts on continuous processes in the MON database are considered partially representative of the nationwide impacts. Nationwide impacts for process vents, storage tanks, and equipment components associated with continuous MON processes were extrapolated using information in EPA's 1993 Toxic Release Inventory (TRI) database. Information on process wastewater generated by MON continuous processes was not available. Thus, nationwide impacts for process wastewater generated by MON continuous processes were estimated using a proportional relationship between MON process vent and MON wastewater emissions information.

The following section describes the procedure used to extrapolate nationwide impacts for MON process vents, storage tanks, and equipment components with TRI information. A total of 335 facilities were identified in the 1993 TRI database as major sources of HAP and operating under SIC 28. Facilities with batch, surface coating, or HON processes were excluded from the total. The TRI subtotal of facilities operating in the seven states that provided electronic information is 156. Thus, states providing the electronic information account for approximately half (156 ÷ 335 = 46.6 percent) of all “miscellaneous” organic chemical manufacturing facilities that reported to the TRI in 1993. Nationwide impacts were estimated by doubling the current impacts (i.e., baseline emissions, emission reductions, and control costs) for process vents, storage tanks, and equipment components associated with MON continuous processes.

The following section describes the procedure used to extrapolate nationwide impacts for MON wastewater with MON process vent emissions information. The ratio of wastewater emissions from MON batch and continuous processes were assumed proportional to the ratio of process vent emissions from MON batch and continuous processes. Baseline HAP emissions from continuous MON process vents are roughly 70 percent more than the baseline HAP emissions from batch MON process vents ((5,347 tpy - 3,134 tpy)/3,134 tpy * 100% = 70 %). Therefore, impacts associated with MON continuous wastewater streams are estimated as 1.7 times the impact values for MON batch wastewater streams. Thus, nationwide impacts for all MON wastewater streams were estimated by multiplying the current impacts for batch wastewater by 2.7.

2.2 Primary Air Impacts

Table 3 summarizes the organic HAP emission reductions achieved by each regulatory option for each emission source type. The MACT Floor regulatory option is estimated to reduce organic HAP emissions from all existing sources by 38,780 tons/yr from a baseline level of 57,595 tons/yr. The MACT Floor option represents an overall 67.3 percent reduction. The above-the-floor regulatory option, Option 4, is estimated to reduce the most organic HAP emissions from all existing sources. Option 4 reduces HAP emissions by 39,308 tons/yr which represents less than a one percent increase in overall HAP emission reduction from the baseline level, or 68.2 percent.

The largest reduction in HAP emissions resulted from the control of MON wastewater, more than 18,000 tons/yr which represents a 71 to 72 percent reduction from the MON wastewater baseline. Emissions from wastewater streams represent almost 45 percent of the emissions from all chemical manufacturing sources covered by the MON. The next largest reduction in HAP emissions resulted from the control of MON equipment components, 15,200 tons/yr which represents a 67 percent reduction from the MON equipment components baseline. Emissions from equipment components represent approximately 40 percent of the emissions from all chemical manufacturing sources covered MON.

2.3 Cost Impacts

Cost impacts include the total capital investment of new control equipment, the cost of energy (supplemental fuel, steam, and electricity) required to operate control equipment, operation and maintenance costs, and the cost savings generated by reducing the loss of valuable product in the form of emissions. Note that the cost

Table 3. Summary of HAP Emission Reductions by Emission Point for Existing Sources

Emission Source Type and Regulatory Option	Baseline HAP Emissions (ton/yr)	Controlled HAP Emissions (ton/yr)	HAP Emission Reductions (ton/yr)	Percent Reduction (%)
Batch Process Vents				
MACT Floor	3,134	1,768	1,366	44
Above Floor	3,134	1,597	1,537	49
Continuous Process Vents				
MACT Floor	5,347	1,793	3,554	66
Above Floor	5,347	1,762	3,585	67
Storage Tanks				
MACT Floor	620	264	356	57
Above Floor	620	234	386	62
Wastewater				
MACT Floor	25,812	7,507	18,305	71
Above Floor	25,812	6,048	18,601	72
Equipment Leaks				
MACT Floor	22,682	7,483	15,199	67
Total				
MACT Floor	57,595	18,815	38,780	67.3
Above Floor	57,595	18,287	39,308	68.2

impacts currently do not include the costs of monitoring, recordkeeping, and reporting associated with the proposed options. Average cost effectiveness ($/ton of pollutant removed) is also presented as part of the cost impacts and is determined by dividing the total annual costs ($/yr) by the annual HAP emission reduction (tons/yr).

Table 4 presents the estimated total capital investment, total annual costs, and average cost effectiveness for complying with each regulatory option. For the MACT floor option, the estimated total capital investment for existing sources is $103.7 million in 1999 dollars, and the total annual cost is $59.1 million/yr in 1999 dollars. For Option 4, the estimated total capital investment for existing sources increases to $110.7 million in 1999 dollars, and the total annual cost increases to $64.6 million/yr in 1999 dollars.

The actual cost of the impacts for the proposed options may be less than presented because of the potential to combine emission streams and use common control

Table 4. Summary of Cost Impacts by Emission Point for Existing Sources

Emission Point and Regulatory Option	Total Capital Costs ($1,000)	Total Annual Costs ($1,000/yr)	Cost Effectiveness ($/ton)	
			Average	Incremental
Batch Process Vents				
MACT Floor	14,087	14,657	10,729	---
Above Floor	15,681	16,929	11,011	13,287
Continuous Process Vents				
MACT Floor	18,459	20,935	5,890	---
Above Floor	18,792	22,486	6,272	50,032
Storage Vessels				
MACT Floor	4,934	1,394	3,917	---
Above Floor	6,025	1,714	4,440	10,667
Wastewater				
MACT Floor	52,933	18,150	992	---
Above Floor	56,932	19,485	1,047	4,510
Equipment Leaks MACT Floor	13,265	3,958	260	---
Total				
MACT Floor	103,678	59,094	1,524	---
Above Floor	110,695	64,572	1,643	---

devices, to upgrade existing control devices, and to vent emission streams into current control devices. Because the effect of such practices is highly site-specific and information was unavailable, it is not possible to quantify this reduction in actual compliance costs.

A tool used to identify a more cost effective control option over others is the incremental cost effectiveness ($/ton HAP). The incremental cost effectiveness is a measure of the cost associated with each additional ton of HAP reduced over a less stringent option. For example, the incremental cost effectiveness for the MACT Floor option compared to the baseline (i.e., no control) is $1,524/ton HAP. While, the incremental cost effectiveness for Option 1 compared to the MACT Floor option is $4,510/ton HAP. As shown in Table 2, the incremental cost effectiveness for the remaining regulatory options range from $11,000/ton to $50,000/ton.

3.0 EMISSION CONTROL MEASURES AND COSTING PROCEDURES

The estimation of control costs applies only to major existing MON sources. Costs were estimated by applying only those controls necessary to bring each facility into compliance with the proposed regulatory option. For emission points already in compliance with the proposed regulatory option, no costs were estimated. The costing procedures used for all emission control measures are documented and established EPA procedures. A summary of assumed general values used in the control cost estimating procedures are provided in Attachment 1.

3.1 Continuous and Batch Process Vents

Control costs for continuous and batch process vents are based on the application of a 98 percent efficient combustion device. Control costs were developed for three types of combustion device: a flare, a thermal incinerator without heat recovery, and a thermal incinerator with 70 percent heat recovery. The combustion device providing the lowest total annual cost was selected. A separate device was sized and costed for each process vent associated with a continuous product process. While, one control device was sized and costed for all applicable vents within a facility that are associated with a batch product process. Vent-specific estimated costs and emission reductions associated with control requirements of the MACT floor and above-the-floor regulatory option (Option 4) are provided in Attachments 2 and 3, respectively.

Cost procedures provided in EPA's Handbook: Control Technologies for Hazardous Air Pollutants (EPA 625/6-91/014) were used to estimate the total capital investment (TCI) and the total annual costs for all three combustion control technologies. The procedures in this handbook are consistent with the costing procedures in the OAQPS Control Cost Manual (EPA 450/3-90/006). Process vent characteristics necessary to estimate control costs were obtained from two primary sources. Information on MON continuous process vents was obtained from electronic emission inventories maintained by seven state regulatory agencies. Information on MON batch process vents was obtained from responses to a Section 114 survey.

3.2 Storage Tanks

Control technologies selected to meet requirements of the proposed regulatory options include an internal floating roof (IFR) or a control device capable of achieving a 95 percent reduction in organic HAP emissions. For each vertical storage tank requiring control, costs estimates were developed for an internal floating roof with a liquid-mounted rim seal and controlled deck fittings. For each horizontal tank requiring control, costs estimates were developed for a refrigerated condenser with a 95 percent emission reduction efficiency.

The estimated total capital investment and total annual costs for installing an internal floating roof in a storage tank are based on procedures in the HON Background

Information Document for Proposed Standards, Volume 1B (EPA-453/D-92-016b). While, procedures provided in EPA's OAQPS Control Cost Manual were used to estimate the total capital investment and total annual costs for the refrigerated condensers. Storage tank characteristics required to estimate control costs were obtained from the same sources used for the process vent control costs. Characteristics of tanks associated with continuous product processes were obtained from electronic emission inventories maintained by regulatory agencies in seven states. Characteristics of tanks associated with batch product processes were obtained from responses to a Section 114 survey.

For MON batch processes, tank-specific estimated costs and emission reductions associated with the vertical storage tank control requirements of the MACT floor and Option 4 are provided in Attachments 4 and 5, respectively. For MON batch processes, tank-specific impacts associated with the horizontal storage tank control requirements of the MACT floor and Option 4 are provided in Attachments 6 and 7, respectively. Finally, for MON continuous processes, tank-specific impacts associated with the vertical storage tank control requirements of the MACT floor and Option 4 are provided in Attachments 8 and 9, respectively.

3.3 Equipment Leaks

The MACT floor developed for equipment components requires facilities to implement a leak detection and repair (LDAR) program equivalent to the HON program for all MON product processes. Since the HON LDAR program is the most stringent in practice, a regulatory option more stringent than the MACT floor was not developed. Facility-specific estimated costs and emission reductions associated with LDAR requirements of the MACT floor regulatory option are provided in Attachment 10.

The costing algorithms used to develop the LDAR cost estimates are those used to support the equipment leak standards for the amino/phenolic resin NESHAP (Docket Number A-92-19, Item Number II-B-11). These costing algorithms were derived from work used to support the HON equipment leak standards. Variations in the LDAR costs used for MON facilities include:

- In-house personnel rather than subcontracting personnel are assumed to be responsible for implementing the LDAR program.
- The monitoring instrument is assumed to be purchased rather than rented.
- Facilities subject to Method 21 monitoring are assumed to purchase a spreadsheet program for tracking components.

Equipment component characteristics necessary to estimate the LDAR costs are based on model MON product processes. Development of the model product process characteristics such as equipment counts, emission rates, and leak rates is documented in the draft Alpha-Gamma report, "Miscellaneous Organic NESHAP - Ranking of Equipment Leak Programs."

3.4 Wastewater Collection and Treatment

The control technology most suitable for achieving the required organic HAP reductions from process wastewater streams is steam stripping. All wastewater streams requiring control within a facility were combined and a single steam stripper was costed. The steam stripper design characteristics are the same as those used to support development of the HON wastewater standards. The estimated total capital investment and total annual costs for installing a stainless steel steam stripper are based on the cost algorithms presented in the HON Background Information Document for proposed standards, Volume 1B (EPA 453/D-92-016b). Characteristics of wastewater streams associated with batch MON product processes were obtained from responses to a Section 114 survey. However, little to no information was available for wastewater streams associated with continuous MON product processes in the electronic emission inventories. Facility-specific estimated costs and emission reductions associated with the wastewater control requirements of the MACT floor and above-the-floor regulatory option are provided in Attachments 11 and 12, respectively.

ATTACHMENT 1

Assumed General Values Used in the Control Cost Estimating Procedures

Description	Value
GENERAL	
Cost of natural gas	\$3.30 /1,000 ft^3
Cost of electricity	\$0.059 /kw-hr
Cost of steam	\$6.00 /1,000 lb
Cost of technical labor	\$12.96/hr
Cost of maintenance labor	\$14.26/hr
Capital recovery factor, 7% @ 15 years	0.1098
Default hours of operation	8,760 hr/yr
Reference temperature, T_{ref}	68 ^oF
FLARES	
Emission stream temperature, T_e	100 ^oF
Default mean molecular weight of emission stream, MW_e	100 lb/lb mol
Flare gas temperature, T_{flg}	95 ^oF
Default continuous vent flow rate, Q_e	6,450 scfm
Default batch vent flow rate, Q_e	415 scfm
Molecular weight of flue gas	29 lb/lb mol
Specific volume of ideal gas at 68 ^oF	385 ft^3/lb mol
Density of air at 68 ^oF	0.0753 lb/scf
Average heat content of HAP	15,000 Btu/lb
THERMAL INCINERATORS	
Combustion temperature, T_c	1,600 ^oF
Residence time, T_r	0.75 sec
Fuel (natural gas) heating value, h_f	21,600 Btu/lb
Density of methane at 68 ^oF	0.0417 lb/scf
Mean heat capacity of air between 68 ^oF and 1,600 ^oF, Cp_{air}	0.239 Btu/lb-^oF

ATTACHMENT 2

Estimated Impacts Associated with Process Vent Control Requirements of the MACT Floor Regulatory Option

Continuous and Batch Process Vents – MACT Floor Options

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
1	M1	Batch	49,935	49,858	48,784	$376,491	$157,548	$6,459	Incinerator 70%
2	M10	Batch	6,840,000	20,800	0	$0	$0	$0	None
3	M100	Batch	145,000	145	0	$0	$0	$0	None
4	M101	Batch	197,540	14,687	1,767	$33,411	$226,881	$256,740	Flare
5	M102	Batch	106,816	11,083	9,914	$297,483	$84,614	$17,070	Incinerator
6	M105	Batch	63,511	6	0	$0	$0	$0	None
7	M106	Batch	709,470	16,377	50	$32,834	$111,014	$4,408,530	Flare
8	M107	Batch	941,836	98,143	79,307	$33,564	$97,591	$2,461	Flare
9	M108	Batch	2,150,836	587,137	157,664	$36,247	$236,454	$2,999	Flare
10	M109	Batch	91,200	912	0	$0	$0	$0	None
11	M11	Batch	1,850,000	18,500	0	$0	$0	$0	None
12	M110	Batch	75,000	1,500	0	$0	$0	$0	None
13	M111	Batch	416,364	20,818	625	$323,626	$167,589	$536,675	Incinerator 70%
14	M113	Batch	135,600	60,780	47,174	$329,859	$130,077	$5,515	Incinerator 70%
15	M114	Batch	86,400	4,320	130	$230,105	$89,152	$1,375,802	Incinerator 70%
16	M115	Batch	66,660	6,666	533	$32,679	$104,964	$393,654	Flare
17	M116	Batch	244,028	48,824	28,815	$33,556	$219,183	$15,213	Flare
18	M119	Batch	2,127,871	171,110	103,941	$456,959	$1,041,273	$20,036	Incinerator
19	M12	Batch	884,165	8,842	0	$0	$0	$0	None
20	M120	Batch	1,584,000	1,584	0	$0	$0	$0	None
21	M122	Batch	17,760	17,760	17,405	$377,520	$297,342	$34,168	Incinerator 70%
22	M123	Batch	266,667	4,000	0	$0	$0	$0	None
23	M124	Batch	11,080	554	17	$32,711	$107,077	$12,885,319	Flare
24	M125	Batch	65,400	771	22	$173,480	$87,550	$8,106,481	Incinerator
25	M126	Batch	237,634	4,753	0	$0	$0	$0	None
26	M127	Batch	320,510	60,897	10,352	$159,906	$80,842	$15,618	Incinerator
27	M128	Batch	2,631,640	159,046	18,689	$45,201	$312,072	$33,397	Flare
28	M131	Batch	11,994	11,994	11,754	$160,166	$32,982	$5,612	Incinerator
29	M132	Batch	88,656	88,656	86,883	$159,906	$80,842	$1,861	Incinerator
30	M133	Batch	553,220	15,058	399	$24,104	$78,783	$394,546	Flare
31	M134	Batch	195,711	72,129	53,285	$45,266	$349,534	$13,120	Flare
32	M136	Batch	175,666	62,575	53,888	$376,491	$157,548	$5,847	Incinerator 70%
33	M138	Batch	14,000	14,000	13,720	$32,710	$109,911	$16,022	Flare
34	M141	Batch	28,420	1,421	43	$32,704	$102,406	$4,804,410	Flare
35	M144	Batch	682,956	51,195	20,521	$272,345	$191,519	$18,666	Incinerator
36	M145	Batch	29,000	29,000	28,420	$376,983	$224,284	$15,784	Incinerator 70%
37	M147	Batch	17,939	179	0	$0	$0	$0	None
38	M148	Batch	758,304	50,103	6,134	$21,527	$33,539	$10,935	Flare
39	M149	Batch	295,980	14,799	444	$37,582	$189,943	$855,657	Flare
40	M15	Batch	51,096	1,022	0	$0	$0	$0	None
41	M150	Batch	2,172,233	63,647	40,335	$26,169	$131,025	$6,497	Flare

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
42	M151	Batch	160,000	8,000	240	$25,750	$66,527	$554,392	Flare
43	M152	Batch	40,000	40,000	39,200	$304,710	$259,486	$13,239	Incinerator
44	M153	Batch	94,178	4,238	106	$215,161	$36,930	$697,120	Incinerator
45	M155	Batch	63,812	1,914	19	$162,660	$28,780	$3,006,749	Incinerator
46	M157	Batch	50,670	19,390	14,310	$33,455	$175,337	$24,505	Flare
47	M158	Batch	47,697	47,697	46,743	$32,698	$110,554	$4,730	Flare
48	M160	Batch	287,500	18,000	12,250	$413,655	$716,497	$116,979	Incinerator
49	M17	Batch	32,036	12,956	10,521	$159,916	$84,052	$15,978	Incinerator
50	M18	Batch	948,463	51,009	2,891	$335,409	$347,596	$240,495	Incinerator
51	M19	Batch	15,100	15,100	14,798	$250,518	$96,867	$13,092	Incinerator 70%
52	M2	Batch	42,857	3,000	150	$159,906	$42,450	$566,002	Incinerator
53	M20	Batch	31,713	634	0	$0	$0	$0	None
54	M21	Batch	68,413	35,486	33,130	$33,462	$174,766	$10,550	Flare
55	M22	Batch	3,888,700	43,394	3,048	$24,537	$96,157	$63,095	Flare
56	M24	Batch	24,616	24,616	24,124	$377,385	$278,876	$23,121	Incinerator 70%
57	M25	Batch	1,764,361	21,324	1,052	$407,858	$680,419	$1,293,572	Incinerator
58	M26	Batch	404,200	82,277	44,599	$237,728	$140,797	$6,314	Incinerator
59	M27	Batch	481,950	233,753	119,404	$222,957	$124,601	$2,087	Incinerator
60	M28	Batch	237,572	237,572	232,821	$376,491	$157,548	$1,353	Incinerator 70%
61	M33	Batch	55,626	556	0	$0	$0	$0	None
62	M36	Batch	38,000	38,000	37,240	$32,696	$80,152	$4,305	Flare
63	M37	Batch	84,000	1,680	0	$0	$0	$0	None
64	M38	Batch	44,000	44,000	43,120	$376,491	$157,548	$7,307	Incinerator 70%
65	M39	Batch	100,000	1,500	0	$0	$0	$0	None
66	M41	Batch	2,042,210	44,055	77	$247,444	$153,090	$3,958,929	Incinerator
67	M42	Batch	99,309	60,652	46,049	$425,267	$197,615	$8,583	Incinerator 70%
68	M43	Batch	11,170	2,234	402	$377,290	$133,178	$662,379	Incinerator 70%
69	M44	Batch	312,000	32,660	21,116	$33,538	$164,722	$15,602	Flare
70	M45	Batch	22,200	11,100	5,328	$32,707	$111,176	$41,733	Flare
71	M46	Batch	327,766	30,757	2,524	$33,538	$164,610	$130,441	Flare
72	M47	Batch	33,860	13,544	5,147	$32,681	$48,007	$18,655	Flare
73	M49	Batch	72,600	3,630	109	$329,622	$206,712	$3,796,364	Incinerator 70%
74	M50	Batch	100,700	1,007	0	$0	$0	$0	None
75	M51	Batch	32,160	322	0	$0	$0	$0	None
76	M52	Batch	88,028	880	0	$0	$0	$0	None
77	M54	Batch	102,523	75,991	74,209	$93,199	$63,165	$1,702	Incinerator
78	M56	Batch	36,000	10,800	3,024	$46,722	$434,681	$287,487	Flare
79	M59	Batch	270,000	27,000	2,160	$33,101	$130,643	$120,966	Flare
80	M60	Batch	60,469	11,489	1,953	$250,459	$118,233	$121,069	Incinerator 70%
81	M61	Batch	392,500	7,850	0	$0	$0	$0	None
82	M62	Batch	25,400	1,270	38	$377,048	$233,040	$12,232,880	Incinerator 70%
83	M63	Batch	284,540	129,929	122,609	$139,387	$72,652	$1,185	Incinerator
84	M65	Batch	6,224,091	31,507	0	$0	$0	$0	None

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
85	M67	Batch	11,280	1,692	220	$377,554	$272,579	$2,478,442	Incinerator 70%
86	M68	Batch	2,448,885	48,978	0	$0	$0	$0	None
87	M69	Batch	32,306	835	5	$250,502	$119,854	$49,005,723	Incinerator 70%
88	M70	Batch	15,000	3,000	540	$46,737	$173,480	$642,519	Flare
89	M71	Batch	70,000	700	0	$0	$0	$0	None
90	M74	Batch	41,178	20,014	18,555	$252,261	$96,050	$10,353	Incinerator 70%
91	M75	Batch	242,430	12,336	383	$32,659	$107,786	$563,121	Flare
92	M78	Batch	13,520	2,231	323	$32,662	$35,880	$221,847	Flare
93	M8	Batch	186,800	2,921	94	$173,951	$87,805	$1,876,175	Incinerator
94	M80	Batch	62,000	3,100	93	$377,113	$241,933	$5,202,860	Incinerator 70%
95	M82	Batch	57,470	1,584	22	$46,772	$432,775	$39,877,908	Flare
96	M83	Batch	1,150,419	19,382	1,875	$32,543	$97,335	$103,801	Flare
97	M84	Batch	602,700	1,546	0	$0	$0	$0	None
98	M85	Batch	20,000	4,000	720	$33,433	$176,987	$491,631	Flare
99	M86	Batch	627,822	6,458	0	$0	$0	$0	None
100	M87	Batch	6,447,311	281,156	130,456	$46,735	$263,635	$4,042	Flare
101	M89	Batch	18,450	369	0	$0	$0	$0	None
102	M9	Batch	220,840	55,785	15,464	$204,336	$107,910	$13,956	Incinerator
103	M90	Batch	279,878	72,120	31,767	$169,699	$85,563	$5,387	Incinerator
104	M91	Batch	315,791	27,181	3,196	$45,704	$311,584	$195,001	Flare
105	M92	Batch	32,739	164	0	$0	$0	$0	None
106	M94	Batch	1,354,990	52,480	2,878	$33,379	$144,965	$100,731	Flare
107	M95	Batch	1,174,171	234,514	193,205	$45,553	$246,281	$2,549	Flare
108	M97	Batch	114,995	20,882	11,053	$159,906	$80,842	$14,628	Incinerator
109	M98	Batch	675,261	546,240	515,318	$417,995	$190,886	$741	Incinerator 70%
110	M99	Batch	285,000	14,250	428	$100,563	$61,606	$288,215	Incinerator
111	M314	Continuous	18,020	901	27	$268,100	$137,305	$10,159,452	Incinerator 70%
112	M314	Continuous	559,009	559	0	$0	$0	$0	None
113	M314	Continuous	466,100	9,468	3	$418,765	$368,566	$248,549,711	Incinerator 70%
114	M314	Continuous	221,960	4,440	0	$0	$0	$0	None
115	M315	Continuous	29,184,000	145,920	0	$0	$0	$0	None
116	M320	Continuous	214,000	3,210	0	$0	$0	$0	None
117	M320	Continuous	372,000	5,580	0	$0	$0	$0	None
118	M320	Continuous	335,867	5,038	0	$0	$0	$0	None
119	M320	Continuous	840,000	12,600	0	$0	$0	$0	None
120	M322	Continuous	1,066,000	10,660	0	$0	$0	$0	None
121	M325	Continuous	378,600	378,600	371,028	$319,141	$147,192	$793	Incinerator 70%
122	M328	Continuous	742,000	742,000	727,160	$377,233	$258,247	$710	Incinerator 70%
123	M330	Continuous	30,620	30,620	30,008	$18,270	$42,401	$2,826	Flare
124	M330	Continuous	18,000	18,000	17,640	$18,340	$43,166	$4,894	Flare
125	M330	Continuous	9,000	9,000	8,820	$18,245	$43,142	$9,783	Flare
126	M337	Continuous	799,600	7,996	0	$0	$0	$0	None
127	M343	Continuous	10,000	10,000	9,800	$18,210	$43,247	$8,826	Flare

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
128	M343	Continuous	1,400,000	140	0	$0	$0	$0	None
129	M343	Continuous	200,000	20	0	$0	$0	$0	None
130	M343	Continuous	9,000,000	900	0	$0	$0	$0	None
131	M347	Continuous	108,882	108,882	106,704	$377,483	$292,257	$5,478	Incinerator 70%
132	M350	Continuous	495,200	9,904	0	$0	$0	$0	None
133	M351	Continuous	149,900	29,980	5,396	$22,830	$63,677	$23,600	Flare
134	M351	Continuous	86,300	17,260	3,107	$32,994	$119,753	$77,091	Flare
135	M351	Continuous	76,720	15,344	2,762	$22,769	$59,578	$43,142	Flare
136	M351	Continuous	26,555	5,311	956	$18,643	$53,748	$112,446	Flare
137	M351	Continuous	11,857	166	0	$0	$0	$0	None
138	M358	Continuous	1,184,680	59,234	1,777	$45,653	$291,317	$327,871	Flare
139	M359	Continuous	84,550	1,691	0	$0	$0	$0	None
140	M44	Continuous	16,140	16,140	15,817	$18,301	$43,840	$5,543	Flare
141	M44	Continuous	89,000	8,900	712	$18,473	$43,548	$122,326	Flare
142	M44	Continuous	41,000	820	0	$0	$0	$0	None
143	M107	Continuous	16,000	16,000	15,680	$18,457	$48,187	$6,146	Flare
144	M107	Continuous	2,600,000	26,000	0	$0	$0	$0	None
145	M117	Continuous	13,154	13,154	12,891	$18,264	$43,146	$6,694	Flare
146	M117	Continuous	858,000	3,432	0	$0	$0	$0	None
147	M117	Continuous	37,471,000	149,884	0	$0	$0	$0	None
148	M126	Continuous	212,415	212,415	208,167	$377,526	$298,178	$2,865	Incinerator 70%
149	M126	Continuous	11,283	11,283	11,057	$18,222	$43,159	$7,806	Flare
150	M146	Continuous	306,000	31	0	$0	$0	$0	None
151	M23	Continuous	13,226	13,226	12,961	$23,083	$90,421	$13,952	Flare
152	M255	Continuous	57,300	57,300	56,154	$373,237	$292,483	$10,417	Incinerator 70%
153	M256	Continuous	54,880	54,880	53,782	$377,562	$302,995	$11,267	Incinerator 70%
154	M258	Continuous	12,440	12,440	12,191	$18,464	$48,257	$7,917	Flare
155	M258	Continuous	1,188,000	11,880	0	$0	$0	$0	None
156	M258	Continuous	3,288,000	32,880	0	$0	$0	$0	None
157	M258	Continuous	292,000	2,920	0	$0	$0	$0	None
158	M259	Continuous	840,000	8,400	0	$0	$0	$0	None
159	M259	Continuous	284,360	2,844	0	$0	$0	$0	None
160	M260	Continuous	163,194	163,194	159,930	$377,404	$281,457	$3,520	Incinerator 70%
161	M262	Continuous	1,313,333	3,940	0	$0	$0	$0	None
162	M262	Continuous	60,000	180	0	$0	$0	$0	None
163	M262	Continuous	11,980,000	35,940	0	$0	$0	$0	None
164	M269	Continuous	340,200	340,200	333,396	$0	$0	$0	Flare
165	M269	Continuous	3,999,985	16,000	0	$0	$0	$0	None
166	M271	Continuous	160,000	160	0	$0	$0	$0	None
167	M271	Continuous	1,020,000	1,020	0	$0	$0	$0	None
168	M271	Continuous	2,000	2	0	$0	$0	$0	None
169	M271	Continuous	2,000,000	2,000	0	$0	$0	$0	None
170	M271	Continuous	12,620,000	12,620	0	$0	$0	$0	None

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
171	M271	Continuous	5,600,000	5,600	0	$0	$0	$0	None
172	M271	Continuous	16,200,000	16,200	0	$0	$0	$0	None
173	M271	Continuous	6,200,000	6,200	0	$0	$0	$0	None
174	M271	Continuous	2,000,000	2,000	0	$0	$0	$0	None
175	M271	Continuous	7,600,000	7,600	0	$0	$0	$0	None
176	M271	Continuous	2,200,000	2,200	0	$0	$0	$0	None
177	M271	Continuous	620,000	620	0	$0	$0	$0	None
178	M271	Continuous	97,700	1,954	0	$0	$0	$0	None
179	M277	Continuous	40,800	40,800	39,984	$311,445	$189,310	$9,469	Incinerator 70%
180	M277	Continuous	19,157	19,157	18,774	$33,140	$196,505	$20,934	Flare
181	M277	Continuous	29,600	7,400	1,702	$281,420	$152,941	$179,719	Incinerator 70%
182	M277	Continuous	66,000	660	0	$0	$0	$0	None
183	M277	Continuous	316,200	3,162	0	$0	$0	$0	None
184	M279	Continuous	33,091	33,091	32,429	$32,719	$110,099	$6,790	Flare
185	M279	Continuous	18,779	18,779	18,403	$32,712	$110,514	$12,010	Flare
186	M279	Continuous	53,500	535	0	$0	$0	$0	None
187	M279	Continuous	1,671,220	16,712	0	$0	$0	$0	None
188	M280	Continuous	146,670	2,933	0	$0	$0	$0	None
189	M280	Continuous	483,350	9,667	0	$0	$0	$0	None
190	M280	Continuous	1,654,000	165	0	$0	$0	$0	None
191	M281	Continuous	13,142	13,142	12,879	$46,047	$22,120	$3,435	Flare
192	M281	Continuous	591,320	591,320	579,494	$409,716	$334,190	$1,153	Incinerator 70%
193	M281	Continuous	26,000	260	0	$0	$0	$0	None
194	M283	Continuous	196,210	3,924	0	$0	$0	$0	None
195	M283	Continuous	2,150,000	21,492	0	$0	$0	$0	None
196	M285	Continuous	9,652	9,652	9,459	$220,835	$104,073	$22,005	Incinerator 70%
197	M285	Continuous	56,433	56,433	55,304	$222,493	$101,716	$3,678	Incinerator 70%
198	M285	Continuous	95,346	95,346	93,439	$258,083	$111,350	$2,383	Incinerator 70%
199	M285	Continuous	144,867	30,422	5,780	$86,850	$79,149	$27,386	Incinerator
200	M287	Continuous	292,115	292,115	286,273	$377,215	$255,822	$1,787	Incinerator 70%
201	M293	Continuous	2,927	2,927	2,869	$18,197	$43,149	$30,081	Flare
202	M293	Continuous	100,680	1,007	0	$0	$0	$0	None
203	M297	Continuous	52,000	5	0	$0	$0	$0	None
204	M299	Continuous	245,200	12,260	368	$377,260	$261,887	$1,424,073	Incinerator 70%
205	M299	Continuous	21,800	872	17	$377,610	$309,548	$35,498,624	Incinerator 70%
206	M299	Continuous	530,034	10,634	1	$376,867	$208,513	$623,828,501	Incinerator 70%
207	M300	Continuous	7,120	71	0	$0	$0	$0	None
208	M300	Continuous	7,120	71	0	$0	$0	$0	None
209	M300	Continuous	25,300	506	0	$0	$0	$0	None
210	M300	Continuous	355,300	7,106	0	$0	$0	$0	None
211	M301	Continuous	81,760	8,176	654	$46,103	$407,659	$1,246,511	Flare
212	M301	Continuous	81,760	8,176	654	$46,103	$407,659	$1,246,511	Flare
213	M301	Continuous	42,300	4,230	338	$46,138	$409,498	$2,420,201	Flare

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
214	M301	Continuous	39,000	3,900	312	$46,141	$409,652	$2,625,974	Flare
215	M301	Continuous	28,600	2,860	229	$46,151	$410,137	$3,585,114	Flare
216	M301	Continuous	26,400	2,640	211	$46,153	$410,240	$3,884,848	Flare
217	M301	Continuous	17,720	1,772	142	$46,160	$410,644	$5,793,510	Flare
218	M303	Continuous	142,631	142,631	139,778	$377,434	$285,546	$4,086	Incinerator 70%
219	M303	Continuous	663,010	663	0	$0	$0	$0	None
220	M306	Continuous	14,060	14,060	13,779	$18,429	$27,790	$4,034	Flare
221	M306	Continuous	62,360	62,360	61,113	$18,437	$44,351	$1,451	Flare
222	M306	Continuous	130,000	2,600	0	$0	$0	$0	None
223	M306	Continuous	726,000	14,520	0	$0	$0	$0	None
224	M307	Continuous	45,720	4,572	366	$377,617	$310,527	$1,697,982	Incinerator 70%
225	M307	Continuous	204,988	16,399	984	$377,531	$298,769	$607,291	Incinerator 70%
226	M307	Continuous	1,180,300	23,606	0	$0	$0	$0	None
227	M311	Continuous	32,900	658	0	$0	$0	$0	None
228	M311	Continuous	3,700	74	0	$0	$0	$0	None
229	M314	Continuous	27,097	2,904	253	$424,089	$438,502	$3,464,445	Incinerator 70%
230	M314	Continuous	34,660	3,466	277	$234,839	$106,588	$768,811	Incinerator 70%
Subtotals:				11,615,156	6,286,311	$23,316,691	$25,124,454	$7,993	
Batch Totals:				6,267,656	2,732,117	$14,087,088	$14,656,739	$10,729	
Continuous Totals				5,347,500	3,554,193	$9,229,603	$10,467,715	$5,890	
All Continuous Totals				10,694,999	7,108,387	$18,459,206	$20,935,430	$5,890	
National Totals:				16,962,656	9,840,504	$32,546,294	$35,592,169	$7,234	

ATTACHMENT 3

Estimated Impacts Associated with Process Vent Control Requirements of the Above-the-floor Regulatory Option

Continuous and Batch Process Vents – Above-the-Floor Option

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
1	M123	Batch	266,667	4,000	0	$0	$0	$0	None
2	M124	Batch	11,080	554	17	$32,711	$107,077	$12,885,319	Flare
3	M125	Batch	65,400	771	22	$173,480	$87,550	$8,106,481	Incinerator
4	M126	Batch	237,634	4,753	0	$0	$0	$0	None
5	M127	Batch	320,510	60,897	10,352	$159,906	$80,842	$15,618	Incinerator
6	M128	Batch	2,631,640	159,046	18,689	$45,201	$312,072	$33,397	Flare
7	M129	Batch	5,092	5,092	4,990	$59,656	$22,263	$8,923	Flare
8	M131	Batch	11,994	11,994	11,754	$160,166	$32,982	$5,612	Incinerator
9	M132	Batch	94,246	94,246	92,361	$159,906	$80,842	$1,751	Incinerator
10	M133	Batch	572,095	21,895	6,492	$24,160	$78,792	$24,275	Flare
11	M134	Batch	195,711	72,129	53,285	$45,266	$349,534	$13,120	Flare
12	M1	Batch	72,588	72,438	70,840	$159,989	$108,828	$3,073	Incinerator
13	M10	Batch	6,840,000	20,800	0	$0	$0	$0	None
14	M100	Batch	171,400	1,465	40	$87,563	$58,740	$2,966,667	Incinerator
15	M101	Batch	204,540	15,737	1,904	$45,371	$288,448	$303,008	Flare
16	M102	Batch	106,816	11,083	9,914	$297,483	$84,614	$17,070	Incinerator
17	M103	Batch	11,600	660	25	$377,346	$273,642	$21,941,512	Incinerator 70%
18	M105	Batch	79,049	8	0	$0	$0	$0	None
19	M106	Batch	709,470	16,377	50	$32,834	$111,014	$4,408,530	Flare
20	M107	Batch	948,446	98,275	79,307	$34,141	$114,987	$2,900	Flare
21	M108	Batch	2,161,319	589,598	158,196	$36,292	$236,461	$2,989	Flare
22	M109	Batch	91,200	912	0	$0	$0	$0	None
23	M11	Batch	1,855,000	18,550	0	$0	$0	$0	None
24	M110	Batch	75,000	1,500	0	$0	$0	$0	None
25	M111	Batch	416,364	20,818	625	$323,626	$167,589	$536,675	Incinerator 70%
26	M113	Batch	135,600	60,780	47,174	$329,859	$130,077	$5,515	Incinerator 70%
27	M114	Batch	86,400	4,320	130	$230,105	$89,152	$1,375,802	Incinerator 70%
28	M115	Batch	66,660	6,666	533	$32,679	$104,964	$393,654	Flare
29	M116	Batch	252,540	50,527	29,122	$45,207	$277,948	$19,089	Flare
30	M119	Batch	2,136,271	174,050	104,911	$457,630	$1,047,142	$19,963	Incinerator
31	M12	Batch	884,165	8,842	0	$0	$0	$0	None
32	M120	Batch	1,584,000	1,584	0	$0	$0	$0	None
33	M122	Batch	26,640	26,640	26,107	$377,459	$289,059	$22,144	Incinerator 70%
34	M136	Batch	187,184	68,020	59,073	$376,491	$157,548	$5,334	Incinerator 70%
35	M138	Batch	29,630	22,600	20,531	$60,085	$574,044	$55,920	Flare
36	M141	Batch	28,420	1,421	43	$32,704	$102,406	$4,804,410	Flare
37	M142	Batch	8,000	800	64	$377,575	$228,921	$7,153,781	Incinerator 70%
38	M144	Batch	702,730	57,907	26,969	$292,005	$230,076	$17,062	Incinerator
39	M145	Batch	29,000	29,000	28,420	$376,983	$224,284	$15,784	Incinerator 70%
40	M147	Batch	17,939	179	0	$0	$0	$0	None
41	M148	Batch	758,304	50,103	6,134	$21,527	$33,539	$10,935	Flare
42	M149	Batch	301,827	20,646	6,174	$37,584	$189,944	$61,530	Flare
43	M15	Batch	51,096	1,022	0	$0	$0	$0	None
44	M150	Batch	2,205,526	83,926	55,779	$39,523	$219,670	$7,876	Flare
45	M151	Batch	168,900	8,178	240	$25,755	$113,655	$947,125	Flare
46	M152	Batch	46,450	46,450	45,521	$32,489	$86,987	$3,822	Flare

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
47	M153	Batch	94,178	4,238	106	$215,161	$36,930	$697,120	Incinerator
48	M154	Batch	9,436	755	45	$60,262	$15,247	$673,264	Flare
49	M155	Batch	63,812	1,914	19	$162,660	$28,780	$3,006,749	Incinerator
50	M157	Batch	56,523	20,268	14,424	$33,287	$239,333	$33,185	Flare
51	M158	Batch	47,697	47,697	46,743	$32,698	$110,554	$4,730	Flare
52	M160	Batch	287,500	18,000	12,250	$413,655	$716,497	$116,979	Incinerator
53	M17	Batch	45,841	26,761	24,050	$159,906	$80,842	$6,723	Incinerator
54	M18	Batch	954,963	52,049	3,036	$337,245	$353,715	$232,993	Incinerator
55	M19	Batch	22,018	22,018	21,578	$297,898	$168,818	$15,647	Incinerator 70%
56	M2	Batch	42,857	3,000	150	$159,906	$42,450	$566,002	Incinerator
57	M20	Batch	31,713	634	0	$0	$0	$0	None
58	M21	Batch	68,413	35,486	33,130	$33,462	$174,766	$10,550	Flare
59	M22	Batch	3,896,900	43,476	3,048	$35,167	$115,150	$75,558	Flare
60	M24	Batch	24,616	24,616	24,124	$377,385	$278,876	$23,121	Incinerator 70%
61	M25	Batch	1,828,560	22,624	1,113	$422,221	$772,811	$1,388,949	Incinerator
62	M26	Batch	410,320	82,460	44,600	$238,070	$141,207	$6,332	Incinerator
63	M27	Batch	499,550	244,033	125,419	$224,853	$126,524	$2,018	Incinerator
64	M28	Batch	250,186	250,186	245,182	$376,491	$157,548	$1,285	Incinerator 70%
65	M32	Batch	9,964	498	15	$32,711	$109,440	$14,644,721	Flare
66	M33	Batch	55,626	556	0	$0	$0	$0	None
67	M34	Batch	5,725	5,725	5,611	$32,712	$80,952	$28,857	Flare
68	M36	Batch	38,000	38,000	37,240	$32,696	$80,152	$4,305	Flare
69	M37	Batch	84,000	1,680	0	$0	$0	$0	None
70	M38	Batch	44,000	44,000	43,120	$376,491	$157,548	$7,307	Incinerator 70%
71	M39	Batch	100,000	1,500	0	$0	$0	$0	None
72	M41	Batch	2,042,210	44,055	77	$247,444	$153,090	$3,958,929	Incinerator
73	M42	Batch	195,462	129,706	107,709	$349,663	$397,883	$7,388	Incinerator
74	M43	Batch	11,170	2,234	402	$377,290	$133,178	$662,379	Incinerator 70%
75	M44	Batch	334,790	46,767	34,767	$45,410	$335,583	$19,304	Flare
76	M45	Batch	22,200	11,100	5,328	$32,707	$111,176	$41,733	Flare
77	M46	Batch	327,766	30,757	2,524	$33,538	$164,610	$130,441	Flare
78	M47	Batch	33,860	13,544	5,147	$32,681	$48,007	$18,655	Flare
79	M49	Batch	88,900	4,445	133	$353,675	$187,510	$2,812,298	Incinerator 70%
80	M50	Batch	100,700	1,007	0	$0	$0	$0	None
81	M51	Batch	32,160	322	0	$0	$0	$0	None
82	M52	Batch	97,628	976	0	$0	$0	$0	None
83	M54	Batch	102,523	75,991	74,209	$93,199	$63,165	$1,702	Incinerator
84	M55	Batch	8,040	804	64	$32,711	$77,996	$2,425,249	Flare
85	M56	Batch	36,000	10,800	3,024	$46,722	$434,681	$287,487	Flare
86	M59	Batch	270,000	27,000	2,160	$33,101	$130,643	$120,966	Flare
87	M60	Batch	78,549	14,924	2,537	$329,579	$202,772	$159,843	Incinerator 70%
88	M61	Batch	392,500	7,850	0	$0	$0	$0	None
89	M62	Batch	25,400	1,270	38	$377,048	$233,040	$12,232,880	Incinerator 70%
90	M63	Batch	295,658	135,585	127,813	$139,841	$72,812	$1,139	Incinerator
91	M65	Batch	6,248,507	31,629	0	$0	$0	$0	None
92	M67	Batch	31,280	4,692	610	$376,491	$157,548	$516,585	Incinerator 70%
93	M68	Batch	2,448,885	48,978	0	$0	$0	$0	None
94	M69	Batch	41,006	1,270	18	$297,874	$167,226	$18,641,325	Incinerator 70%

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
95	M7	Batch	9,529	9,529	9,338	$32,712	$111,508	$23,882	Flare
96	M70	Batch	15,000	3,000	540	$46,737	$173,480	$642,519	Flare
97	M71	Batch	70,000	700	0	$0	$0	$0	None
98	M74	Batch	41,178	20,014	18,555	$252,261	$96,050	$10,353	Incinerator 70%
99	M75	Batch	242,430	12,336	383	$32,659	$107,786	$563,121	Flare
100	M78	Batch	13,520	2,231	323	$32,662	$35,880	$221,847	Flare
101	M79	Batch	15,400	7,480	6,538	$33,454	$175,427	$53,661	Flare
102	M8	Batch	186,800	2,921	94	$173,951	$87,805	$1,876,175	Incinerator
103	M80	Batch	71,600	3,580	107	$377,033	$231,000	$4,301,676	Incinerator 70%
104	M82	Batch	57,470	1,584	22	$46,772	$432,775	$39,877,908	Flare
105	M83	Batch	1,184,071	22,213	2,066	$33,409	$146,736	$142,037	Flare
106	M84	Batch	616,700	1,560	0	$0	$0	$0	None
107	M85	Batch	40,000	8,010	2,240	$45,631	$305,583	$272,842	Flare
108	M86	Batch	665,922	6,919	0	$0	$0	$0	None
109	M87	Batch	6,473,149	304,153	151,573	$46,745	$261,955	$3,456	Flare
110	M88	Batch	9,526	9,526	9,336	$377,316	$114,666	$24,565	Incinerator 70%
111	M89	Batch	18,450	369	0	$0	$0	$0	None
112	M9	Batch	237,272	58,318	16,028	$207,617	$110,579	$13,798	Incinerator
113	M90	Batch	279,878	72,120	31,767	$169,699	$85,563	$5,387	Incinerator
114	M91	Batch	344,870	33,826	5,006	$179,166	$90,726	$36,245	Incinerator
115	M92	Batch	32,739	164	0	$0	$0	$0	None
116	M94	Batch	1,383,897	61,801	9,352	$33,376	$144,739	$30,952	Flare
117	M95	Batch	1,239,757	300,100	257,479	$226,752	$128,494	$998	Incinerator
118	M97	Batch	114,995	20,882	11,053	$159,906	$80,842	$14,628	Incinerator
119	M98	Batch	675,261	546,240	515,318	$417,995	$190,886	$741	Incinerator 70%
120	M99	Batch	285,000	14,250	428	$100,563	$61,606	$288,215	Incinerator
121	M283	Continuous	196,210	3,924	0	$0	$0	$0	None
122	M283	Continuous	2,150,000	21,492	0	$0	$0	$0	None
123	M285	Continuous	9,652	9,652	9,459	$220,835	$104,073	$22,005	Incinerator 70%
124	M285	Continuous	56,433	56,433	55,304	$222,493	$101,716	$3,678	Incinerator 70%
125	M285	Continuous	95,346	95,346	93,439	$258,083	$111,350	$2,383	Incinerator 70%
126	M285	Continuous	144,867	30,422	5,780	$86,850	$79,149	$27,386	Incinerator
127	M287	Continuous	292,115	292,115	286,273	$377,215	$255,822	$1,787	Incinerator 70%
128	M293	Continuous	2,927	2,927	2,869	$18,197	$43,149	$30,081	Flare
129	M293	Continuous	100,680	1,007	0	$0	$0	$0	None
130	M107	Continuous	16,000	16,000	15,680	$18,457	$48,187	$6,146	Flare
131	M107	Continuous	2,600,000	26,000	0	$0	$0	$0	None
132	M117	Continuous	13,154	13,154	12,891	$18,264	$43,146	$6,694	Flare
133	M117	Continuous	7,150	1,430	257	$18,225	$43,140	$335,198	Flare
134	M117	Continuous	858,000	3,432	0	$0	$0	$0	None
135	M117	Continuous	37,471,000	149,884	0	$0	$0	$0	None
136	M126	Continuous	212,415	212,415	208,167	$377,526	$298,178	$2,865	Incinerator 70%
137	M126	Continuous	11,283	11,283	11,057	$18,222	$43,159	$7,806	Flare
138	M126	Continuous	8,400	420	13	$33,418	$163,366	$25,931,111	Flare
139	M146	Continuous	306,000	31	0	$0	$0	$0	None
140	M23	Continuous	13,226	13,226	12,961	$23,083	$90,421	$13,952	Flare
141	M255	Continuous	57,300	57,300	56,154	$373,237	$292,483	$10,417	Incinerator 70%
142	M256	Continuous	54,880	54,880	53,782	$377,562	$302,995	$11,267	Incinerator 70%

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
143	M258	Continuous	12,440	12,440	12,191	$18,464	$48,257	$7,917	Flare
144	M258	Continuous	1,188,000	11,880	0	$0	$0	$0	None
145	M258	Continuous	3,288,000	32,880	0	$0	$0	$0	None
146	M258	Continuous	292,000	2,920	0	$0	$0	$0	None
147	M259	Continuous	840,000	8,400	0	$0	$0	$0	None
148	M259	Continuous	284,360	2,844	0	$0	$0	$0	None
149	M260	Continuous	163,194	163,194	159,930	$377,404	$281,457	$3,520	Incinerator 70%
150	M262	Continuous	1,313,333	3,940	0	$0	$0	$0	None
151	M262	Continuous	60,000	180	0	$0	$0	$0	None
152	M262	Continuous	11,980,000	35,940	0	$0	$0	$0	None
153	M269	Continuous	340,200	340,200	333,396	$0	$0	$0	Flare
154	M269	Continuous	3,999,985	16,000	0	$0	$0	$0	None
155	M271	Continuous	160,000	160	0	$0	$0	$0	None
156	M271	Continuous	1,020,000	1,020	0	$0	$0	$0	None
157	M271	Continuous	2,000	2	0	$0	$0	$0	None
158	M271	Continuous	2,000,000	2,000	0	$0	$0	$0	None
159	M271	Continuous	12,620,000	12,620	0	$0	$0	$0	None
160	M271	Continuous	5,600,000	5,600	0	$0	$0	$0	None
161	M271	Continuous	16,200,000	16,200	0	$0	$0	$0	None
162	M271	Continuous	6,200,000	6,200	0	$0	$0	$0	None
163	M271	Continuous	2,000,000	2,000	0	$0	$0	$0	None
164	M271	Continuous	7,600,000	7,600	0	$0	$0	$0	None
165	M271	Continuous	2,200,000	2,200	0	$0	$0	$0	None
166	M271	Continuous	620,000	620	0	$0	$0	$0	None
167	M271	Continuous	97,700	1,954	0	$0	$0	$0	None
168	M277	Continuous	40,800	40,800	39,984	$311,445	$189,310	$9,469	Incinerator 70%
169	M277	Continuous	19,157	19,157	18,774	$33,140	$196,505	$20,934	Flare
170	M277	Continuous	29,600	7,400	1,702	$281,420	$152,941	$179,719	Incinerator 70%
171	M277	Continuous	66,000	660	0	$0	$0	$0	None
172	M277	Continuous	316,200	3,162	0	$0	$0	$0	None
173	M279	Continuous	33,091	33,091	32,429	$32,719	$110,099	$6,790	Flare
174	M279	Continuous	18,779	18,779	18,403	$32,712	$110,514	$12,010	Flare
175	M279	Continuous	7,057	7,057	6,916	$33,187	$184,415	$53,330	Flare
176	M279	Continuous	53,500	535	0	$0	$0	$0	None
177	M279	Continuous	1,671,220	16,712	0	$0	$0	$0	None
178	M280	Continuous	146,670	2,933	0	$0	$0	$0	None
179	M280	Continuous	483,350	9,667	0	$0	$0	$0	None
180	M280	Continuous	1,654,000	165	0	$0	$0	$0	None
181	M281	Continuous	13,142	13,142	12,879	$46,047	$22,120	$3,435	Flare
182	M281	Continuous	591,320	591,320	579,494	$409,716	$334,190	$1,153	Incinerator 70%
183	M281	Continuous	26,000	260	0	$0	$0	$0	None
184	M297	Continuous	52,000	5	0	$0	$0	$0	None
185	M299	Continuous	245,200	12,260	368	$377,260	$261,887	$1,424,073	Incinerator 70%
186	M299	Continuous	21,800	872	17	$377,610	$309,548	$35,498,624	Incinerator 70%
187	M299	Continuous	530,034	10,634	1	$376,867	$208,513	$623,828,501	Incinerator 70%
188	M300	Continuous	7,120	71	0	$0	$0	$0	None
189	M300	Continuous	7,120	71	0	$0	$0	$0	None
190	M300	Continuous	25,300	506	0	$0	$0	$0	None

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
191	M300	Continuous	355,300	7,106	0	$0	$0	$0	None
192	M301	Continuous	81,760	8,176	654	$46,103	$407,659	$1,246,511	Flare
193	M301	Continuous	81,760	8,176	654	$46,103	$407,659	$1,246,511	Flare
194	M301	Continuous	42,300	4,230	338	$46,138	$409,498	$2,420,201	Flare
195	M301	Continuous	39,000	3,900	312	$46,141	$409,652	$2,625,974	Flare
196	M301	Continuous	28,600	2,860	229	$46,151	$410,137	$3,585,114	Flare
197	M301	Continuous	26,400	2,640	211	$46,153	$410,240	$3,884,848	Flare
198	M301	Continuous	17,720	1,772	142	$46,160	$410,644	$5,793,510	Flare
199	M303	Continuous	142,631	142,631	139,778	$377,434	$285,546	$4,086	Incinerator 70%
200	M303	Continuous	663,010	663	0	$0	$0	$0	None
201	M306	Continuous	14,060	14,060	13,779	$18,429	$27,790	$4,034	Flare
202	M306	Continuous	62,360	62,360	61,113	$18,437	$44,351	$1,451	Flare
203	M306	Continuous	130,000	2,600	0	$0	$0	$0	None
204	M306	Continuous	726,000	14,520	0	$0	$0	$0	None
205	M307	Continuous	45,720	4,572	366	$377,617	$310,527	$1,697,982	Incinerator 70%
206	M307	Continuous	204,988	16,399	984	$377,531	$298,769	$607,291	Incinerator 70%
207	M307	Continuous	1,180,300	23,606	0	$0	$0	$0	None
208	M311	Continuous	32,900	658	0	$0	$0	$0	None
209	M311	Continuous	3,700	74	0	$0	$0	$0	None
210	M311	Continuous	7,450	149	0	$0	$0	$0	None
211	M314	Continuous	27,097	2,904	253	$424,089	$438,502	$3,464,445	Incinerator 70%
212	M314	Continuous	34,660	3,466	277	$234,839	$106,588	$768,811	Incinerator 70%
213	M314	Continuous	18,020	901	27	$268,100	$137,305	$10,159,452	Incinerator 70%
214	M314	Continuous	559,009	559	0	$0	$0	$0	None
215	M314	Continuous	466,100	9,468	3	$418,765	$368,566	$248,549,711	Incinerator 70%
216	M314	Continuous	221,960	4,440	0	$0	$0	$0	None
217	M315	Continuous	29,184,000	145,920	0	$0	$0	$0	None
218	M320	Continuous	214,000	3,210	0	$0	$0	$0	None
219	M320	Continuous	372,000	5,580	0	$0	$0	$0	None
220	M320	Continuous	335,867	5,038	0	$0	$0	$0	None
221	M320	Continuous	840,000	12,600	0	$0	$0	$0	None
222	M322	Continuous	1,066,000	10,660	0	$0	$0	$0	None
223	M325	Continuous	378,600	378,600	371,028	$319,141	$147,192	$793	Incinerator 70%
224	M325	Continuous	8,280	8,280	8,114	$18,235	$43,452	$10,710	Flare
225	M328	Continuous	742,000	742,000	727,160	$377,233	$258,247	$710	Incinerator 70%
226	M330	Continuous	30,620	30,620	30,008	$18,270	$42,401	$2,826	Flare
227	M330	Continuous	18,000	18,000	17,640	$18,340	$43,166	$4,894	Flare
228	M330	Continuous	9,000	9,000	8,820	$18,245	$43,142	$9,783	Flare
229	M337	Continuous	799,600	7,996	0	$0	$0	$0	None
230	M343	Continuous	10,000	10,000	9,800	$18,210	$43,247	$8,826	Flare
231	M343	Continuous	9,200	9,200	9,016	$45,241	$297,464	$65,986	Flare
232	M343	Continuous	6,560	6,560	6,429	$18,199	$43,280	$13,464	Flare
233	M343	Continuous	1,400,000	140	0	$0	$0	$0	None
234	M343	Continuous	200,000	20	0	$0	$0	$0	None
235	M343	Continuous	9,000,000	900	0	$0	$0	$0	None
236	M347	Continuous	108,882	108,882	106,704	$377,483	$292,257	$5,478	Incinerator 70%
237	M350	Continuous	495,200	9,904	0	$0	$0	$0	None
238	M351	Continuous	149,900	29,980	5,396	$22,830	$63,677	$23,600	Flare

	MFID	Process Type	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
239	M351	Continuous	86,300	17,260	3,107	$32,994	$119,753	$77,091	Flare
240	M351	Continuous	76,720	15,344	2,762	$22,769	$59,578	$43,142	Flare
241	M351	Continuous	26,555	5,311	956	$18,643	$53,748	$112,446	Flare
242	M351	Continuous	11,857	166	0	$0	$0	$0	None
243	M358	Continuous	1,184,680	59,234	1,777	$45,653	$291,317	$327,871	Flare
244	M359	Continuous	84,550	1,691	0	$0	$0	$0	None
245	M44	Continuous	16,140	16,140	15,817	$18,301	$43,840	$5,543	Flare
246	M44	Continuous	89,000	8,900	712	$18,473	$43,548	$122,326	Flare
247	M44	Continuous	7,880	79	0	$0	$0	$0	None
248	M44	Continuous	41,000	820	0	$0	$0	$0	None
Subtotals:				11,615,156	6,659,833	$25,077,192	$28,171,671	$8,460	
Batch Totals:				6,267,656	3,074,895	$15,681,084	$16,928,839	$11,011	
Continuous Totals:				5,347,500	3,584,939	$9,396,108	$11,242,832	$6,272	
All Continuous Totals:				10,694,999	7,169,877	$18,792,216	$22,485,664	$6,272	
National Totals:				16,962,656	10,244,772	$34,473,300	$39,414,503	$7,695	

ATTACHMENT 4

Estimated Impacts Associated with
Batch Vertical Storage Tank Control Requirements of the
MACT Floor Regulatory Option

Vertical Tanks with HAP Partial Pressure =>1.0 psia and IFR Control Cost (MACT Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	10	Tank 01	1.29	467			467	444	$11,960	$2,932	$13,205
2	10	Tank 03	1.33	183			183	174	$10,445	$2,586	$29,674
3	10	Tank 09	1.29	1,038			1,038	987	$12,031	$2,886	$5,851
4	10	Tank 11	1.29	238			238	226	$10,467	$2,586	$22,922
5	10	Tank 13	1.06	556			556	529	$10,467	$2,550	$9,647
6	10	Tank 15	1.29	639			639	607	$10,467	$2,540	$8,363
7	10	Tank 18	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
8	10	Tank 19	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
9	10	Tank 20	1.93	879			879	835	$10,467	$2,513	$6,022
10	10	Tank 24	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
11	10	Tank 25	1.93	1,441	Scrubber	85	144	144	$14,646	$3,639	$50,518
12	10	Tank 26	1.93	1,441	Scrubber	85	144	144	$14,646	$3,639	$50,518
13	10	Tank 27	1.93	2,257	Scrubber	85	226	226	$14,646	$3,629	$32,151
14	10	Tank 29	1.11	490			490	465	$10,467	$2,557	$10,991
15	10	Tank 32	2.38	910			910	864	$9,769	$2,336	$5,406
16	11	TK-0011	2.50	92			92	87	$12,077	$3,004	$68,879
17	11	TK-0014	2.50	611			611	580	$12,077	$2,945	$10,151
18	11	TK-0080	1.20	336			336	319	$20,747	$5,140	$32,192
19	11	TK-0370	8.80	169			169	161	$12,077	$2,995	$37,262
20	11	TK-0430	1.50	419			419	398	$9,811	$2,402	$12,061
21	11	TK-0930	1.00	114			114	109	$9,806	$2,435	$44,870
22	27	METHANOL	1.95	599			599	569	$10,511	$2,556	$8,982
23	31	210/3025	1.80	770			770	732	$9,669	$2,326	$6,359
24	31	242/3001	1.50	961			961	913	$9,803	$2,338	$5,123
25	31	242/3002	1.50	961			961	913	$9,803	$2,338	$5,123
26	31	313/3004	1.92	10,487			10,487	9,963	$28,501	$5,929	$1,190
27	31	333/3001	1.92	1,794			1,794	1,704	$14,436	$3,401	$3,992
28	31	340/3011	1.50	1,125			1,125	1,069	$9,803	$2,320	$4,341
29	33	209	1.90	329			329	313	$9,669	$2,376	$15,203

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
30	33	646	1.30	44			44	41	$11,317	$2,820	$136,056
31	33	682	1.90	196			196	186	$11,317	$2,803	$30,158
32	36	RM14	2.40	5,130			5,130	4,873	$12,881	$2,635	$1,081
33	36	RTK34	1.80	297			297	283	$10,511	$2,590	$18,335
34	38	102	2.40	3,596			3,596	3,416	$10,511	$2,217	$1,298
35	41	115	1.40	258	Thermal oxidizer	93	6	6	$10,126	$2,527	$888,988
36	41	149	2.20	2,128			2,128	2,022	$9,700	$2,181	$2,157
37	41	199	2.20	2,794			2,794	2,654	$10,524	$2,311	$1,741
38	41	CR-164	2.20	3,852			3,852	3,660	$10,552	$2,198	$1,201
39	41	CR-166	2.20	3,789			3,789	3,600	$10,552	$2,205	$1,225
40	42	160	1.22	659			659	626	$10,422	$2,527	$8,068
41	42	180	1.80	313			313	297	$9,700	$2,386	$16,072
42	43	1010	2.44	2,206			2,206	2,096	$12,866	$2,962	$2,827
43	43	1020	2.44	1,843			1,843	1,751	$12,866	$3,003	$3,430
44	43	1030	2.44	2,441			2,441	2,319	$12,866	$2,935	$2,531
45	43	1060	2.44	1,337			1,337	1,271	$11,317	$2,674	$4,209
46	43	1130	2.44	1,843			1,843	1,751	$12,866	$3,003	$3,430
47	43	1200	2.44	823			823	782	$11,317	$2,732	$6,986
48	43	1210	1.17	750			750	712	$11,317	$2,740	$7,693
49	45	T-1141	1.54	938			938	891	$11,317	$2,719	$6,101
50	45	T-596	1.54	698			698	663	$11,317	$2,746	$8,279
51	48	VS 2704	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
52	48	VS 703	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
53	48	VS 704	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
54	52	T-2431	1.00	2,442			2,442	2,320	$12,719	$2,899	$2,499
55	52	T-2457	3.25	3,947			3,947	3,750	$11,185	$2,346	$1,251
56	53	11-211	1.74	173			173	165	$9,720	$2,407	$29,250
57	53	11-235	1.81	249			249	236	$9,720	$2,398	$20,310
58	53	16-237	1.74	78			78	74	$10,554	$2,625	$71,159
59	57	ALA05/4E	1.20	2,300			2,300	2,185	$10,468	$2,353	$2,154
60	57	ALA07	1.95	291			291	276	$10,440	$2,573	$18,616
61	60	Tank 61	2.00	1,092			1,092	1,038	$11,279	$2,692	$5,189

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
62	60	Tank 64	3.00	1,401			1,401	1,331	$11,279	$2,657	$3,992
63	60	Tank 73	2.00	689			689	654	$11,279	$2,737	$8,369
64	63	V-33	6.15	422			422	401	$10,511	$2,576	$12,858
65	63	V-47	3.01	1,484			1,484	1,410	$10,511	$2,456	$3,484
66	63	V-48	3.01	3,482			3,482	3,308	$10,511	$2,230	$1,348
67	63	V-50	13.63	9,453			9,453	8,980	$10,511	$1,555	$346
68	63	V-51	2.46	1,130			1,130	1,074	$10,511	$2,496	$4,648
69	63	V-52	13.63	11,167			11,167	10,609	$10,511	$1,361	$257
70	63	V-53	2.85	4,374			4,374	4,155	$10,511	$2,129	$1,025
71	63	V-54	2.85	3,472			3,472	3,299	$10,511	$2,231	$1,353
72	64	T027	1.86	592			592	563	$15,199	$3,727	$13,247
73	65	VT-1	3.66	2,531			2,531	2,404	$12,715	$2,888	$2,402
74	65	VT-201	3.66	2,531			2,531	2,404	$12,715	$2,888	$2,402
75	68	ST6	1.80	257			257	244	$10,554	$2,605	$21,370
76	68	ST7	1.90	159			159	151	$9,769	$2,420	$31,957
77	73	N110	2.01	495			495	471	$9,669	$2,357	$10,016
78	74	Y-210	2.45	403			403	383	$10,524	$2,581	$13,471
79	75	D501	1.90	474			474	450	$10,511	$2,570	$11,419
80	82	AT-3	1.91	250			250	238	$9,669	$2,385	$20,070
81	82	AT-4	1.91	172			172	164	$9,669	$2,394	$29,240
82	82	AT-6	1.91	211			211	200	$10,467	$2,589	$25,831
83	83	597	1.90	625	Condenser	90	31	31	$10,033	$2,501	$160,066
84	83	606	1.90	1,604	Condenser	90	80	80	$12,438	$3,095	$77,173
85	86	T-18	1.93	561			561	533	$11,180	$2,727	$10,233
86	87	2T116 (# 781)	1.39	107			107	102	$9,669	$2,401	$47,201
87	87	4T013 (# 690)	1.93	176			176	167	$9,669	$2,394	$28,602
88	89	T-1121	2.40	251			251	239	$9,672	$2,386	$20,004
89	90	C-132	1.34	4,908	Absorber	0	4,663	4,430	$15,535	$3,350	$1,513
90	90	C-133	1.34	4,908	Absorber	0	4,663	4,430	$15,535	$3,350	$1,513
91	92	211	1.35	464			464	440	$11,305	$2,769	$12,573
92	92	212	1.35	712			712	676	$11,305	$2,741	$8,110
93	92	216	1.35	547			547	519	$11,305	$2,760	$10,631

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
94	92	241	1.35	327			327	310	$11,307	$2,785	$17,954
95	92	252	1.35	311			311	295	$11,307	$2,787	$18,888
96	92	253	1.35	345			345	328	$11,307	$2,783	$16,966
97	92	260	18.83	75,303			75,303	71,538	$14,344	($4,931)	($138)
98	92	261	4.50	3,888			3,888	3,694	$14,344	$3,141	$1,701
99	92	304	1.51	298			298	283	$10,518	$2,592	$18,312
100	109	V129B	1.90	355			355	338	$9,720	$2,386	$14,138
101	110	V-334	1.87	191			191	182	$9,793	$2,423	$26,698
102	110	V-372	1.87	191			191	182	$9,793	$2,423	$26,698
103	110	V-374	1.87	191			191	182	$9,793	$2,423	$26,698
104	110	V-376	1.87	191			191	182	$9,793	$2,423	$26,698
105	112	02TK101	2.34	1,056			1,056	1,003	$11,180	$2,671	$5,327
106	112	02TK102	2.29	1,372			1,372	1,304	$11,294	$2,664	$4,087
107	112	02TK103	1.96	906			906	860	$15,173	$3,685	$8,566
108	112	02TK104	2.11	2,762			2,762	2,624	$11,287	$2,505	$1,909
109	112	02TK150	1.68	435			435	413	$10,511	$2,574	$12,450
110	112	02TK254	1.96	366			366	347	$11,268	$2,771	$15,956
111	112	02TK255	2.16	262			262	249	$11,268	$2,783	$22,346
112	112	03TK305B	1.96	301			301	286	$10,498	$2,586	$18,115
113	112	03TK310	1.12	305	Condenser		305	290	$10,892	$2,684	$18,517
114	112	03V309	1.21	127	Condenser		127	121	$10,892	$2,704	$44,878
115	112	03V310	2.16	246	Condenser		246	234	$11,578	$2,862	$24,474
116	112	03V381	1.12	305	Condenser		305	290	$10,892	$2,684	$18,517
117	112	04TK433	2.34	1,367			1,367	1,299	$12,055	$2,855	$4,397
118	119	T-114	2.35	795			795	756	$9,803	$2,357	$6,239
119	119	T-128	1.87	228			228	217	$9,765	$2,411	$22,233
120	124	Tank 15	1.38	231			231	220	$10,511	$2,597	$23,618
121	125	101	1.95	203	Condenser	71	49	49	$10,805	$2,691	$110,240
122	134	TF-32	2.26	2,976			2,976	2,827	$15,221	$3,463	$2,450
123	134	TF-42	4.44	3,187			3,187	3,028	$15,221	$3,439	$2,272
124	134	TF-49	3.23	1,664			1,664	1,580	$15,221	$3,611	$4,570
125	135	TF-13A	2.90	376			376	357	$11,317	$2,782	$15,588

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
126	135	TF-2	2.07	1,572			1,572	1,494	$15,221	$3,621	$4,848
127	136	101-A-03	3.53	1,214			1,214	1,153	$15,221	$3,662	$6,350
128	137	C-10	1.35	470			470	447	$10,526	$2,574	$11,527
129	137	C-11	1.35	470			470	447	$10,526	$2,574	$11,527
130	137	C-12	1.78	619			619	588	$10,526	$2,557	$8,703
131	141	CRU-#068	1.76	3,112			3,112	2,957	$12,100	$2,668	$1,805
132	141	CRU-#072	1.72	2,697			2,697	2,562	$10,490	$2,313	$1,806
133	147	T-6240	1.90	6	Scrubber	90	0	0	$11,538	$2,880	$18,483,627
134	147	T-6250	1.90	6	Scrubber	90	0	0	$11,538	$2,880	$18,483,627
135	149	S404	2.35	1,216			1,216	1,155	$11,317	$2,687	$4,653
136	149	S405	1.66	436			436	414	$11,317	$2,775	$13,402
137	150	V-53	2.18	168	N2 Blkt		168	160	$10,107	$2,504	$31,302
138	150	V-56	2.18	324	N2 Blkt		324	308	$10,107	$2,486	$16,166
139	150	V-57	2.18	266	N2 Blkt		266	252	$10,107	$2,493	$19,753
140	156	DT-02A	1.77	518			518	492	$9,714	$2,366	$9,612
141	156	DT-02B	1.77	469			469	445	$9,714	$2,372	$10,654
142	156	DT-06	1.77	482			482	458	$9,701	$2,367	$10,346
143	156	DT-08A	1.77	359			359	341	$9,714	$2,384	$13,979
144	156	DT-08C	1.77	359			359	341	$9,714	$2,384	$13,979
145	156	DT-09A	1.77	359			359	341	$9,714	$2,384	$13,979
146	156	DT-09B	1.77	359			359	341	$9,714	$2,384	$13,979
147	156	DT-09C	1.77	359			359	341	$9,714	$2,384	$13,979
148	156	DT-11	1.77	359			359	341	$9,714	$2,384	$13,979
149	156	DT-13	2.60	1,845	Scrubber	70	461	461	$12,288	$3,012	$13,058
150	156	DT-14	2.60	1,845	Scrubber	70	461	461	$12,288	$3,012	$13,058
151	156	DT-23	1.77	104			104	99	$9,753	$2,423	$48,924
152	156	DT-30A	1.77	359			359	341	$9,714	$2,384	$13,979
153	158	422-199	1.03	79	Insulated but not traced		79	75	$10,783	$2,682	$71,684
154	158	441-015	1.11	164			164	155	$11,949	$2,964	$38,125
155	158	441-027	6.00	1,437			1,437	1,365	$9,769	$2,276	$3,334
156	158	441-031	1.11	211			211	200	$9,769	$2,415	$24,113
157	158	441-281	6.00	2,142			2,142	2,035	$10,520	$2,384	$2,343

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
158	158	441-452	1.11	192			192	182	$12,881	$3,193	$35,057
159	158	445-008	1.11	211			211	200	$9,769	$2,415	$24,113
160	161	T-1	6.38	2,104	Condenser	22	1,536	1,536	$10,892	$2,536	$3,302
161	162	141-T-6 (5004)	1.76	946		0	899	854	$11,225	$2,700	$6,322
162	167	Tank 521	2.95	831	None	0	789	750	$10,852	$2,619	$6,985
163	167	Tank 714	6.99	2,825	Condenser	86	263	263	$10,015	$2,468	$18,789
Total:				279,879			395,985	249,101	$1,858,996	$434,367	$3,487

ATTACHMENT 5

Estimated Impacts Associated with
Batch Vertical Storage Tank Control Requirements of the
Above-the-floor Regulatory Option

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	10	Tank 01	1.29	467			467	444	$11,960	$2,932	$13,205
2	10	Tank 03	1.33	183			183	174	$10,445	$2,586	$29,674
3	10	Tank 07	0.52	1,254			1,254	1,192	$12,031	$2,861	$4,802
4	10	Tank 09	1.29	1,038			1,038	987	$12,031	$2,886	$5,851
5	10	Tank 11	1.29	238			238	226	$10,467	$2,586	$22,922
6	10	Tank 13	1.06	556			556	529	$10,467	$2,550	$9,647
7	10	Tank 15	1.29	639			639	607	$10,467	$2,540	$8,363
8	10	Tank 16	0.54	436			436	414	$10,467	$2,563	$12,388
9	10	Tank 18	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
10	10	Tank 19	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
11	10	Tank 20	1.93	879			879	835	$10,467	$2,513	$6,022
12	10	Tank 21	0.76	536			536	509	$12,031	$2,942	$11,554
13	10	Tank 23	0.76	550			550	522	$12,031	$2,941	$11,266
14	10	Tank 24	1.93	1,567	Scrubber	85	157	157	$14,646	$3,637	$46,411
15	10	Tank 25	1.93	1,441	Scrubber	85	144	144	$14,646	$3,639	$50,518
16	10	Tank 26	1.93	1,441	Scrubber	85	144	144	$14,646	$3,639	$50,518
17	10	Tank 27	1.93	2,257	Scrubber	85	226	226	$14,646	$3,629	$32,151
18	10	Tank 28	0.91	319			319	303	$10,467	$2,577	$17,011
19	10	Tank 29	1.11	490			490	465	$10,467	$2,557	$10,991
20	10	Tank 30	0.60	945			945	898	$10,467	$2,506	$5,580
21	10	Tank 32	2.38	910			910	864	$9,769	$2,336	$5,406
22	11	TK-0011	2.50	92			92	87	$12,077	$3,004	$68,879
23	11	TK-0014	2.50	611			611	580	$12,077	$2,945	$10,151
24	11	TK-0080	1.20	336			336	319	$20,747	$5,140	$32,192
25	11	TK-0130	0.50	26			26	25	$9,769	$2,435	$195,626
26	11	TK-0370	8.80	169			169	161	$12,077	$2,995	$37,262
27	11	TK-0430	1.50	419			419	398	$9,811	$2,402	$12,061
28	11	TK-0930	1.00	114			114	109	$9,806	$2,435	$44,870
29	22	70S0148	0.64	376			376	357	$9,669	$2,371	$13,267
30	24	S0124	0.64	237			237	225	$10,476	$2,588	$22,963

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
31	27	METHANOL	1.95	599			599	569	$10,511	$2,556	$8,982
32	31	210/3025	1.80	770			770	732	$9,669	$2,326	$6,359
33	31	242/3001	1.50	961			961	913	$9,803	$2,338	$5,123
34	31	242/3002	1.50	961			961	913	$9,803	$2,338	$5,123
35	31	313/3004	1.92	10,487			10,487	9,963	$28,501	$5,929	$1,190
36	31	333/3001	1.92	1,794			1,794	1,704	$14,436	$3,401	$3,992
37	31	340/3011	1.50	1,125			1,125	1,069	$9,803	$2,320	$4,341
38	32	71T6	0.56	1,593			1,593	1,513	$14,363	$3,405	$4,501
39	33	209	1.90	329			329	313	$9,669	$2,376	$15,203
40	33	508	0.66	71			71	67	$9,803	$2,439	$72,329
41	33	645	0.77	10			10	9	$11,320	$2,824	$595,372
42	33	646	1.30	44			44	41	$11,317	$2,820	$136,056
43	33	682	1.90	196			196	186	$11,317	$2,803	$30,158
44	33	953	0.85	196			196	186	$9,695	$2,398	$25,742
45	36	RM14	2.40	5,130			5,130	4,873	$12,881	$2,635	$1,081
46	36	RTK34	1.80	297			297	283	$10,511	$2,590	$18,335
47	38	102	2.40	3,596			3,596	3,416	$10,511	$2,217	$1,298
48	41	115	1.40	258	Thermal oxidizer	93	6	6	$10,126	$2,527	$888,988
49	41	138	0.60	725	Thermal oxidizer	93	16	16	$13,074	$3,261	$408,716
50	41	139	0.60	299	Thermal oxidizer	93	7	7	$13,074	$3,262	$990,943
51	41	149	2.20	2,128			2,128	2,022	$9,700	$2,181	$2,157
52	41	199	2.20	2,794			2,794	2,654	$10,524	$2,311	$1,741
53	41	CR-164	2.20	3,852			3,852	3,660	$10,552	$2,198	$1,201
54	41	CR-166	2.20	3,789			3,789	3,600	$10,552	$2,205	$1,225
55	41	CR-186	0.73	45			45	43	$9,769	$2,433	$114,302
56	42	160	1.22	659			659	626	$10,422	$2,527	$8,068
57	42	180	1.80	313			313	297	$9,700	$2,386	$16,072
58	42	185	0.50	840			840	798	$12,021	$2,905	$7,277
59	43	1010	2.44	2,206			2,206	2,096	$12,866	$2,962	$2,827
60	43	1012	0.57	117			117	112	$9,669	$2,400	$43,048
61	43	1020	3.23	2,619			2,619	2,488	$12,866	$2,915	$2,343
62	43	1030	3.23	3,465			3,465	3,292	$12,866	$2,820	$1,713
63	43	1060	2.44	1,337			1,337	1,271	$11,317	$2,674	$4,209
64	43	1070	0.79	588			588	558	$11,317	$2,758	$9,879

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
65	43	1080	0.79	289			289	274	$11,317	$2,792	$20,347
66	43	1130	3.23	2,619			2,619	2,488	$12,866	$2,915	$2,343
67	43	1150	0.79	298			298	283	$11,317	$2,791	$19,723
68	43	1180	0.79	606			606	576	$11,317	$2,756	$9,570
69	43	1200	3.23	1,165			1,165	1,107	$11,317	$2,693	$4,864
70	43	1210	1.17	750			750	712	$11,317	$2,740	$7,693
71	43	1240	0.79	307			307	291	$11,317	$2,790	$19,144
72	43	1360	3.16	1,231			1,231	1,170	$11,317	$2,686	$4,592
73	43	1370	0.79	230			230	219	$11,317	$2,799	$25,581
74	43	3073	0.56	640			640	608	$12,866	$3,139	$10,332
75	43	5101	0.96	1,182			1,182	1,123	$9,669	$2,280	$4,060
76	43	5102	0.96	1,182			1,182	1,123	$9,669	$2,280	$4,060
77	43	5103	0.96	712			712	676	$9,669	$2,333	$6,899
78	45	T-1141	1.54	938			938	891	$11,317	$2,719	$6,101
79	45	T-596	1.54	698			698	663	$11,317	$2,746	$8,279
80	48	VS 2704	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
81	48	VS 703	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
82	48	VS 704	2.50	2,264			2,264	2,151	$12,866	$2,955	$2,748
83	52	T-2421	0.58	307			307	292	$12,059	$2,975	$20,406
84	52	T-2431	1.00	2,442			2,442	2,320	$12,719	$2,899	$2,499
85	52	T-2457	3.25	3,947			3,947	3,750	$11,185	$2,346	$1,251
86	53	11-211	2.28	242			242	230	$9,720	$2,399	$20,874
87	53	11-213	0.54	19			19	18	$9,720	$2,424	$269,261
88	53	11-231	0.54	65			65	62	$9,720	$2,419	$78,169
89	53	11-233	0.57	133			133	126	$9,720	$2,411	$38,298
90	53	11-235	2.38	349			349	331	$9,720	$2,387	$14,416
91	53	11-241	0.57	45			45	43	$9,720	$2,421	$113,233
92	53	11-245	0.57	80			80	76	$9,720	$2,417	$63,588
93	53	16-217	0.55	22			22	21	$10,554	$2,632	$255,156
94	53	16-237	1.74	78			78	74	$10,554	$2,625	$71,159
95	57	ALA05/4E	1.20	2,300			2,300	2,185	$10,468	$2,353	$2,154
96	57	ALA07	1.95	291			291	276	$10,440	$2,573	$18,616
97	60	Tank 61	2.00	1,092			1,092	1,038	$11,279	$2,692	$5,189
98	60	Tank 64	3.00	1,401			1,401	1,331	$11,279	$2,657	$3,992

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
99	60	Tank 73	2.00	689			689	654	$11,279	$2,737	$8,369
100	63	V-33	6.15	422			422	401	$10,511	$2,576	$12,858
101	63	V-47	3.01	1,484			1,484	1,410	$10,511	$2,456	$3,484
102	63	V-48	3.01	3,482			3,482	3,308	$10,511	$2,230	$1,348
103	63	V-50	13.63	9,453			9,453	8,980	$10,511	$1,555	$346
104	63	V-51	2.46	1,130			1,130	1,074	$10,511	$2,496	$4,648
105	63	V-52	13.63	11,167			11,167	10,609	$10,511	$1,361	$257
106	63	V-53	2.85	4,374			4,374	4,155	$10,511	$2,129	$1,025
107	63	V-54	2.85	3,472			3,472	3,299	$10,511	$2,231	$1,353
108	64	T027	1.86	592			592	563	$15,199	$3,727	$13,247
109	64	T191	0.87	372			372	354	$12,096	$2,977	$16,827
110	65	VT-1	3.66	2,531			2,531	2,404	$12,715	$2,888	$2,402
111	65	VT-201	3.66	2,531			2,531	2,404	$12,715	$2,888	$2,402
112	68	ST12	0.70	716			716	680	$9,769	$2,358	$6,937
113	68	ST2	0.60	618			618	587	$12,866	$3,141	$10,705
114	68	ST6	1.80	257			257	244	$10,554	$2,605	$21,370
115	68	ST7	1.90	159			159	151	$9,769	$2,420	$31,957
116	73	N110	2.01	495			495	471	$9,669	$2,357	$10,016
117	73	T312	0.52	162			162	154	$9,669	$2,395	$31,035
118	74	Y-210	2.45	403			403	383	$10,524	$2,581	$13,471
119	75	D501	1.90	474			474	450	$10,511	$2,570	$11,419
120	80	RS-48	0.76	633			633	601	$9,669	$2,342	$7,794
121	82	AT-3	1.91	250			250	238	$9,669	$2,385	$20,070
122	82	AT-4	1.91	172			172	164	$9,669	$2,394	$29,240
123	82	AT-6	1.91	211			211	200	$10,467	$2,589	$25,831
124	83	597	1.90	625	Condenser	90	31	31	$10,033	$2,501	$160,066
125	83	606	1.90	1,604	Condenser	90	80	80	$12,438	$3,095	$77,173
126	86	T-18	1.93	561			561	533	$11,180	$2,727	$10,233
127	87	2T116 (# 781)	1.39	107			107	102	$9,669	$2,401	$47,201
128	87	4T013 (# 690)	1.93	176			176	167	$9,669	$2,394	$28,602
129	89	T-1121	2.40	251			251	239	$9,672	$2,386	$20,004
130	90	C-132	2.27	6,011	Absorber	0	5,711	5,425	$15,535	$3,232	$1,192
131	90	C-133	2.27	6,011	Absorber	0	5,711	5,425	$15,535	$3,232	$1,192
132	92	11	0.68	157			157	149	$10,518	$2,607	$34,915

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
133	92	12	0.68	150			150	143	$10,518	$2,608	$36,604
134	92	13	0.68	145			145	138	$10,517	$2,609	$37,895
135	92	14	0.68	136			136	130	$10,517	$2,610	$40,286
136	92	211	1.35	464			464	440	$11,305	$2,769	$12,573
137	92	212	1.35	712			712	676	$11,305	$2,741	$8,110
138	92	216	1.35	547			547	519	$11,305	$2,760	$10,631
139	92	236	0.68	299			299	284	$13,532	$3,344	$23,556
140	92	241	1.35	327			327	310	$11,307	$2,785	$17,954
141	92	252	1.35	311			311	295	$11,307	$2,787	$18,888
142	92	253	1.35	345			345	328	$11,307	$2,783	$16,966
143	92	260	18.83	75,303			75,303	71,538	$14,344	($4,931)	($138)
144	92	261	4.50	3,888			3,888	3,694	$14,344	$3,141	$1,701
145	92	304	1.51	298			298	283	$10,518	$2,592	$18,312
146	92	344	0.79	396			396	376	$11,990	$2,948	$15,690
147	92	620	0.86	237			237	225	$12,858	$3,183	$28,251
148	92	622	0.86	190			190	181	$12,858	$3,188	$35,313
149	92	712	0.72	569			569	540	$26,790	$6,622	$24,518
150	109	V129B	1.90	355			355	338	$9,720	$2,386	$14,138
151	110	V-334	1.87	191			191	182	$9,793	$2,423	$26,698
152	110	V-372	1.87	191			191	182	$9,793	$2,423	$26,698
153	110	V-374	1.87	191			191	182	$9,793	$2,423	$26,698
154	110	V-376	1.87	191			191	182	$9,793	$2,423	$26,698
155	112	02TK101	2.34	1,056			1,056	1,003	$11,180	$2,671	$5,327
156	112	02TK102	2.29	1,372			1,372	1,304	$11,294	$2,664	$4,087
157	112	02TK103	1.96	906			906	860	$15,173	$3,685	$8,566
158	112	02TK104	2.11	2,762			2,762	2,624	$11,287	$2,505	$1,909
159	112	02TK150	1.68	435			435	413	$10,511	$2,574	$12,450
160	112	02TK254	1.96	366			366	347	$11,268	$2,771	$15,956
161	112	02TK255	2.16	262			262	249	$11,268	$2,783	$22,346
162	112	03TK305B	1.96	301			301	286	$10,498	$2,586	$18,115
163	112	03TK310	1.12	305	Condenser		305	290	$10,892	$2,684	$18,517
164	112	03V309	1.21	127	Condenser		127	121	$10,892	$2,704	$44,878
165	112	03V310	2.16	246	Condenser		246	234	$11,578	$2,862	$24,474
166	112	03V369	0.74	102	Condenser		102	97	$10,892	$2,707	$55,959

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
167	112	03V374	0.62	63	Condenser		63	60	$10,892	$2,711	$90,883
168	112	03V381	1.12	305	Condenser		305	290	$10,892	$2,684	$18,517
169	112	04TK433	2.34	1,367			1,367	1,299	$12,055	$2,855	$4,397
170	119	T-114	2.35	795			795	756	$9,803	$2,357	$6,239
171	119	T-128	1.87	228			228	217	$9,765	$2,411	$22,233
172	124	Tank 15	1.38	231			231	220	$10,511	$2,597	$23,618
173	125	101	1.95	203	Condenser	71	49	49	$10,805	$2,691	$110,240
174	134	TF-32	2.26	2,976			2,976	2,827	$15,221	$3,463	$2,450
175	134	TF-33	0.74	1,411			1,411	1,341	$15,221	$3,640	$5,430
176	134	TF-42	4.44	3,187			3,187	3,028	$15,221	$3,439	$2,272
177	134	TF-49	3.23	1,664			1,664	1,580	$15,221	$3,611	$4,570
178	135	TF-13A	2.90	376			376	357	$11,317	$2,782	$15,588
179	135	TF-14	0.87	365			365	347	$11,317	$2,783	$16,042
180	135	TF-17	0.95	410			410	390	$11,317	$2,778	$14,254
181	135	TF-2	2.07	1,572			1,572	1,494	$15,221	$3,621	$4,848
182	135	TF-6	0.66	980			980	931	$15,221	$3,688	$7,920
183	136	101-A-01	0.80	778			778	739	$15,221	$3,711	$10,043
184	136	101-A-03	3.53	1,214			1,214	1,153	$15,221	$3,662	$6,350
185	136	398-A-32	0.55	298			298	283	$11,317	$2,791	$19,717
186	136	398-A-34	0.65	209			209	199	$11,317	$2,801	$28,166
187	137	C-10	1.35	470			470	447	$10,526	$2,574	$11,527
188	137	C-11	1.35	470			470	447	$10,526	$2,574	$11,527
189	137	C-12	1.78	619			619	588	$10,526	$2,557	$8,703
190	137	C-9	0.75	258			258	245	$10,526	$2,598	$21,196
191	141	CRU-#068	1.76	3,112			3,112	2,957	$12,100	$2,668	$1,805
192	141	CRU-#072	1.72	2,697			2,697	2,562	$10,490	$2,313	$1,806
193	143	T1201	0.54	441			441	419	$10,529	$2,578	$12,307
194	143	T1202	0.54	441			441	419	$10,529	$2,578	$12,307
195	143	T1215	0.54	737			737	700	$10,556	$2,551	$7,289
196	143	T1216	0.54	798			798	758	$11,962	$2,895	$7,638
197	143	T203	0.54	1,187			1,187	1,128	$9,695	$2,286	$4,053
198	147	3056	0.60	144			144	136	$9,669	$2,397	$35,160
199	147	T-6240	1.90	6	Scrubber	90	0	0	$11,538	$2,880	$18,483,627
200	147	T-6250	1.90	6	Scrubber	90	0	0	$11,538	$2,880	$18,483,627

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
201	149	S404	2.35	1,216			1,216	1,155	$11,317	$2,687	$4,653
202	149	S405	1.66	436			436	414	$11,317	$2,775	$13,402
203	150	V-53	2.18	168	N2 Blkt		168	160	$10,107	$2,504	$31,302
204	150	V-56	2.18	324	N2 Blkt		324	308	$10,107	$2,486	$16,166
205	150	V-57	2.18	266	N2 Blkt		266	252	$10,107	$2,493	$19,753
206	150	V-61	0.51	70	N2 Blkt		70	66	$10,107	$2,515	$76,177
207	150	V-63	0.54	118	N2 Blkt		118	112	$10,107	$2,509	$44,755
208	150	V-64	0.55	65	N2 Blkt		65	62	$10,107	$2,515	$81,142
209	150	V-69	0.66	42	N2 Blkt		42	39	$10,107	$2,518	$127,591
210	156	DT-02A	1.77	518			518	492	$9,714	$2,366	$9,612
211	156	DT-02B	1.77	469			469	445	$9,714	$2,372	$10,654
212	156	DT-06	1.77	482			482	458	$9,701	$2,367	$10,346
213	156	DT-08A	1.77	359			359	341	$9,714	$2,384	$13,979
214	156	DT-08C	1.77	359			359	341	$9,714	$2,384	$13,979
215	156	DT-09A	1.77	359			359	341	$9,714	$2,384	$13,979
216	156	DT-09B	1.77	359			359	341	$9,714	$2,384	$13,979
217	156	DT-09C	1.77	359			359	341	$9,714	$2,384	$13,979
218	156	DT-11	1.77	359			359	341	$9,714	$2,384	$13,979
219	156	DT-13	2.60	1,845	Scrubber	70	461	461	$12,288	$3,012	$13,058
220	156	DT-14	2.60	1,845	Scrubber	70	461	461	$12,288	$3,012	$13,058
221	156	DT-22	0.66	2,071			2,071	1,968	$9,714	$2,191	$2,227
222	156	DT-23	1.77	104			104	99	$9,753	$2,423	$48,924
223	156	DT-30A	1.77	359			359	341	$9,714	$2,384	$13,979
224	156	XT-04A	0.66	1,826			1,826	1,735	$12,108	$2,816	$3,246
225	157	TK 5731	0.57	319			319	303	$9,720	$2,390	$15,792
226	158	422-199	1.03	79	Insulated but not traced		79	75	$10,783	$2,682	$71,684
227	158	441-015	1.11	164			164	155	$11,949	$2,964	$38,125
228	158	441-025	0.74	226			226	214	$9,769	$2,413	$22,505
229	158	441-027	6.00	1,437			1,437	1,365	$9,769	$2,276	$3,334
230	158	441-028	0.74	55			55	53	$9,769	$2,432	$92,314
231	158	441-031	1.11	211			211	200	$9,769	$2,415	$24,113
232	158	441-281	6.00	2,142			2,142	2,035	$10,520	$2,384	$2,343
233	158	441-421	0.72	138			138	131	$12,881	$3,200	$48,820
234	158	441-422	0.72	119			119	113	$12,881	$3,202	$56,757

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
235	158	441-452	1.11	192			192	182	$12,881	$3,193	$35,057
236	158	445-008	1.11	211			211	200	$9,769	$2,415	$24,113
237	161	T-1	6.38	2,104	Condenser	22	1,536	1,536	$10,892	$2,536	$3,302
238	162	141-T-6 (5004)	1.76	946		0	899	854	$11,225	$2,700	$6,322
239	167	Tank 521	2.95	831	None	0	789	750	$10,852	$2,619	$6,985
240	167	Tank 714	6.99	2,825	Condenser	86	263	263	$10,015	$2,468	$18,789
Total:				320,135			395,985	286,289	$2,729,115	$647,122	$4,521

ATTACHMENT 6

Estimated Impacts Associated with Batch Horizontal Storage Tank Control Requirements of the MACT Floor Regulatory Option

Horizontal Tanks with HAP Partial Pressure => 1.0 psia and Condenser Cost (MACT Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	28	TLI-4	9.55	16,465	Carbon adsorber	81	3,128	2,305	$24,558	$16,503	$14,319
2	28	TLI-5	9.55	31,537	Carbon adsorber	81	5,992	4,415	$28,105	$16,652	$7,543
3	134	23-6	2.79	1,223			1,223	1,162	$25,019	$16,812	$28,937
4	161	T-16	2.78	1,439			1,439	1,367	$23,636	$16,569	$24,237
5	166	TP930 HT-1	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
6	166	TP930 HT-6	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
7	166	TP930 HT13	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
8	137	U-9	1.95	349			349	332	$23,396	$16,527	$99,657
9	137	U-8	1.95	279			279	265	$22,925	$16,445	$123,927
10	10	Tank 05	1.93	1,216	Scrubber	85	182	122	$27,261	$17,203	$283,053
11	156	G-65-1	1.77	359			359	341	$23,735	$16,587	$97,263
12	84	T014	1.70	5,823			5,823	5,532	$31,285	$17,912	$6,475
13	84	T013	1.70	5,823			5,823	5,532	$31,285	$17,912	$6,475
14	130	T-325A	1.70	1,711			1,711	1,625	$25,888	$16,963	$20,878
15	141	PO-#129	1.63	880			880	836	$23,616	$16,566	$39,640
16	28	TS-146	1.62	332			332	315	$22,556	$16,381	$103,923
17	40	TF_ST104	1.49	274			274	260	$21,918	$16,269	$125,131
18	87	4T003 (# 672)	1.37	328			328	312	$21,832	$16,254	$104,277
19	57	ALA05	1.20	5,835			5,835	5,543	$26,323	$17,040	$6,148
20	2	T035	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
21	2	T038	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
22	2	T037	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
23	2	T036	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
Total:							335,137	38,496	$551,269	$381,534	$19,822

ATTACHMENT 7

Estimated Impacts Associated with
Batch Horizontal Storage Tank Control Requirements of the
Above-the-floor Regulatory Option

Horizontal Tanks with HAP Partial Pressure => 0.5 psia and Condenser Cost (Above Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	28	TLI-5	9.55	31,537	Carbon adsorber	81	5,992	4,415	$28,105	$16,652	$7,543
2	28	TLI-4	9.55	16,465	Carbon adsorber	81	3,128	2,305	$24,558	$16,503	$14,319
3	134	23-6	2.79	1,223			1,223	1,162	$25,019	$16,812	$28,937
4	161	T-16	2.78	1,439			1,439	1,367	$23,636	$16,569	$24,237
5	166	TP930 HT-1	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
6	166	TP930 HT-6	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
7	166	TP930 HT13	2.10	375	None	0	375	356	$23,017	$16,461	$92,354
8	137	U-9	1.95	349			349	332	$23,396	$16,527	$99,657
9	137	U-8	1.95	279			279	265	$22,925	$16,445	$123,927
10	10	Tank 05	1.93	1,216	Scrubber	85	182	122	$27,261	$17,203	$283,053
11	156	G-65-1	1.77	359			359	341	$23,735	$16,587	$97,263
12	84	T014	1.70	5,823			5,823	5,532	$31,285	$17,912	$6,475
13	84	T013	1.70	5,823			5,823	5,532	$31,285	$17,912	$6,475
14	130	T-325A	1.70	1,711			1,711	1,625	$25,888	$16,963	$20,878
15	141	PO-#129	1.63	880			880	836	$23,616	$16,566	$39,640
16	28	TS-146	1.62	332			332	315	$22,556	$16,381	$103,923
17	40	TF_ST104	1.49	274			274	260	$21,918	$16,269	$125,131
18	87	4T003 (# 672)	1.37	328			328	312	$21,832	$16,254	$104,277
19	57	ALA05	1.20	5,835			5,835	5,543	$26,323	$17,040	$6,148
20	2	T035	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
21	2	T038	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
22	2	T037	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
23	2	T036	1.16	1,885			1,885	1,790	$19,720	$15,889	$17,750
24	40	TF_ST144	0.60	134			134	127	$21,237	$16,151	$254,537
25	54	C-749	0.58	525			525	499	$20,623	$16,045	$64,332
26	54	C-751	0.58	698			698	663	$21,291	$16,162	$48,725
27	40	TF_ST118	0.54	795			795	755	$24,282	$16,682	$44,189
28	134	23-4	0.50	406			406	385	$21,528	$16,201	$84,075
Total:							335,137	40,925	$660,230	$462,775	$22,616

ATTACHMENT 8

Estimated Impacts Associated with Continuous Vertical Storage Tank Control Requirements of the MACT Floor Regulatory Option

Continuous Vertical Tanks with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	M262	HEXANE STORAGE TANKS D. 708/ TANKC6D708/ 34	2.93	9,067	FLARE & CONDENSER	100	27	0.00	$0	$0	$0
2	M262	HEXANE STORAGE TANKS D. 705/ TANKC6D705/ 34	2.93	156,000	FLARE & CONDENSER	100	468	0.00	$0	$0	$0
3	M44	TANKS 520-529,547,551,552/ FA05T500C/ EA05SK501	1.68	5,040	SCRUBBER	99	50	0.00	$0	$0	$0
4	M44	TANK T-382/ FB03T0382/ EB03FL1	1.93	14,600	FLARE-WASTE GAS,GROUND-(<30FT.)	98	292	0.00	$0	$0	$0
5	M289	TANK T-503/ 5T6040/ 5T6040	2.93	320	IFR	95	16	0.00	$0	$0	$0
6	M280	NO. 2 RECYCLE VA TANK/ 05TFL023/ 05TFL-023	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
7	M283	HEXANE STORAGE TANK 4702/ T-101/ T-101	2.93	22,000	IFR	95	1,100	0.00	$0	$0	$0
8	M283	HEXANE STORAGE TANK 4703/ T-102/ T-102	2.93	18,000	IFR	95	900	0.00	$0	$0	$0
9	M289	TANK 2T-502/ 5T6030/ 5T6030	2.93	320	IFR	95	16	0.00	$0	$0	$0
10	M289	TANK 2T-503/ 5T6050/ 5T6050	2.93	320	IFR	95	16	0.00	$0	$0	$0
11	M289	TANK T-501/ 5T6010/ 5T6010	2.93	320	IFR	95	16	0.00	$0	$0	$0
12	M289	TANK T-502/ 5T6020/ 5T6020	2.93	120	IFR	95	6	0.00	$0	$0	$0
13	M280	VINYL ACETATE TANK/ 05TFL018/ 05TFL-018	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
14	M300	TANK 4914/ AP1T4914/ AP1T4914	2.93	200	IFR	95	10	0.00	$0	$0	$0
15	M270	HEXANE STORAGE TANK/ TK-760/ 1796-04A	2.93	8,400	IFR	95	420	0.00	$0	$0	$0
16	M258	DRY METHANOL STORAGE TANK/ TC104DRYME/ CF104	1.93	11,600	IFR	95	580	0.00	$0	$0	$0
17	M257	SEAL FLUSH METHANOL TANK/ 984/ 984	1.93	5,200	IFR	95	260	0.00	$0	$0	$0
18	M258	SPENT HEXANE STORAGE TANK/ TC102SPTHX/ CF102	2.93	27,200	IFR	95	1,360	0.00	$0	$0	$0
19	M257	FRESH METHANOL TANK/ 982/ 982	1.93	4,640	IFR	95	232	0.00	$0	$0	$0
20	M257	MOTHER LIQUOR TANK--10.30/ 985/ 985	1.93	12,000	IFR	95	600	0.00	$0	$0	$0

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
21	M257	RECOVERED METHANOL TANK/ 983/ 983	1.93	9,560	IFR	95	478	0.00	$0	$0	$0
22	M257	MOTHER LIQUOR TANK--10.31/ 986/ 986	1.93	12,000	IFR	95	600	0.00	$0	$0	$0
23	M279	POLYMER TANK 1/ VS-236T/ VS-15	1.93	2,782	VAPOR-CONDENSERS	89	306	18.36	$16,327	$4,055	$441,721
24	M279	POLYMER TANK 2/ VS-237T/ VS-15	1.93	7,276	VAPOR-CONDENSERS	89	800	48.02	$16,327	$4,023	$167,541
25	M279	VINYL ACETATE (A DISTILLATE) TANK/ VS-18T/ VS-41	3.54	200	VAPOR-CONDENSERS	83	34	4.08	$19,498	$4,864	$2,384,314
26	M279	VINYL ACETATE (B DISTILLATE) TANK/ VS-268T/ VS-41	3.54	358	VAPOR-CONDENSERS	83	61	7.30	$19,498	$4,862	$1,332,785
27	M279	MILLION GAL VAM. TANK/ VS-11T/ VS-11	1.61	17,270	VAPOR-CONDENSERS	82	3,074	393.47	$44,072	$10,737	$54,576
28	M279	"B" PLANT CONVERTIBLE TANK/ VS-14T/ VS-38	1.93	2,386	VAPOR-CONDENSERS	79	492	76.69	$20,357	$5,037	$131,361
29	M279	METHYL ACETATE TANK/ VS-16T/ VS-39	1.93	9	VAPOR-CONDENSERS	77	2	0.40	$18,693	$4,666	$23,179,334
30	M44	TANKS 360 AND 361/ FB03T0361/ EB03CT361	1.93	7,938	VAPOR-CONDENSERS	68	2,540	685.80	$27,035	$6,493	$18,936
31	M44	TANK 364/ FB03T0364/ EB03CT364	1.93	112	VAPOR-CONDENSERS	68	36	9.72	$15,510	$3,868	$795,885
32	M279	VINYL "A" TANK/ VS-07T/ VS-10	1.61	8,784	NONE	0	8,784	8,345.18	$30,354	$6,583	$1,578
33	M279	VINYL "B" TANK/ VS-08T/ VS-10	1.61	6,919	NONE	0	6,919	6,572.86	$30,354	$6,794	$2,067
34	M279	VINYL ACETATE "B" DAY TANK/ VS-06T/ VS-10	1.61	4,745	NONE	0	4,745	4,507.94	$22,551	$5,092	$2,259
35	M279	VINYL "C" DAY TANK/ VS-10T/ VS-10	1.61	944	NONE	0	944	896.99	$22,551	$5,522	$12,312
36	M279	WASHWATER TANK/ VS-218T/ VS-366	1.93	89	NONE	0	89	84.55	$14,281	$3,554	$84,069
37	M280	BIG A CRUDE TANK/ 04TFX034A/ 04TVS-034	1.93	84	NONE	0	84	79.99	$34,823	$8,682	$217,077
38	M280	BIG B CRUDE TANK/ 04TFX034B/ 04TVS-034	1.93	8	NONE	0	8	7.98	$34,823	$8,691	$2,178,195
39	M280	CRUDE KA TANK - OP 1A/ 06TFX044/ 06TFX-044	1.93	18	NONE	0	18	16.72	$19,920	$4,970	$594,498
40	M279	SODIUM METHYLATE (NAOME DAY) TANK/ VS-20T/ VS-42	1.93	0	NONE	0	0	0.00	$9,720	$2,426	$4
41	M279	CENTRATE AND WASH TANK/ VS-265T/ VS-36	1.93	175	NONE	0	175	166.63	$30,354	$7,556	$90,692
42	M279	VINYL "C" TANK/ VS-09T/ VS-10	1.61	8,684	NONE	0	8,684	8,249.42	$30,354	$6,595	$1,599

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
43	M280	E REWORK TANK/ 04TFX026/ 04TFX-026	1.93	4	NONE	0	4	3.61	$22,578	$5,635	$3,121,884
44	M280	NO. 3 TWKA RECEIVER TANK - OP 1A/ 06TFX042/ 06TFX-042	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
45	M280	NO. 3 TWKA STORAGE TANK - OP 1/ 1A/ 06TFX013/ 06TFX-013	1.93	2	NONE	0	2	1.52	$33,821	$8,441	$11,106,579
46	M280	NO. 4 TWKA RECEIVER TANK - OP 1A/ 06TFX043/ 06TFX-043	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
47	M280	RECYCLE AQUA COLUMN TAILS TANK/ 04TFX031/ 04TFX-031	1.93	0	NONE	0	0	0.19	$9,769	$2,438	$25,663,158
48	M279	METHANOL STORAGE TANK/ VS-15T/ VS-37	1.93	883	NONE	0	883	839.04	$25,030	$6,148	$14,655
49	M126	METHANOL TANK 41/ MEOH TK 41/ PP-130F	1.93	1,560	NONE	0	1,560	1,482.00	$15,221	$3,623	$4,889
50	M280	WASTE ORGANIC STORAGE TANK/ 04TFX027/ 04TFX-027	1.93	215	NONE	0	215	204.06	$11,240	$2,781	$27,257
51	M280	F CRUDE DCH STORAGE TANK/ 04TFX025/ 04TFX-025	1.93	22	NONE	0	22	21.28	$22,578	$5,633	$529,417
52	M126	METHANOL TANK 41/ MEOH TK 41/ PJ-14I	1.93	1,340	NONE	0	1,340	1,273.00	$15,221	$3,648	$5,731
53	M280	HMI STORAGE TANK/ 04TFX033C/ 04TVS-033	1.93	5	NONE	0	5	4.75	$11,279	$2,815	$1,185,263
54	M279	INHIBITOR STORAGE TANK/ VS-23T/ VS-44	1.93	433	NONE	0	433	411.73	$11,240	$2,757	$13,392
55	M270	TANK STORAGE/ TK-902/ 03	2.93	723	NONE	0	723	686.85	$9,769	$2,357	$6,863
56	M270	TANK STORAGE/ TK-401/ 29	2.93	2,444	NONE	0	2,444	2,321.80	$9,669	$2,137	$1,841
57	M280	A CRUDE RECEIVER TANK/ 04TFX030A/ 04TVS-030	1.93	3	NONE	0	3	3.23	$14,309	$3,571	$2,211,146
58	M146	D-123 CHILLED WATER DRUM/ 5-1-D123/ 5-1-11	1.93	0	NONE	0	0	0	$13,532	$3,377	$17,773,684
59	M280	B CRUDE RECEIVER TANK/ 04TFX030B/ 04TVS-030	1.93	22	NONE	0	22	20.52	$14,309	$3,569	$347,856
60	M279	VINYL ACETATE "A" DAY TANK/ VS-05T/ VS-10	1.61	5,765	NONE	0	5,765	5,476.56	$22,551	$4,977	$1,818
61	M280	WASTE COLLECTION TANK/ 11TFX076/ 11TFX-076	1.93	0	NONE	0	0	0.19	$9,720	$2,426	$25,536,842
62	M358	3-150,000 GALLON POND PITCH/ HEADS TANKS/ 18	1.93	4,500	None	0	4,500	4,275.00	$32,814	$7,682	$3,594
63	M358	NEW ROSIN TANK, ST-25, PT SOURCE 12-87/ 50	1.93	3,882	None	0	3,882	3,687.90	$10,520	$2,187	$1,186

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
64	M358	2-16,900 GALLON RESIN STORAGE TANKS/ 17	1.93	7,765	None	0	7,765	7,376.75	$13,585	$2,513	$681
65	M358	2-9,800 GALLON ROSIN PRODUCT TANKS/ 15	1.93	3,882	None	0	3,882	3,687.90	$11,302	$2,382	$1,292
66	M306	TANK/ 2A/ 2A	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
67	M44	TANKS 530,531,532,533,534,535/ FA05T500D/ EA0500DTU	3.62	766	NONE	0	766	727.70	$12,100	$2,934	$8,064
68	M44	T-352,353,&354/ FB03T0354/ EB0300TU	1.93	130	NONE	0	130	123.50	$12,866	$3,197	$51,773
69	M293	STORAGE TANK/ 130T-F402/ 130T-F402	1.68	0	NONE	0	0	0.38	$32,823	$8,192	$43,115,789
70	M293	STORAGE TANK/ 130T-F622/ 130T-F622	1.68	507	NONE	0	507	481.84	$12,066	$2,954	$12,261
71	M300	TANK 4845/ AP1T4845/ AP1T4845	1.93	318	NONE	0	318	302.10	$11,960	$2,949	$19,523
72	M300	TANK 4846/ AP1T4846/ AP1T4846	2.06	81	NONE	0	81	76.95	$14,416	$3,589	$93,281
73	M44	1100 PROCESS AREA/ FA1100P/ EA11LD1100	1.38	108	NONE	0	108	102.60	$9,669	$2,401	$46,803
74	M358	RXN. OIL, HEADS OR PITCH STORAGE TANK/ 23	1.93	4,500	None	0	4,500	4,275.00	$11,317	$2,316	$1,084
75	M306	TANK/ 2B/ 2B	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
76	M330	POLY ETHYLENE PLANT STORAGE TANK FARM/ PE MISCSTG/ M	2.32	8,868	NONE	0	8,868	8,424.60	$10,520	$1,623	$385
77	M343	R-1372 SCRUBBER/ TKR1372/ TKR1372	1.93	120,000	None	0	120,000	114,000	$9,669	($11,149)	($196)
78	M44	TANKS 500-512/ FA05T500B/ EA0500BTU	1.68	1,448	NONE	0	1,448	1,375.60	$14,281	$3,401	$4,945
79	M44	1100 PROCESS AREA/ FA1100P/ EA1100PU	6.93	2,916	NONE	0	2,916	2,770.20	$9,669	$2,084	$1,505
80	M44	TANKS 536-541,545,546,549,550/ FA05T500E/ EA0500ETU	2.06	218	NONE	0	218	207.29	$11,317	$2,800	$27,015
81	M44	TANKS 520-529,547,551,552/ FA05T500C/ EA0500CTU	1.68	1,450	NONE	0	1,450	1,377.50	$12,100	$2,856	$4,147
82	M358	RESIN PRODUCT STORAGE TANK, RS-21, PT. SOURCE 15/ 93	1.93	3,882	None	0	3,882	3,687.90	$12,866	$2,773	$1,504
83	M281	MIX TANK/ EP008T34/ 008T34	1.93	38			38	36.10	$10,467	$2,608	$144,488
84	M44	T-352,353,&354/ FB03T0354/ EB03CT354	1.93	18	PROCESS CHANGE		18	17.10	$13,204	$3,294	$385,263
85	M126	CRUDE DIBASIC ESTER TANK/ CDBE TK/ PD-20	1.93	3,880	VAPOR RECOVERY SYSTEM		3,880	3,686	$11,578	$2,451	$1,330
86	M281	FLUX OIL TANK FB-910/ OL225T910/ 225T910	3.16	1,528			1,528	1,451.41	$16,823	$4,026	$5,548

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
87	M281	MOLTEN STORAGE TANK-C-13/ EB065T74/ 030B11	2.93	562			562	533.90	$19,130	$4,711	$17,647
88	M281	MOLTEN STORAGE TANK-C-13/ EB065T74/ 030B11	2.93	562	VAPOR RECOVERY		562	533.90	$19,467	$4,796	$17,966
89	M281	REJECT TANK/ OX050T138/ 050T138	1.93	10			10	9.50	$15,221	$3,798	$799,579
90	M281	STORAGE TANK 40T-114/ SD022T114/ 022T114	13.29	2,300			2,300	2,185.00	$25,089	$6,002	$5,494
91	M281	STORAGE TANK 43 T-162/ OX026T162/ 027FL1	13.29	420			420	399.00	$13,561	$3,337	$16,727
92	M281	STORAGE TANK/ EP008T51/ 008T51	2.24	60			60	57.00	$9,769	$2,432	$85,333
93	M281	STORAGE TANK/ OX026T35/ 027FL1	13.29	60			60	57.00	$11,200	$2,789	$97,860
94	M281	TANK STORAGE/ OX026T32/ 027FL1	13.29	240			240	228.00	$12,725	$3,149	$27,623
95	M281	CRUDE NPG TANK/ OX050T191/ 050T191	1.93	460			460	437.00	$14,363	$3,533	$16,169
Total:							254,560	211,975	$1,262,035	$289,283	$2,728
National Total:							509,121	423,951	$2,524,070	$578,566	

ATTACHMENT 9

Estimated Impacts Associated with Continuous Vertical Storage Tank Control Requirements of the Above-the-floor Regulatory Option

Continuous Vertical Tanks with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor)

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	M262	HEXANE STORAGE TANKS D. 708/ TANKC6D708/ 34	2.93	9,067	FLARE & CONDENSER	100	27	0.00	$0	$0	$0
2	M262	HEXANE STORAGE TANKS D. 705/ TANKC6D705/ 34	2.93	156,000	FLARE & CONDENSER	100	468	0.00	$0	$0	$0
3	M44	TANKS 520-529,547,551,552/ FA05T500C/ EA05SK501	1.68	5,040	SCRUBBER	99	50	0.00	$0	$0	$0
4	M44	TANK T-382/ FB03T0382/ EB03FL1	1.93	14,600	FLARE-WASTE GAS,GROUND-(<30FT.)	98	292	0.00	$0	$0	$0
5	M257	RECOVERED METHANOL TANK/ 983/ 983	1.93	9,560	IFR	95	478	0.00	$0	$0	$0
6	M280	VINYL ACETATE TANK/ 05TFL018/ 05TFL-018	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
7	M280	NO. 2 RECYCLE VA TANK/ 05TFL023/ 05TFL-023	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
8	M289	TANK T-503/ 5T6040/ 5T6040	2.93	320	IFR	95	16	0.00	$0	$0	$0
9	M289	TANK T-502/ 5T6020/ 5T6020	2.93	120	IFR	95	6	0.00	$0	$0	$0
10	M270	HEXANE STORAGE TANK/ TK-760/ 1796-04A	2.93	8,400	IFR	95	420	0.00	$0	$0	$0
11	M258	SPENT HEXANE STORAGE TANK/ TC102SPTHX/ CF102	2.93	27,200	IFR	95	1,360	0.00	$0	$0	$0
12	M300	TANK 4914/ AP1T4914/ AP1T4914	2.93	200	IFR	95	10	0.00	$0	$0	$0
13	M257	SEAL FLUSH METHANOL TANK/ 984/ 984	1.93	5,200	IFR	95	260	0.00	$0	$0	$0
14	M257	MOTHER LIQUOR TANK--10.31/ 986/ 986	1.93	12,000	IFR	95	600	0.00	$0	$0	$0
15	M257	MOTHER LIQUOR TANK--10.30/ 985/ 985	1.93	12,000	IFR	95	600	0.00	$0	$0	$0
16	M257	FRESH METHANOL TANK/ 982/ 982	1.93	4,640	IFR	95	232	0.00	$0	$0	$0
17	M289	TANK T-501/ 5T6010/ 5T6010	2.93	320	IFR	95	16	0.00	$0	$0	$0
18	M289	TANK 2T-503/ 5T6050/ 5T6050	2.93	320	IFR	95	16	0.00	$0	$0	$0
19	M289	TANK 2T-502/ 5T6030/ 5T6030	2.93	320	IFR	95	16	0.00	$0	$0	$0
20	M283	HEXANE STORAGE TANK 4703/ T-102/ T-102	2.93	18,000	IFR	95	900	0.00	$0	$0	$0
21	M283	HEXANE STORAGE TANK 4702/ T-101/ T-101	2.93	22,000	IFR	95	1,100	0.00	$0	$0	$0

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
22	M258	DRY METHANOL STORAGE TANK/ TC104DRYME/ CF104	1.93	11,600	IFR	95	580	0.00	$0	$0	$0
23	M279	POLYMER TANK 1/ VS-236T/ VS-15	1.93	2,782	VAPOR-CONDENSERS	89	306	18.36	$16,327	$4,055	$441,721
24	M279	POLYMER TANK 2/ VS-237T/ VS-15	1.93	7,276	VAPOR-CONDENSERS	89	800	48.02	$16,327	$4,023	$167,541
25	M279	VINYL ACETATE (A DISTILLATE) TANK/ VS-18T/ VS-41	3.54	200	VAPOR-CONDENSERS	83	34	4.08	$19,498	$4,864	$2,384,314
26	M279	VINYL ACETATE (B DISTILLATE) TANK/ VS-268T/ VS-41	3.54	358	VAPOR-CONDENSERS	83	61	7.30	$19,498	$4,862	$1,332,785
27	M279	MILLION GAL VAM. TANK/ VS-11T/ VS-11	1.61	17,270	VAPOR-CONDENSERS	82	3,074	393.47	$44,072	$10,737	$54,576
28	M279	"B" PLANT CONVERTIBLE TANK/ VS-14T/ VS-38	1.93	2,386	VAPOR-CONDENSERS	79	492	76.69	$20,357	$5,037	$131,361
29	M279	METHYL ACETATE TANK/ VS-16T/ VS-39	1.93	9	VAPOR-CONDENSERS	77	2	0.40	$18,693	$4,666	$23,179,334
30	M44	TANK 364/ FB03T0364/ EB03CT364	1.93	112	VAPOR-CONDENSERS	68	36	9.72	$15,510	$3,868	$795,885
31	M44	TANKS 360 AND 361/ FB03T0361/ EB03CT361	1.93	7,938	VAPOR-CONDENSERS	68	2,540	685.80	$27,035	$6,493	$18,936
32	M279	WASHWATER TANK/ VS-218T/ VS-366	1.93	89	NONE	0	89	84.55	$14,281	$3,554	$84,069
33	M280	A CRUDE RECEIVER TANK/ 04TFX030A/ 04TVS-030	1.93	3	NONE	0	3	3.23	$14,309	$3,571	$2,211,146
34	M280	B CRUDE RECEIVER TANK/ 04TFX030B/ 04TVS-030	1.93	22	NONE	0	22	20.52	$14,309	$3,569	$347,856
35	M280	BIG A CRUDE TANK/ 04TFX034A/ 04TVS-034	1.93	84	NONE	0	84	79.99	$34,823	$8,682	$217,077
36	M279	VINYL "A" TANK/ VS-07T/ VS-10	1.61	8,784	NONE	0	8,784	8,345.18	$30,354	$6,583	$1,578
37	M280	BIG B CRUDE TANK/ 04TFX034B/ 04TVS-034	1.93	8	NONE	0	8	7.98	$34,823	$8,691	$2,178,195
38	M280	CRUDE KA TANK - OP 1A/ 06TFX044/ 06TFX-044	1.93	18	NONE	0	18	16.72	$19,920	$4,970	$594,498
39	M280	E REWORK TANK/ 04TFX026/ 04TFX-026	1.93	4	NONE	0	4	3.61	$22,578	$5,635	$3,121,884
40	M280	F CRUDE DCH STORAGE TANK/ 04TFX025/ 04TFX-025	1.93	22	NONE	0	22	21.28	$22,578	$5,633	$529,417
41	M280	HMI STORAGE TANK/ 04TFX033C/ 04TVS-033	1.93	5	NONE	0	5	4.75	$11,279	$2,815	$1,185,263

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
42	M279	SODIUM METHYLATE (NAOME DAY) TANK/ VS-20T/ VS-42	1.93	0	NONE	0	0	0.00	$9,720	$2,426	
43	M279	VINYL ACETATE "A" DAY TANK/ VS-05T/ VS-10	1.61	5,765	NONE	0	5,765	5,476.56	$22,551	$4,977	$1,818
44	M279	VINYL "C" TANK/ VS-09T/ VS-10	1.61	8,684	NONE	0	8,684	8,249.42	$30,354	$6,595	$1,599
45	M280	NO. 4 TWKA RECEIVER TANK - OP 1A/ 06TFX043/ 06TFX-043	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
46	M279	VINYL "B" TANK/ VS-08T/ VS-10	1.61	6,919	NONE	0	6,919	6,572.86	$30,354	$6,794	$2,067
47	M279	NORTH CO-MONOMER STORAGR TANK/ VS-22T/ VS-43	0.77	530	NONE	0	530	503.69	$9,669	$2,354	$9,347
48	M280	WASTE COLLECTION TANK/ 11TFX076/ 11TFX-076	1.93	0	NONE	0	0	0.19	$9,720	$2,426	$25,536,842
49	M280	WASTE ORGANIC STORAGE TANK/ 04TFX027/ 04TFX-027	1.93	215	NONE	0	215	204.06	$11,240	$2,781	$27,257
50	M279	VINYL "C" DAY TANK/ VS-10T/ VS-10	1.61	944	NONE	0	944	896.99	$22,551	$5,522	$12,312
51	M279	VINYL ACETATE "B" DAY TANK/ VS-06T/ VS-10	1.61	4,745	NONE	0	4,745	4,507.94	$22,551	$5,092	$2,259
52	M279	METHANOL STORAGE TANK/ VS-15T/ VS-37	1.93	883	NONE	0	883	839.04	$25,030	$6,148	$14,655
53	M44	TANKS 536-541,545,546,549,550/ FA05T500E/ EA0500ETU	2.06	218	NONE	0	218	207	$11,317	$2,800	$27,015
54	M44	TANKS 530,531,532,533,534,535/ FA05T500D/ EA0500DTU	3.62	766	NONE	0	766	727.70	$12,100	$2,934	$8,064
55	M279	INHIBITOR STORAGE TANK/ VS-23T/ VS-44	1.93	433	NONE	0	433	411.73	$11,240	$2,757	$13,392
56	M44	TANKS 520-529,547,551,552/ FA05T500C/ EA0500CTU	1.68	1,450	NONE	0	1,450	1,377.50	$12,100	$2,856	$4,147
57	M44	TANKS 500-512/ FA05T500B/ EA0500BTU	1.68	1,448	NONE	0	1,448	1,375.60	$14,281	$3,401	$4,945
58	M280	NO. 3 TWKA STORAGE TANK - OP 1/ 1A/ 06TFX013/ 06TFX-013	1.93	2	NONE	0	2	1.52	$33,821	$8,441	$11,106,579
59	M279	CENTRATE AND WASH TANK/ VS-265T/ VS-36	1.93	175	NONE	0	175	166.63	$30,354	$7,556	$90,692
60	M44	T-352,353,&354/ FB03T0354/ EB0300TU	1.93	130	NONE	0	130	123.50	$12,866	$3,197	$51,773
61	M280	RECYCLE AQUA COLUMN TAILS TANK/ 04TFX031/ 04TFX-031	1.93	0	NONE	0	0	0.19	$9,769	$2,438	$25,663,158
62	M270	TANK STORAGE/ TK-902/ 03	2.93	723	NONE	0	723	686.85	$9,769	$2,357	$6,863
63	M270	TANK STORAGE/ TK-401/ 29	2.93	2,444	NONE	0	2,444	2,321.80	$9,669	$2,137	$1,841

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
64	M146	D-123 CHILLED WATER DRUM/ 5-1-D123/ 5-1-11	1.93	0	NONE	0	0	0.38	$13,532	$3,377	$17,773,684
65	M126	METHANOL TANK 41/ MEOH TK 41/ PP-130F	1.93	1,560	NONE	0	1,560	1,482.00	$15,221	$3,623	$4,889
66	M126	METHANOL TANK 41/ MEOH TK 41/ PJ-14I	1.93	1,340	NONE	0	1,340	1,273.00	$15,221	$3,648	$5,731
67	M280	NO. 3 TWKA RECEIVER TANK - OP 1A/ 06TFX042/ 06TFX-042	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
68	M293	STORAGE TANK/ 130T-F402/ 130T-F402	1.68	0	NONE	0	0	0.38	$32,823	$8,192	$43,115,789
69	M293	STORAGE TANK/ 130T-F622/ 130T-F622	1.68	507	NONE	0	507	481.84	$12,066	$2,954	$12,261
70	M300	TANK 4845/ AP1T4845/ AP1T4845	1.93	318	NONE	0	318	302.10	$11,960	$2,949	$19,523
71	M300	TANK 4846/ AP1T4846/ AP1T4846	2.06	81	NONE	0	81	76.95	$14,416	$3,589	$93,281
72	M358	3-150,000 GALLON POND PITCH/ HEADS TANKS/ 18	1.93	4,500	None	0	4,500	4,275.00	$32,814	$7,682	$3,594
73	M306	TANK/ 2A/ 2A	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
74	M306	TANK/ 2B/ 2B	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
75	M306	TANK/ 3/ 3	0.71	260	NONE	0	260	247.00	$9,695	$2,391	$19,360
76	M330	POLY ETHYLENE PLANT STORAGE TANK FARM/ PE MISCSTG/ M	2.32	8,868	NONE	0	8,868	8,424.60	$10,520	$1,623	$385
77	M343	R-1372 SCRUBBER/ TKR1372/ TKR1372	1.93	120,000	None	0	120,000	114,000.00	$9,669	($11,149)	($196)
78	M358	2-16,900 GALLON RESIN STORAGE TANKS/ 17	1.93	7,765	None	0	7,765	7,376.75	$13,585	$2,513	$681
79	M358	2-9,800 GALLON ROSIN PRODUCT TANKS/ 15	1.93	3,882	None	0	3,882	3,687.90	$11,302	$2,382	$1,292
80	M358	RXN. OIL, HEADS OR PITCH STORAGE TANK/ 23	1.93	4,500	None	0	4,500	4,275.00	$11,317	$2,316	$1,084
81	M358	NEW ROSIN TANK, ST-25, PT SOURCE 12-87/ 50	1.93	3,882	None	0	3,882	3,687.90	$10,520	$2,187	$1,186
82	M358	RESIN PRODUCT STORAGE TANK, RS-21, PT. SOURCE 15/ 93	1.93	3,882	None	0	3,882	3,687.90	$12,866	$2,773	$1,504
83	M358	RESINATE TANKS, PT. SOURCES 4-84, 5-84 AND 6-84/ 30	0.71	6,666	None	0	6,666	6,332.70	$12,045	$2,253	$712
84	M358	ST-26 RESINATE TANK, PT SOURCE 1-88/ 57	0.71	2,244	None	0	2,244	2,131.80	$12,739	$2,926	$2,745
85	M358	TOLUENE TANK ST-4, POINT SOURCE 7-84/ 31	0.71	1,498	None	0	1,498	1,423.10	$12,049	$2,838	$3,988
86	M44	1100 PROCESS AREA/ FA1100P/ EA1100PU	6.93	2,916	NONE	0	2,916	2,770.20	$9,669	$2,084	$1,505

	Facility #	Tank ID	HAP Partial Pressure (psia)	Uncontrolled HAP Emissions (lb/yr)	Control Device	Control Efficiency	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
87	M44	1100 PROCESS AREA/ FA1100P/ EA11LD1100	1.38	108	NONE	0	108	102.60	$9,669	$2,401	$46,803
88	M281	MOLTEN STORAGE TANK-C-13/ EB065T74/ 030B11	2.93	562	VAPOR RECOVERY		562	533.90	$19,467	$4,796	$17,966
89	M44	T-352,353,&354/ FB03T0354/ EB03CT354	1.93	18	PROCESS CHANGE		18	17.10	$13,204	$3,294	$385,263
90	M126	CRUDE DIBASIC ESTER TANK/ CDBE TK/ PD-20	1.93	3,880	VAPOR RECOVERY SYSTEM		3,880	3,686	$11,578	$2,451	$1,330
91	M281	CRUDE NPG TANK/ OX050T191/ 050T191	1.93	460			460	437.00	$14,363	$3,533	$16,169
92	M281	FLUX OIL TANK FB-910/ OL225T910/ 225T910	3.16	1,528			1,528	1,451.41	$16,823	$4,026	$5,548
93	M281	MOLTEN STORAGE TANK-C-13/ EB065T74/ 030B11	2.93	562			562	533.90	$19,130	$4,711	$17,647
94	M281	REJECT TANK/ OX050T138/ 050T138	1.93	10			10	9.50	$15,221	$3,798	$799,579
95	M281	STORAGE TANK 40T-114/ SD022T114/ 022T114	13.29	2,300			2,300	2,185.00	$25,089	$6,002	$5,494
96	M281	STORAGE TANK 43 T-162/ OX026T162/ 027FL1	13.29	420			420	399.00	$13,561	$3,337	$16,727
97	M281	STORAGE TANK/ EP008T51/ 008T51	2.24	60			60	57.00	$9,769	$2,432	$85,333
98	M281	STORAGE TANK/ OX026T35/ 027FL1	13.29	60			60	57.00	$11,200	$2,789	$97,860
99	M281	TANK STORAGE/ OX026T32/ 027FL1	13.29	240			240	228.00	$12,725	$3,149	$27,623
100	M281	MIX TANK/ EP008T34/ 008T34	1.93	38			38	36.10	$10,467	$2,608	$144,488
Total:							254,560	222,614	$1,318,232	$302,045	$2,714
National Total:							509,121	445,227	$2,636,464	$604,090	

ATTACHMENT 10

Estimated Impacts Associated with LDAR Control Requirements of the MACT Floor Regulatory Option

Equipment Leak Control Cost – MACT Floor

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
1	M1	6	0	187,800	None	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
2	M10	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
3	M100	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
4	M101	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207
5	M102	6	0	187,800	None	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
6	M103	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207
7	M104	1	0	31,300	LA non-HON	0.42	2	18,154	9,390	Batch	$163	($7,447)	($1,586)
8	M105	7	0	219,100	None	0	0	219,100	157,752	Batch	$55,519	$16,348	$207
9	M106	8	0	250,400	HON	0.72	1	70,112	0	Batch	$0	$0	$0
10	M107	0	1	105,000	HON	0.69	1	32,550	0	Continuous	$0	$0	$0
11	M107	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
12	M107	7	0	219,100	TX28VHP	0.39	2	133,651	72,303	Batch	($2,627)	($52,846)	($1,462)
13	M108	11	0	344,300	None	0	0	344,300	247,896	Batch	$79,307	$25,689	$207
14	M109	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
15	M11	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
16	M110	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
17	M111	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
18	M112	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
19	M113	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
20	M113	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	$1,053
21	M114	1	0	31,300	HON	0.72	1	8,764	0	Batch	$0	$0	$0
22	M114	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
23	M115	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
24	M116	4	0	125,200	AVO	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
25	M116	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
26	M117	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
27	M118	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
28	M119	6	0	187,800	AVO	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
29	M12	5	0	156,500	Subpart VV	0.21	2	123,635	79,815	Batch	($1,697)	$42,029	$1,053
30	M120	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
31	M121	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
32	M122	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
33	M123	1	0	31,300	Subpart V	0.2	2	25,040	16,276	Batch	$163	($8,465)	($1,040)
34	M124	2	0	62,600	AVO	0	0	62,600	45,072	Batch	$25,784	$4,671	$207

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
35	M125	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
36	M125	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
37	M126	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
38	M126	1	0	31,300	TXReg5	0.38	0	19,406	10,642	Batch	$19,837	$3,192	$600
39	M127	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
40	M128	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
41	M129	127	0	3,975,100	None	0	0	3,975,100	2,862,072	Batch	$821,159	$296,596	$207
42	M13	3	0	93,900	AVO	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
43	M130	163	0	5,101,900	None	0	0	5,101,900	3,673,368	Batch	$1,054,751	$380,670	$207
44	M131	39	0	1,220,700	None	0	0	1,220,700	878,904	Batch	$258,823	$91,081	$207
45	M132	2	0	62,600	AVO	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
46	M133	4	0	125,200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
47	M134	26	0	813,800	None	0	0	813,800	585,936	Batch	$175,012	$60,720	$207
48	M135	0	0	0	HON	0.72	1	0	0	Batch	$0	$0	$0
49	M136	6	0	187,800	AVO	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
50	M137	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
51	M138	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
52	M141	1	0	31,300	Subpart V	0.2	2	25,040	16,276	Batch	$163	($8,465)	($1,040)
53	M142	8	0	250,400	None	0	0	250,400	180,288	Batch	$61,466	$18,683	$207
54	M142	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
55	M144	7	0	219,100	Subpart VV	0.21	2	173,089	111,741	Batch	($2,627)	($58,841)	($1,053)
56	M145	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
57	M146	3	0	93,900	TX28MID	0.39	2	57,279	30,987	Batch	($767)	($22,648)	($1,462)
58	M146	0	4	420,000	TX28MID	0.6	2	168,000	37,800	Continuous	$4,148	$21,924	$1,160
59	M147	3	0	93,900	Subpart VV	0.21	2	74,181	47,889	Batch	($767)	($25,217)	($1,053)
60	M148	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
61	M149	11	0	344,300	None	0	0	344,300	247,896	Batch	$79,307	$25,689	$207
62	M15	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
63	M15	1	0	31,300	Subpart V	0.2	2	25,040	16,276	Batch	$163	($8,465)	($1,040)
64	M15	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	$1,053
65	M150	3	0	93,900	LA non-HON	0.42	2	54,462	28,170	Batch	($767)	($22,339)	$1,586
66	M150	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
67	M151	2	0	62,600	TX28M	0.02	0	61,348	43,820	Batch	$25,784	$4,761	$217
68	M152	6	0	187,800	Subpart VV	0.21	2	148,362	95,778	Batch	($2,162)	($50,434)	$1,053
69	M153	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
70	M154	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
71	M155	6	0	187,800	None	0	0	187,800	135,216	Batch	$49,572	$14,012	$207

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
72	M156	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
73	M157	13	0	406,900	Subpart VV	0.21	2	321,451	207,519	Batch	($5,417)	($109,276)	($1,053)
74	M158	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
75	M16	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
76	M160	2	0	62,600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
77	M17	52	0	1,627,600	None	0	0	1,627,600	1,171,872	Batch	$342,634	$121,441	$207
78	M18	6	0	187,800	Subpart VV	0.21	2	148,362	95,778	Batch	($2,162)	($50,434)	($1,053)
79	M19	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
80	M2	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
81	M20	8	0	250,400	None	0	0	250,400	180,288	Batch	$61,466	$18,683	$207
82	M21	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
83	M22	3	0	93,900	HON	0.72	1	26,292	0	Batch	$0	$0	$0
84	M22	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
85	M23	0	1	105,000	LA 2122	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
86	M23	2	0	62,600	LA non-HON	0.42	2	36,308	18,780	Batch	($302)	($14,892)	($1,586)
87	M23	0	2	210,000	LA non-HON	0.66	2	71,400	6,300	Continuous	$2,388	$11,176	$3,548
88	M23	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
89	M24	3	0	93,900	AVO	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
90	M25	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
91	M25	43	0	1,345,900	Subpart VV	0.21	2	1,063,261	686,409	Batch	($19,367)	($361,450)	($1,053)
92	M254	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
93	M255	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
94	M256	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
95	M258	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
96	M259	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
97	M26	19	0	594,700	None	0	0	594,700	428,184	Batch	$133,383	$44,373	$207
98	M260	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
99	M261	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
100	M262	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
101	M265	0	2	210,000	TX28MID	0.6	2	84,000	18,900	Continuous	$2,388	$10,962	$1,160
102	M269	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
103	M27	7	0	219,100	None	0	0	219,100	157,752	Batch	$55,519	$16,348	$207
104	M27	2	0	62,600	Subpart VV	0.21	2	49,454	31,926	Batch	($302)	($16,811)	($1,053)
105	M270	0	1	105,000	TX28RCT	0.6	2	42,000	9,450	Continuous	$1,508	$5,481	$1,160
106	M271	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
107	M277	0	4	420,000	None	0	0	420,000	289,800	Continuous	$175,650	$84,360	$582
108	M279	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
109	M28	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
110	M280	0	3	315,000	28M	0.24	0	239,400	141,750	Continuous	$130,335	$68,486	$966
111	M281	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
112	M283	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
113	M284	0	1	105,000	28M	0.24	0	79,800	47,250	Continuous	$52,705	$22,829	$966
114	M285	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
115	M287	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
116	M289	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
117	M29	4	0	125,200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
118	M293	0	2	210,000	TX28MID	0.6	2	84,000	18,900	Continuous	$2,388	$10,962	$1,160
119	M297	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
120	M299	0	3	315,000	None	0	0	315,000	217,350	Continuous	$130,335	$63,270	$582
121	M3	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
122	M30	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
123	M300	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
124	M301	0	1	105,000	TX28VHP	0.6	2	42,000	9,450	Continuous	$1,508	$5,481	$1,160
125	M303	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
126	M306	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
127	M307	0	1	105,000	TX28VHP	0.6	2	42,000	9,450	Continuous	$1,508	$5,481	$1,160
128	M308	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
129	M311	0	1	105,000	TX28RCT	0.6	2	42,000	9,450	Continuous	$1,508	$5,481	$1,160
130	M314	0	4	420,000	None	0	0	420,000	289,800	Continuous	$175,650	$84,360	$582
131	M315	0	2	210,000	TX28MID	0.6	2	84,000	18,900	Continuous	$2,388	$10,962	$1,160
132	M318	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
133	M32	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
134	M320	0	2	210,000	TX28MID	0.6	2	84,000	18,900	Continuous	$2,388	$10,962	$1,160
135	M322	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
136	M325	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
137	M326	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
138	M328	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
139	M33	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
140	M330	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
141	M334	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
142	M337	0	1	105,000	29MID	0.6	0	42,000	9,450	Continuous	$52,705	$25,437	$5,383
143	M34	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
144	M342	0	1	105,000	TX28MID	0.6	2	42,000	9,450	Continuous	$1,508	$5,481	$1,160
145	M343	0	1	105,000	28M	0.24	0	79,800	47,250	Continuous	$52,705	$22,829	$966

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
146	M347	0	1	105,000	LA non-HON	0.66	2	35,700	3,150	Continuous	$1,508	$5,588	$3,548
147	M35	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207
148	M350	0	1	105,000	28M	0.24	0	79,800	47,250	Continuous	$52,705	$22,829	$966
149	M351	0	3	315,000	None	0	0	315,000	217,350	Continuous	$130,335	$63,270	$582
150	M352	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
151	M358	0	2	210,000	None	0	0	210,000	144,900	Continuous	$91,520	$42,180	$582
152	M359	0	1	105,000	None	0	0	105,000	72,450	Continuous	$52,705	$21,090	$582
153	M36	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
154	M37	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
155	M38	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
156	M380	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
157	M39	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
158	M4	4	0	125,200	Subpart VV	0.21	2	98,908	63,852	Batch	($1,232)	($33,623)	($1,053)
159	M40	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
160	M41	1	0	31,300	AVO	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
161	M42	36	0	1,126,800	None	0	0	1,126,800	811,296	Batch	$240,982	$84,074	$207
162	M43	12	0	375,600	HON	0.72	1	105,168	0	Batch	$0	$0	$0
163	M44	0	2	210,000	28M	0.24	0	159,600	94,500	Continuous	$91,520	$45,658	$966
164	M44	6	0	187,800	HON	0.72	1	52,584	0	Batch	$0	$0	$0
165	M45	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
166	M45	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
167	M46	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
168	M47	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
169	M48	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
170	M49	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
171	M49	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
172	M5	10	0	313,000	None	0	0	313,000	225,360	Batch	$73,360	$23,354	$207
173	M50	2	0	62,600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
174	M51	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
175	M52	4	0	125,200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
176	M53	1	0	31,300	TX28M	0.02	0	30,674	21,910	Batch	$19,837	$2,380	$217
177	M54	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
178	M55	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
179	M56	2	0	62,600	Subpart VV	0.21	2	49,454	31,926	Batch	($302)	($16,811)	($1,053)
180	M58	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
181	M59	1	0	31,300	HON	0.72	1	8,764	0	Batch	$0	$0	$0
182	M6	0	0	0	None	0	0	0	0	Batch	$0	$0	$0

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
183	M60	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
184	M61	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207
185	M62	11	0	344,300	None	0	0	344,300	247,896	Batch	$79,307	$25,689	$207
186	M62	2	0	62,600	Subpart V	0.2	2	50,080	32,552	Batch	($302)	($16,930)	($1,040)
187	M63	4	0	125,200	AVO	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
188	M64	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
189	M65	2	0	62,600	LA non-HON	0.42	2	36,308	18,780	Batch	($302)	($14,892)	($1,586)
190	M66	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
191	M67	6	0	187,800	None	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
192	M68	2	0	62,600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
193	M69	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
194	M7	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
195	M70	2	0	62,600	None	0	0	62,600	45,072	Batch	$25,784	$4,671	$207
196	M71	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
197	M72	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
198	M73	8	0	250,400	None	0	0	250,400	180,288	Batch	$61,466	$18,683	$207
199	M74	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
200	M75	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207
201	M76	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
202	M77	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
203	M78	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
204	M79	2	0	62,600	Subpart VV	0.21	2	49,454	31,926	Batch	($302)	($16,811)	($1,053)
205	M8	1	0	31,300	Subpart VV	0.21	2	24,727	15,963	Batch	$163	($8,406)	($1,053)
206	M80	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
207	M81	4	0	125,200	AVO	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
208	M82	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
209	M83	13	0	406,900	None	0	0	406,900	292,968	Batch	$91,201	$30,360	$207
210	M84	5	0	156,500	HON	0.72	1	43,820	0	Batch	$0	$0	$0
211	M84	3	0	93,900	None	0	0	93,900	67,608	Batch	$31,731	$7,006	$207
212	M85	13	0	406,900	HON	0.72	1	113,932	0	Batch	$0	$0	$0
213	M86	6	0	187,800	HON	0.72	1	52,584	0	Batch	$0	$0	$0
214	M87	11	0	344,300	None	0	0	344,300	247,896	Batch	$79,307	$25,689	$207
215	M88	6	0	187,800	None	0	0	187,800	135,216	Batch	$49,572	$14,012	$207
216	M89	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
217	M9	11	0	344,300	HON	0.72	1	96,404	0	Batch	$0	$0	$0
218	M90	22	0	688,600	None	0	0	688,600	495,792	Batch	$151,224	$51,379	$207
219	M91	5	0	156,500	None	0	0	156,500	112,680	Batch	$43,625	$11,677	$207

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP Emissions (lb/yr)	LDAR Program	Reduction	MACT	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
220	M92	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
221	M93	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
222	M94	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
223	M95	10	0	313,000	None	0	0	313,000	225,360	Batch	$73,360	$23,354	$207
224	M96	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
225	M97	4	0	125,200	None	0	0	125,200	90,144	Batch	$37,678	$9,342	$207
226	M98	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
227	M99	1	0	31,300	None	0	0	31,300	22,536	Batch	$19,837	$2,335	$207
Total				42,230,200				37,739,032	25,637,376		$10,000,867	$2,416,392	$189
Batch Total				32,990,200				30,114,982	20,877,726		$6,737,076	$875,163	$84
Continuous Total				9,240,000				7,624,050	4,759,650		$3,263,791	$1,541,229	$648
Overall Continuous Total				18,480,000				15,248,100	9,519,300		$6,527,582	$3,082,458	$648
National Total				51,470,200				45,363,082	30,397,026		$13,264,658	$3,957,621	$260

ATTACHMENT 11

Estimated Impacts Associated with Wastewater Control Requirements of the MACT Floor Regulatory Option

Waste Water with Flow Rate => 10 l/min and Concentration => 1,000 ppm or any Flow Rate and Concentration => 10,000 ppm (MACT Floor)

	Facility #	Flow Rate (l/min)	Uncontrolled HAP Emissions (tpy)	Control Device	MACT	Baseline HAP Emissions (tpy)	HAP Reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	1	71.2	5,761	SS/DP	-1	1,364	0	$0	$0	$0
2	1	7.6	87	DP	0	3	8	$460,089	$152,317	$19,396
3	10	171.7	890	BI, CL	0	248	426	$673,242	$230,782	$542
4	11	14.4	29	OF	0	24	29	$468,963	$155,584	$5,409
5	27	2.0	34	DP	0	6	8	$452,868	$149,659	$18,061
6	29	2.3	79	BI	0	13	19	$453,187	$149,776	$7,825
7	31	0.9	7	OF,OP,EQ,BI,CL	0	6	7	$451,448	$149,136	$20,311
8	31	1.3	15	OP,EQ,BI,CL	0	12	15	$451,903	$149,303	$9,864
9	34	19.2	817	O-Onsite incineratio	-1	550	0	$0	$0	$0
10	34	41.6	696	BI	0	118	168	$504,329	$168,602	$1,001
11	36	10.1	20	SS	-1	16	0	$0	$0	$0
12	43	0.1	17	OF (incin)	-1	5	0	$0	$0	$0
13	45	469.4	1,007	CL,EQ,BI,AS (no incin)	0	171	244	$1,059,779	$373,073	$1,531
14	53	6.1	110	of	0	45	62	$458,234	$151,634	$2,447
15	54	407.4	1,721	BI, CL	0	399	591	$979,229	$343,421	$581
16	57	283.9	218	BI	0	65	120	$818,920	$284,409	$2,372
17	58	144.0	166	SS, DP	-1	136	0	$0	$0	$0
18	63	1,136.3	7,555	Bi	0	1,316	1,890	$1,925,879	$691,900	$366
19	65	435.3	1,129	Tank, AS (incin), Therm	-1	192	0	$0	$0	$0
20	67	65.7	227	O	0	39	55	$535,597	$180,113	$3,275
21	74	1.3	22	O-Onsite Distruct	-1	4	0	$0	$0	$0
22	75	10.1	136	DP	0	23	33	$463,351	$153,518	$4,666
23	81	0.0	2	OF	0	1	2	$450,265	$148,701	$94,067
24	82	78.9	50	HT,TT,DP	0	8	12	$552,665	$186,396	$15,407
25	83	1,798.0	1,036	DP	0	176	251	$2,785,116	$1,008,200	$4,021
26	86	2.9	102	DP	0	17	25	$454,066	$150,100	$6,084
27	88	0.7	33	OF	0	6	8	$451,194	$149,042	$18,549
28	91	2.1	44	HT, BI	0	8	11	$453,036	$149,721	$13,942
29	92	7.9	80	HT,CL,SS,DP	-1	25	0	$0	$0	$0
30	96	0.1	65	BI	0	38	60	$450,405	$148,752	$2,482
31	105	165.6	954	DP	0	458	677	$665,311	$227,863	$337
32	106	15.8	152	TT, AS (incin), DP	-1	113	0	$0	$0	$0
33	108	17.4	151	BI	0	53	96	$472,870	$157,022	$1,627
34	128	94.6	436	SS, DP	-1	279	0	$0	$0	$0
35	130	11.4	2,356	AS, TT, HT, O (Off-site	-1	1,885	0	$0	$0	$0
36	130	0.1	19	O (Off site treatment)	0	15	18	$450,399	$148,750	$8,045
37	133	48.3	228	0 (after burner)	-1	98	0	$0	$0	$0
38	136	0.4	59	EQ, TT, CL, BI, OP	0	41	51	$450,790	$148,894	$2,901
39	138	1.5	152	SS	-1	28	0	$0	$0	$0
40	140	122.4	10,583	HT	0	327	953	$609,245	$207,224	$218
41	143	23.0	133	TT, OF (off-site trash	-1	106	0	$0	$0	$0
42	153	217.3	1,874	BI	0	485	818	$732,408	$252,562	$309
43	158	15.1	508	EQ,BI	0	86	123	$469,898	$155,928	$1,267
Batch Total:			39,765			9,560	6,779	$19,604,686	$6,722,382	$992
Continuous Total:			67,600			16,252	11,525	$33,327,966	$11,428,049	$992
National Total:			107,365			25,812	18,305	$52,932,652	$18,150,431	$992

ATTACHMENT 12

Estimated Impacts Associated with Wastewater Control Requirements of the Above-the-floor Regulatory Option

Waste Water with Flow Rate => 5.0 l/min and Concentration => 1,000 ppm or any Flow Rate and Concentration => 10,000 ppm (Above Floor)

	Facility #	Flow Rate (l/min)	Uncontrolled HAP Emissions (tpy)	Control Device	MACT	Baseline HAP Emissions (tpy)	HAP Reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	1	71.2	5,761	SS/DP	-1	1,364	0	$0	$0	$0
2	1	7.6	87	DP	0	3	8	$460,089	$152,317	$19,396
3	10	203.0	983	BI, CL	0	264	448	$713,830	$245,723	$548
4	11	14.4	29	OF	0	24	29	$468,963	$155,584	$5,409
5	27	2.0	34	DP	0	6	8	$452,868	$149,659	$18,061
6	29	2.3	79	BI	0	13	19	$453,187	$149,776	$7,825
7	31	0.9	7	OF,OP,EQ,BI,CL	0	6	7	$451,448	$149,136	$20,311
8	31	1.3	15	OP,EQ,BI,CL	0	12	15	$451,903	$149,303	$9,864
9	34	24.5	833	O-Onsite incineratio	-1	562	0	$0	$0	$0
10	34	41.6	696	BI	0	118	168	$504,329	$168,602	$1,001
11	36	10.1	20	SS	-1	16	0	$0	$0	$0
12	43	0.1	17	OF (incin)	-1	5	0	$0	$0	$0
13	45	469.4	1,007	CL,EQ,BI,AS (no incin)	0	171	244	$1,059,779	$373,073	$1,531
14	53	6.1	110	of	0	45	62	$458,234	$151,634	$2,447
15	54	438.4	1,832	BI, CL	0	423	623	$1,019,610	$358,286	$575
16	57	283.9	218	BI	0	65	120	$818,920	$284,409	$2,372
17	58	144.0	166	SS, DP	-1	136	0	$0	$0	$0
18	63	1,146.0	7,566	Bi	0	1,322	1,898	$1,938,417	$696,515	$367
19	65	435.3	1,129	Equalization Tank, AS (in	-1	192	0	$0	$0	$0
20	67	65.7	227	O	0	39	55	$535,597	$180,113	$3,275
21	74	1.3	22	O-Onsite Distruct	-1	4	0	$0	$0	$0
22	75	10.1	136	DP	0	23	33	$463,351	$153,518	$4,666
23	81	0.0	2	OF	0	1	2	$450,265	$148,701	$94,067
24	82	78.9	50	HT,TT,DP	0	8	12	$552,665	$186,396	$15,407
25	83	1,798.0	1,036	DP	0	176	251	$2,785,116	$1,008,200	$4,021
26	86	12.4	155	DP	0	26	38	$466,347	$154,621	$4,113
27	88	5.7	26	EQ,TT,BI	0	4	6	$457,632	$151,412	$23,901
28	88	0.7	33	OF	0	6	8	$451,194	$149,042	$18,549
29	91	2.1	44	HT, BI	0	8	11	$453,036	$149,721	$13,942
30	92	13.0	89	HT,CL,SS,DP	-1	32	0	$0	$0	$0
31	96	0.1	65	BI	0	38	60	$450,405	$148,752	$2,482
32	105	165.6	954	DP	0	458	677	$665,311	$227,863	$337
33	106	15.8	152	TT, AS (incin), DP	-1	113	0	$0	$0	$0
34	108	17.4	151	BI	0	53	96	$472,870	$157,022	$1,627
35	109	5.7	8	HT, OF	0	7	8	$457,628	$151,411	$18,007
36	128	94.6	436	SS, DP	-1	279	0	$0	$0	$0
37	130	11.4	2,356	AS, TT, HT, O (Off-site tr	-1	1,885	0	$0	$0	$0
38	130	0.1	19	O (Off site treatment)	0	15	18	$450,399	$148,750	$8,045
39	133	48.3	228	0 (after burner)	-1	98	0	$0	$0	$0
40	134	7.6	19	CL, BI	0	15	19	$460,139	$152,335	$8,046
41	136	0.4	59	EQ, TT, CL, BI, OP	0	41	51	$450,790	$148,894	$2,901
42	138	1.5	152	SS	-1	28	0	$0	$0	$0
43	140	122.4	10,583	HT	0	327	953	$609,245	$207,224	$218
44	143	23.0	133	TT, OF (off-site trash-to-s	-1	106	0	$0	$0	$0
45	153	217.3	1,874	BI	0	485	818	$732,408	$252,562	$309
46	158	15.1	508	EQ,BI	0	86	123	$469,898	$155,928	$1,267
Batch Total:			40,110			9,560	6,889	$21,085,873	$7,216,482	$1,047
Continuous Total:			68,187			16,252	11,712	$35,845,984	$12,268,019	$1,047
National Total:			108,298			25,812	18,601	$56,931,857	$19,484,501	$1,047

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: December 10, 1999
(revised May 17, 2000)

From: David Randall
Jennifer Fields

Subject: MACT Floor, Regulatory Alternative, and Impacts for Wastewater at Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

To: Miscellaneous Organic NESHAP Project File

I. Introduction

The results of previous analyses to establish the MACT floor for the wastewater emission sources at chemical manufacturing facilities were reviewed to verify the accuracy of the resulting MACT floor determination. Our review comprised an effort to duplicate the work previously conducted and to evaluate the method used to generate the resulting MACT floor. We also identified and evaluated other possible options for setting the MACT floor and regulatory alternatives and their impacts. This memorandum presents the results of the review, conclusions, and recommendations for proceeding with the establishment of MACT floors for this industry sector.

II. Review of MACT Floors

A previous analysis (in May 1999) developed a MACT floor for wastewater streams based on the control efficiencies and applicability cutoffs from the HON.[1] Although we made a few minor changes to the database and in the analysis, the resulting MACT floor is the same. The remainder of this section describes the changes, rationale for development of the MACT floor, and nationwide impacts.

A. Database

Based on a review of the MON wastewater database, we made two minor corrections to the data from two facilities. One correction was to delete three records from the first facility because they were mistakenly included at both that facility and the second facility. The other correction was to revise the HAP concentration in a wastewater stream from the second facility because it incorrectly used a concentration from a stream at the first facility. These corrections had no demonstrable effect on subsequent analyses.

The May 1999 memorandum reported 416 streams were left after excluding various compounds and all streams with HAP concentrations less than 1,000 ppmw.[1] However, we believe it should have been 439. The difference can be accounted for by the 23 streams with HAP concentrations equal to 1,000 ppmw.

The original database also included all HAP in the wastewater. For the analyses described below, all HAP that are not listed on Table 9 of the HON were excluded. This excluded 65 wastewater streams. The analyses described below also exclude all streams (seven) for which the HAP concentration is 1,000,000 ppmw or more. Note that the basis for deciding whether a control technique achieves the control level required by the HON has not been evaluated.

After making these changes, the revised database contains 364 streams at 60 facilities that have Table 9 HAP concentrations of at least 1,000 ppmw. A total of 186 of these streams at 45 facilities meet the HON cutoffs (i.e., streams of any flowrate that contain at least 10,000 ppmw of Table 9 compounds, and streams with a flowrate of at least 10 liters per minute that contain at least 1,000 ppmw of Table 9 compounds). Table 1 summarizes these results as well as results for subsets of the data. Attachment 1 presents details of the 186 streams that meet the HON cutoffs.

TABLE 1. SUMMARY OF CURRENT WASTEWATER DATABASE FOR CHEMICAL MANUFACTURING FACILITIES

	Number of streams		Number of facilities	
	Total	Controlled as required by the HON	Total	Controlling all streams as required by the HON
All accepted data[a]	364		60	
All streams meeting either of the HON cutoffs	186	37	45	12
Streams with Table 9 HAP concentrations $10,000 ppmw	137	32	35[b]	7
Streams with Table 9 HAP concentrations $1,000 ppmw and <10,000 ppmw with flow $10 liters per minute	49	5	15[b]	5

[a] Excluding inorganics, miscellaneous other compounds, and streams with HAP concentrations <1,000 ppmw.
[b] Five facilities have streams in both groups.

B. MACT floor analysis

The May 1999 analysis concluded that the MACT floor consists of the HON level of control and the HON cutoffs because more than 12 percent of the streams that meet the cutoff are controlled to the level of the HON. Using the current database, two approaches to developing the floor were examined. The first approach is the same as that used in the May 1999 analysis. As shown in Table 1, more than 12 percent of the streams that meet the HON cutoffs in the current database are also controlled to the level of the HON. A second approach is to develop a floor on a facility-wide basis. Based on the data in Table 1, this approach shows that more than 12 percent of the facilities are controlling all of their wastewater to the level of the HON. Thus, either approach shows the MACT floor to be the HON level of control for streams that meet the HON cutoffs.

In comments submitted to EPA, CMA agreed with the floor for streams with concentrations greater than or equal to 10,000 ppmw, but disagreed with the lower concentration cutoff because less than 12 percent of the streams in this range were controlled. Instead of relying on predetermined cutoffs, they believe the data dictate that cutoffs should be 8,000 ppmw and 10 liters per minute.[2] However, because 5 of the 49 streams with concentrations between 1,000 ppmw and 10,000 ppmw are controlled, the median control level for the top performing 12 percent of the streams is the HON level of control. Thus, we believe evaluating the floor for the streams with concentrations less than 10,000 ppmw separately from the floor for streams with higher concentrations results in the same floor as the analysis of all streams in one group.

Another point to consider if different cutoffs were to be developed is that all of the streams with concentrations greater than or equal to 1,000 ppmw need to be included, not just those with flow rates greater than or equal to 10 liters per minute. Under this approach, 15 of 228 streams are controlled. Thus, the median control level for the top performing 12 percent is the HON level of control. To determine the flowrate cutoff, the facilities can be ranked by the total load in their wastewater (the concentration cutoff is set at 1,000 ppmw because no data were obtained for streams with lower concentrations). The best performing facilities are those with the lowest load. For the top five facilities, the stream with the smallest flow (three of the five facilities have only one stream) was identified. The median of the flows for these five facilities was 2.2 liters per minute. Under this approach, therefore, the cutoff would be 1,000 ppmw and 2.2 liters per minute.

C. Impacts

Emissions and cost impacts were estimated for both the MACT floor and a regulatory alternative. The regulatory alternative consists of the same treatment requirement as the floor, but the applicability cutoffs were changed to: (1) a HAP concentration of 500 ppmw at a flow rate of 1 liter per minute and (2) a HAP concentration of 10,000 ppmw at any flow rate. These are the cutoffs in the NSPS for VOC emissions from SOCMI sources (40 CFR part 60, subpart YYY).

The HAP load was calculated for each wastewater stream from the reported flow rates and HAP concentrations as follows:

$$HAP\ load, \tfrac{lb}{yr} = \frac{Flow, \tfrac{gal}{yr} \times 8.33 \tfrac{lb}{gal} \times HAP\ concentration,\ ppm}{1{,}000{,}000} \qquad \text{Eq. 1}$$

Uncontrolled emissions from each stream were then calculated by multiplying the HAP load by the Fe value for each HAP. The Fe values for each HAP are from Table 34 of the HON.

Baseline emissions were then assumed to be equal to the uncontrolled emissions for the streams that were not treated. For wastewater streams currently treated in a unit that meets the requirements of the HON, the HAP removed was estimated by multiplying the HAP load by the Fr value (from Table 9 in subpart G of the HON). Emission reductions were estimated by multiplying the load reduction by the Fe as follows:

$$HAP\ reduction, \frac{lb}{yr} = (HAP\ Load) \times (Fr) \times (Fe) \qquad \text{Eq.2}$$

Baseline emissions for these controlled streams were then estimated as the difference between the uncontrolled emissions and the reductions.

Emission reductions achieved by the MACT floor and regulatory alternative were also estimated using Equation 2. Wastewater stream characteristics and the estimated uncontrolled and baseline emissions for each wastewater stream are presented in Attachment 2.

Treatment costs for all streams from batch processes that would require additional control under the MACT floor or regulatory alternative were estimated for a steam stripper. The total annual cost (TAC) and total capital investment (TCI) were estimated using the equations developed in the analysis for the HON.[3] These equations express the costs as a function of the wastewater flow rate (in liters per minute) treated by the steam stripper. The original equation estimated costs in July 1989 dollars. The TCI equation was escalated to February 1999 dollars using the Chemical Engineering Plant Cost Index ratio of 387.9/356. We also added costs to purchase and install steam flow, liquid flow, and outlet gas temperature monitors and a data acquisition system ($20,100), resulting in the following equation:

$$TCI\ (\tfrac{\$}{yr}) = 1{,}189 \times Flowrate + 432{,}475 \qquad \text{Eq. 3}$$

In the original analysis, separate equations were developed for the total direct annual costs (TDAC) and the total indirect annual costs (TIAC). We used the TDAC equation without change because the original unit costs for utilities and labor are acceptable. We escalated the TIAC equation using the Chemical Engineering Plant Cost Index ratio of 387.9/356 because most of the elements in the TIAC are calculated as a percentage of the TCI. We also added monitoring labor costs ($12,300/yr); monitoring maintenance materials costs ($500/yr); and associated indirect costs for overhead ($7,690/yr); administrative charges, property taxes, and insurance ($800/yr); and capital recovery ($2,200/yr). Combining the original TDAC equation with the escalated TIAC equation and the monitoring costs produced equation 4.

$$TAC(\frac{\$}{yr}) = \left(418.6 \times \ Flowrate + 156{,}343\right) \qquad \text{Eq. 4}$$

Emissions and treatment costs for wastewater from continuous processes were estimated to be equal to 1.7 times greater than the emissions and costs for the wastewater from batch processes.[4] Thus the nationwide impacts are estimated to be 2.7 times the impacts for the wastewater from batch processes. The results of these analyses are summarized in Table 2. The impacts for each facility with wastewater subject to the applicability cutoffs of the floor and regulatory alternative are presented in Attachments 2 and 3, respectively. Six of the 45 facilities with streams that meet the cutoffs have HAP loads less than 1 Mg/yr; these facilities were excluded from the analyses in Attachments 2 and 3 because a standard based on the HON requirements would exempt these facilities.

TABLE 2. IMPACTS OF REGULATORY ALTERNATIVES FOR EXISTING SOURCES

Regulatory alternative	Total capital investment, $	Total annual cost, $/yr	Emission reduction, Mg/yr	Cost effectiveness, $/Mg	
				Relative to baseline	Incremental
MACT floor	47,000,000	16,900,000	4,380	3,860	N/A
Regulatory alternative	63,400,000	22,730,000	4,780	4,760	14,600

[a] Nationwide uncontrolled and baseline emissions are estimated to be 22,100 and 12,400 Mg/yr, respectively. These values include emissions from all streams with HAP concentrations greater than or equal to 1,000 ppmw.

III. Conclusions

- Slight changes were made to the database, but these changes do not affect the overall conclusion that the MACT floor is equivalent to the HON.

IV. Recommendations

- Because differences were noted between the verified database and the derivative non-CBI database that was released to the industry, recommend that a new non-CBI database be developed and made available to industry.

V. References

1. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to MON Project File. Existing Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON. May 20, 1999.

2. Letter from R. Zvaners, Chemical Manufacturers Association, to R. McDonald, EPA:ESD. October 13, 1999. Comments on draft MACT floor determination for existing sources.

3. Memorandum from C. Zukor and K. Pelt, Radian Corporation, to Mary Tom Kissell, EPA:SDB. February 1, 1994. Total Capital Investment and Total Annual Cost Equations Used in the Framework for Steam Stripping Wastewater.

4. Memorandum from C. Zukor, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. July 27, 1999. National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes.

Attachment 1: Current Wastewater Database for Chemical Manufacturing Facilities

Plant Name	Flow Rate	Units	Flow Rate (l/min)	HAP Conc (ppm)	Load (lb/yr)	MACT
Tennessee Eastman Division	1,494,000	gal/yr	10.76	9,900	123,202	FALSE
Tennessee Eastman Division	1,540,000	gal/yr	11.09	8,700	111,602	FALSE
Tennessee Eastman Division	2,362,000	gal/yr	17.01	1,300	25,577	FALSE
Tennessee Eastman Division	2,555,000	gal/yr	18.40	9,700	206,440	FALSE
Tennessee Eastman Division	2,826,000	gal/yr	20.35	6,400	150,655	FALSE
Tennessee Eastman Division	5,150,000	gal/yr	37.09	1,400	60,058	FALSE
BPCI - Sand Springs Manufacturing Plant	2,000,000	gal/yr	14.40	3,752	62,498	FALSE
Akzo Nobel Resins	1,400,000	gal/yr	10.08	3,400	39,650	TRUE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	2,000	70,050	FALSE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	2,300	80,557	FALSE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	3,800	133,095	FALSE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	4,500	157,612	FALSE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	4,700	164,617	FALSE
Witco Corp. - Sistersville Plant	8	gal/min	30.28	7,200	252,180	FALSE
Witco Corp. - Sistersville Plant	36	gal/min	136.27	4,821	759,849	FALSE
Witco Corp. - Sistersville Plant	40	gal/min	151.41	2,500	437,812	FALSE
Kodak Park - Synthetic Chemicals Division	1,555,200	gal/yr	11.20	7,800	101,045	FALSE
Kodak Park - Synthetic Chemicals Division	1,792,800	gal/yr	12.91	4,100	61,228	FALSE
Kodak Park - Synthetic Chemicals Division	1,792,800	gal/yr	12.91	7,800	116,482	FALSE
Kodak Park - Synthetic Chemicals Division	1,920,000	gal/yr	13.83	6,000	95,959	FALSE
Kodak Park - Synthetic Chemicals Division	2,332,800	gal/yr	16.80	7,800	151,567	FALSE
Kodak Park - Synthetic Chemicals Division	2,505,600	gal/yr	18.05	8,000	166,968	FALSE
Kodak Park - Synthetic Chemicals Division	2,556,000	gal/yr	18.41	1,700	36,194	FALSE
Kodak Park - Synthetic Chemicals Division	2,808,000	gal/yr	20.22	7,800	182,442	FALSE
Kodak Park - Synthetic Chemicals Division	3,823,200	gal/yr	27.53	7,800	248,401	FALSE
Kodak Park - Synthetic Chemicals Division	4,363,200	gal/yr	31.42	7,800	283,486	FALSE
Kodak Park - Synthetic Chemicals Division	4,614,400	gal/yr	33.23	1,000	38,437	FALSE
Kodak Park - Synthetic Chemicals Division	9,158,400	gal/yr	65.96	7,800	595,040	FALSE
Kodak Park - Synthetic Chemicals Division	10,800,000	gal/yr	77.78	1,700	152,934	FALSE
E. I. Du Pont de Nemours & Co. Inc. - Washington Works	25	gal/min	94.63	1,000	109,453	FALSE
E. I. Du Pont de Nemours & Co. Inc. - Washington Works	25	gal/min	94.63	1,000	109,453	FALSE
E. I. Du Pont de Nemours & Co. Inc. - Washington Works	25	gal/min	94.63	2,000	218,906	FALSE
Morton International Inc. - Paterson Facility	20,000,000	gal/yr	144.04	2,051	341,686	TRUE
Ciba Specialty Chemicals Corp	4,285,400	gal/yr	30.86	5,000	178,482	FALSE
Ciba Specialty Chemicals Corp	35	gal/min	132.49	1,100	168,558	FALSE
Ciba Specialty Chemicals Corp	35	gal/min	132.49	1,100	168,558	FALSE
Ciba Specialty Chemicals Corp	35	gal/min	132.49	1,100	168,558	FALSE
Ciba Specialty Chemicals Corp	40	gal/min	151.41	5,200	910,649	FALSE
Ciba Specialty Chemicals Corp	40	gal/min	151.41	5,200	910,649	FALSE
Ciba Specialty Chemicals Corp	40	gal/min	151.41	5,200	910,649	FALSE
Albright & Wilson Americas Inc.	115	gal/min	435.31	4,500	2,265,676	TRUE
Huntsman Petrochemical Corporation - Dayton Manufacturing Facility	9,125,000	gal/yr	65.72	1,500	114,013	FALSE
Chemol Co.,Inc.	30,000	gal/day	78.86	1,100	100,332	FALSE

Plant Name	Flow Rate	Units	Flow Rate (l/min)	HAP Conc (ppm)	Load (lb/yr)	MACT
The Procter & Gamble Manufacturing Company	125	gal/min	473.17	1,000	547,265	FALSE
The Procter & Gamble Manufacturing Company	350	gal/min	1,324.87	1,000	1,532,341	FALSE
Keil Chemical Division	25	gal/min	94.63	8,000	875,624	TRUE
Akzo Nobel Chemicals Inc.	6,700,000	gal/yr	48.25	8,240	459,869	TRUE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	9	gal/min	33.31	3,856	148,562	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	9	gal/min	33.31	4,006	154,341	FALSE
Rhone-Poulenc Inc.	7	gal/min	26.50	40,000	1,225,873	TRUE
Rhone-Poulenc Inc.	17,000	gal/day	44.69	200,000	10,337,224	TRUE
Evans Chemetics	320	gal/yr	0.00	18,000	48	FALSE
Evans Chemetics	400	gal/yr	0.00	18,000	60	FALSE
Tennessee Eastman Division	96,000	gal/yr	0.69	10,000	7,997	FALSE
Tennessee Eastman Division	175,000	gal/yr	1.26	10,100	14,723	FALSE
Tennessee Eastman Division	287,000	gal/yr	2.07	10,100	24,145	FALSE
Tennessee Eastman Division	228,000	gal/yr	1.64	10,500	19,941	FALSE
Tennessee Eastman Division	891,000	gal/yr	6.42	11,200	83,124	FALSE
Tennessee Eastman Division	7,000	gal/yr	0.05	12,600	735	FALSE
Tennessee Eastman Division	2,096,000	gal/yr	15.10	15,200	265,379	FALSE
Tennessee Eastman Division	26,000	gal/yr	0.19	15,200	3,292	FALSE
Tennessee Eastman Division	55,000	gal/yr	0.40	16,100	7,376	FALSE
Tennessee Eastman Division	140	gal/yr	0.00	18,700	22	FALSE
Tennessee Eastman Division	1,340,000	gal/yr	9.65	20,100	224,354	FALSE
Tennessee Eastman Division	69,000	gal/yr	0.50	26,700	15,346	FALSE
Tennessee Eastman Division	300	gal/yr	0.00	27,300	68	FALSE
Tennessee Eastman Division	83,000	gal/yr	0.60	30,600	21,156	FALSE
Tennessee Eastman Division	3,000	gal/yr	0.02	32,700	817	FALSE
Tennessee Eastman Division	40	gal/yr	0.00	35,000	12	FALSE
Tennessee Eastman Division	52,000	gal/yr	0.37	39,000	16,893	FALSE
Tennessee Eastman Division	4,000	gal/yr	0.03	41,100	1,369	FALSE
Tennessee Eastman Division	1,000	gal/yr	0.01	48,800	406	FALSE
Tennessee Eastman Division	4,000	gal/yr	0.03	65,800	2,192	FALSE
Tennessee Eastman Division	3,000	gal/yr	0.02	90,900	2,272	FALSE
Tennessee Eastman Division	600	gal/yr	0.00	90,900	454	FALSE
Tennessee Eastman Division	9,000	gal/yr	0.06	136,800	10,256	FALSE
Tennessee Eastman Division	90,000	gal/yr	0.65	172,200	129,095	FALSE
HENKEL CORPORATION - LOS ANGELES OPERATIONS	190,000	gal/yr	1.37	20,000	31,653	FALSE
HENKEL CORPORATION - LOS ANGELES OPERATIONS	3,500	gal/yr	0.03	30,000	875	FALSE
HENKEL CORPORATION - LOS ANGELES OPERATIONS	89,000	gal/yr	0.64	50,000	37,067	FALSE
Arkansas Eastman Division	95,264	gal/yr	0.69	29,200	23,171	FALSE
Arkansas Eastman Division	217,872	gal/yr	1.57	74,700	135,567	FALSE
Arkansas Eastman Division	12,009	gal/yr	0.09	102,300	10,233	FALSE
Arkansas Eastman Division	433	gal/yr	0.00	450,000	1,623	FALSE
ISP Chemicals Inc.	70,542	gal/yr	0.51	12,751	7,492	FALSE
ISP Chemicals Inc.	56,600	gal/yr	0.41	15,745	7,423	FALSE
ISP Chemicals Inc.	175,824	gal/yr	1.27	20,972	30,715	FALSE

Plant Name	Flow Rate	Units	Flow Rate (l/min)	HAP Conc (ppm)	Load (lb/yr)	MACT
Novartis Crop Protection, Inc. - St. Gabriel Plant Site	11	gal/min	41.64	29,000	1,396,620	FALSE
Novartis Crop Protection, Inc. - St. Gabriel Plant Site	819,000	gal/yr	5.90	30,000	204,662	TRUE
Novartis Crop Protection, Inc. - St. Gabriel Plant Site	329,000	gal/yr	2.37	150,000	411,073	TRUE
Novartis Crop Protection, Inc. - St. Gabriel Plant Site	94,000	gal/yr	0.68	440,000	344,519	TRUE
Novartis Crop Protection, Inc. - St. Gabriel Plant Site	136,000	gal/yr	0.98	600,000	679,708	TRUE
DUPONT FRONT ROYAL SITE	5,610	gal/yr	0.04	740,000	34,580	TRUE
Witco Corp. - Sistersville Plant	7,000	gal/yr	0.05	80,000	4,665	FALSE
Du Pont - Fort Madison Plant	213,208	gal/yr	1.54	124,800	221,641	FALSE
Kodak Park - Synthetic Chemicals Division	2,786,400	gal/yr	20.07	10,800	250,668	FALSE
Kodak Park - Synthetic Chemicals Division	330	gal/yr	0.00	15,000	41	FALSE
Kodak Park - Synthetic Chemicals Division	18,000	gal/yr	0.13	15,800	2,369	FALSE
Kodak Park - Synthetic Chemicals Division	32,400	gal/yr	0.23	19,000	5,128	FALSE
Kodak Park - Synthetic Chemicals Division	162,000	gal/yr	1.17	19,800	26,719	FALSE
Kodak Park - Synthetic Chemicals Division	55,200	gal/yr	0.40	39,000	17,932	FALSE
Kodak Park - Synthetic Chemicals Division	69,900	gal/yr	0.50	41,000	23,872	FALSE
Kodak Park - Synthetic Chemicals Division	72,000	gal/yr	0.52	44,500	26,689	FALSE
Kodak Park - Synthetic Chemicals Division	227,950	gal/yr	1.64	55,000	104,432	FALSE
Kodak Park - Synthetic Chemicals Division	69,500	gal/yr	0.50	75,000	43,419	FALSE
Kodak Park - Synthetic Chemicals Division	22,300	gal/yr	0.16	75,000	13,932	FALSE
Kodak Park - Synthetic Chemicals Division	12,000	gal/yr	0.09	100,000	9,996	FALSE
Kodak Park - Synthetic Chemicals Division	27,650	gal/yr	0.20	107,000	24,644	FALSE
Kodak Park - Synthetic Chemicals Division	245,946	gal/yr	1.77	210,000	430,221	FALSE
Kodak Park - Synthetic Chemicals Division	143,360	gal/yr	1.03	240,000	286,597	FALSE
Exxon Chemical Americas - Bayway Chemical Plant	1	gal/yr	0.00	49,000	0	FALSE
Ciba Specialty Chemicals Corp	11,505	gal/yr	0.08	11,561	1,108	FALSE
Ciba Specialty Chemicals Corp	113,750	gal/yr	0.82	21,820	20,675	FALSE
Ciba Specialty Chemicals Corp	4,931	gal/yr	0.04	26,305	1,080	FALSE
Ciba Specialty Chemicals Corp	21,841	gal/yr	0.16	35,000	6,368	FALSE
Ciba Specialty Chemicals Corp	685,118	gal/yr	4.93	35,000	199,740	FALSE
Ciba Specialty Chemicals Corp	15	gal/min	56.78	37,023	2,431,366	FALSE
Ciba Specialty Chemicals Corp	543,494	gal/yr	3.91	38,940	176,288	FALSE
Ciba Specialty Chemicals Corp	16	gal/min	61.70	41,781	2,981,631	FALSE
Ciba Specialty Chemicals Corp	16	gal/min	61.70	41,781	2,981,631	FALSE
Ciba Specialty Chemicals Corp	16	gal/min	61.70	41,781	2,981,631	FALSE
Ciba Specialty Chemicals Corp	310,544	gal/yr	2.24	48,344	125,054	FALSE
Henkel Corporation - Cincinnati Plant	175,000	gal/yr	1.26	30,000	43,731	TRUE
Henkel Corporation - Cincinnati Plant	7,500	gal/yr	0.05	30,000	1,874	TRUE
Amerchol-Edison	1,400,000	gal/yr	10.08	23,400	272,883	FALSE
South Charleston Training Center	711	gal/yr	0.01	550,000	3,257	FALSE
Cincinnati Specialties,Inc.	169,500	gal/yr	1.22	49,600	70,030	FALSE
Cincinnati Specialties,Inc.	237,600	gal/yr	1.71	68,000	134,582	FALSE
The Lubrizol Corporation - Deer Park Plant	15,000	gal/yr	0.11	20,000	2,499	FALSE
The Lubrizol Corporation - Deer Park Plant	7,500	gal/yr	0.05	20,000	1,249	FALSE

Plant Name	Flow Rate	Units	Flow Rate (l/min)	HAP Conc (ppm)	Load (lb/yr)	MACT
The Lubrizol Corporation - Deer Park Plant	7,500	gal/yr	0.05	20,000	1,249	FALSE
The Lubrizol Corporation - Deer Park Plant	7,500	gal/yr	0.05	20,000	1,249	FALSE
The Lubrizol Corporation - Deer Park Plant	7,500	gal/yr	0.05	20,000	1,249	FALSE
The Lubrizol Corporation - Deer Park Plant	100,000	gal/yr	0.72	80,000	66,638	FALSE
Kalama Chemical, Inc.	40,360	gal/yr	0.29	30,000	10,086	FALSE
The Lubrizol Corporation - Bayport Plant	1,600	gal/yr	0.01	10,000	133	FALSE
Abemarle Coporation	297,000	gal/yr	2.14	37,030	91,610	FALSE
Reilly Industries, Inc.	10,000	gal/yr	0.07	10,000	833	TRUE
Reilly Industries, Inc.	60,000	gal/yr	0.43	10,000	4,998	TRUE
Reilly Industries, Inc.	70,000	gal/yr	0.50	10,000	5,831	TRUE
Reilly Industries, Inc.	40,000	gal/yr	0.29	10,000	3,332	TRUE
Reilly Industries, Inc.	200,000	gal/yr	1.44	13,000	21,657	TRUE
Reilly Industries, Inc.	400,000	gal/yr	2.88	16,000	53,310	TRUE
Reilly Industries, Inc.	40,000	gal/yr	0.29	19,000	6,331	TRUE
Reilly Industries, Inc.	90,000	gal/yr	0.65	19,000	14,244	TRUE
Reilly Industries, Inc.	200,000	gal/yr	1.44	31,000	51,644	TRUE
Air Products and Chemicals, Inc. - Piedmont Plant	14	gal/yr	0.00	10,000	1	FALSE
Air Products and Chemicals, Inc. - Piedmont Plant	14	gal/yr	0.00	10,000	1	FALSE
Air Products and Chemicals, Inc. - Piedmont Plant	1	gal/yr	0.00	10,000	0	FALSE
W.G. Krummrich Plant	44	gal/min	165.61	10,000	1,915,427	FALSE
Hilton Davis Co.	1,219,075	gal/yr	8.78	15,900	161,458	TRUE
Hilton Davis Co.	1,077,468	gal/yr	7.76	16,400	147,191	TRUE
Hilton Davis Co.	1,077,468	gal/yr	7.76	16,400	147,191	TRUE
Hilton Davis Co.	135,936	gal/yr	0.98	39,000	44,160	TRUE
Hilton Davis Co.	23,868	gal/yr	0.17	102,000	20,279	TRUE
Hilton Davis Co.	17,824	gal/yr	0.13	102,000	15,144	TRUE
Hilton Davis Co.	1,554	gal/yr	0.01	132,000	1,709	TRUE
Norco Chemical Plant	5	gal/min	17.41	15,000	302,090	FALSE
Zeneca Specialties, Inc. - Mt. Pleasant Site	15,000	gal/yr	0.11	300,000	37,484	FALSE
Zeneca Specialties, Inc. - Mt. Pleasant Site	3	gal/min	11.36	360,000	4,728,368	TRUE
3M Decatur	368	gal/yr	0.00	27,876	85	FALSE
3M Decatur	83	gal/yr	0.00	30,580	21	FALSE
3M Decatur	3,334	gal/yr	0.02	136,698	3,796	FALSE
3M Decatur	21,256	gal/yr	0.15	224,404	39,732	FALSE
3M Decatur	29,308	gal/yr	0.21	228,416	55,763	FALSE
3M Decatur	390	gal/yr	0.00	242,331	787	FALSE
3M Decatur	2,945	gal/yr	0.02	811,262	19,901	FALSE
Air Products Manufacturing Corporation	24,000	gal/yr	0.17	63,063	12,607	TRUE
Air Products Manufacturing Corporation	7,167	gal/yr	0.05	150,000	8,955	TRUE
Air Products Manufacturing Corporation	1,766	gal/yr	0.01	150,000	2,207	TRUE
Air Products Manufacturing Corporation	30,498	gal/yr	0.22	150,000	38,106	TRUE
Air Products Manufacturing Corporation	153,164	gal/yr	1.10	200,000	255,164	TRUE
Sartomer Company, Inc.	3,200,000	gal/yr	23.05	10,000	266,552	TRUE

Plant Name	Flow Rate	Units	Flow Rate (l/min)	HAP Conc (ppm)	Load (lb/yr)	MACT
Union Carbide Corporation - South Charleston Plant	20,000	gal/yr	0.14	10,000	1,666	FALSE
Union Carbide Corporation - South Charleston Plant	1,200	gal/yr	0.01	40,000	400	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	30	gal/min	113.56	12,802	1,681,460	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	8	gal/min	28.77	19,000	632,200	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	1	gal/min	2.27	59,120	155,301	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	1	gal/min	1.89	103,650	226,896	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	1	gal/min	1.89	153,637	336,320	FALSE
E. I. DuPont de Nemours & Co., Inc. - Chamber Works	1	gal/min	2.27	162,420	426,656	FALSE
Fuji Hunt Specialty Products Company	6,000	gal/yr	0.04	70,000	3,498	FALSE
Stepan Millsdale Plant	50,000	gal/yr	0.36	23,000	9,579	FALSE
Stepan Millsdale Plant	100,000	gal/yr	0.72	25,000	20,824	FALSE
Stepan Millsdale Plant	2,000,000	gal/yr	14.40	60,000	999,570	FALSE
Witco Corporation - Gretna Plant	2,542	lb/yr	0.00	40,000	-	FALSE

Attachment 2: Costing Analysis for MACT Floor

Waste Water with Flow Rate => 10.0 l/min and Concentration => 1,000 ppm or any Flow Rate or Concentration =>10,000 ppm

	Facility #	Flow Rate (1/min)	Uncontrolled load (tpy)	Uncontrolled HAP emissions (tpy)	Control Device	MACT	Baseline HAP emissions (tpy)	HAP reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	1	71.2	5,782	1,369	SS/DP	X	672	0	$0	$0	$0
2	10	154.5	765	251			251	195	$616,175	$221,001	$1,132
3	11	14.4	31	26			26	25	$449,606	$162,374	$6,412
4	27	2.0	35	6			6	1	$434,895	$157,196	$109,794
5	29	2.3	85	15			15	4	$435,264	$157,326	$38,713
6	31	2.3	24	20			20	19	$435,070	$157,258	$8,133
7	34	9.9	820	552	O-Onsite	X	27	0	$0	$0	$0
8	34	41.6	698	119			119	29	$481,997	$173,775	$6,048
9	36	10.1	20	16	SS	X	0	0	$0	$0	$0
10	43	0.0	17	5	OF (incin)	X	2	0	$0	$0	$0
11	45	469.4	1,030	182			182	50	$990,785	$352,852	$7,006
12	53	1.5	111	45			45	32	$434,301	$156,987	$4,842
13	54	388.7	1,749	409			409	202	$894,721	$319,041	$1,578
14	57	283.9	219	65			65	45	$770,126	$275,187	$6,142
15	58	144.0	171	137	SS, DP	X	2	0	$0	$0	$0
16	63	507.1	7,662	1,369			1,369	397	$1,784,298	$632,145	$1,592
17	65	435.3	1,133	193	Equalization	X	146	0	$0	$0	$0
18	67	65.7	57	10			10	2	$510,633	$183,854	$78,385
19	74	1.3	23	4	O-Onsite	X	3	0	$0	$0	$0
20	75	10.1	136	23			23	6	$444,466	$160,565	$28,602
21	81	0.0	2	1			1	1	$432,481	$156,346	$127,983
22	82	78.9	50	9			9	2	$526,267	$189,356	$91,737
23	83	1,798.1	1,040	177			177	43	$2,570,931	$909,017	$21,247

	Facility #	Flow Rate (1/min)	Uncontrolled load (tpy)	Uncontrolled HAP emissions (tpy)	Control Device	MACT	Baseline HAP emissions (tpy)	HAP reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
24	86	2.9	102	17			14	4	$435,962	$157,571	$37,433
25	88	1.0	37	6			6	2	$433,717	$156,781	$102,798
26	89	0.3	5	1			1	0	$432,821	$156,466	$754,103
27	91	2.1	46	9			9	3	$435,019	$157,240	$56,402
28	92	8.0	81	25	HT,CL,SS,D	X	8	0	$0	$0	$0
29	105	165.6	958	460			460	326	$629,438	$225,669	$692
30	106	25.6	269	153	TT, AS	X	3	0	$0	$0	$0
31	108	17.4	151	53			53	34	$453,184	$163,633	$4,828
32	128	94.6	438	280	SS, DP	X	13	0	$0	$0	$0
33	130	11.4	2,365	1,892	AS, TT, HT,	X	23	0	$0	$0	$0
34	130	0.1	19	15			15	15	$432,604	$156,389	$10,278
35	133	48.3	230	99	0 (after)	X	26	0	$0	$0	$0
36	136	0.4	60	42			42	40	$432,969	$156,518	$3,912
37	138	1.6	159	29	SS	X	20	0	$0	$0	$0
38	143	23.0	133	107	TT, OF	X	1	0	$0	$0	$0
39	153	217.3	1,881	487			487	288	$690,891	$247,299	$858
40	155	0.0	2	1			1	1	$432,526	$156,362	$260,949
41	158	15.5	515	88			88	21	$450,890	$162,826	$7,684
Batch Total:			29,111	8,762			4,849	1,789	$17,472,037	$6,261,034	$3,500
Continuous Total:			49,489	14,895			8,243	3,041	$29,702,463	$10,643,758	$3,500
National Total:			78,600	23,657			13,092	4,829	$47,174,500	$16,904,792	$3,500

Attachment 3: Costing Analysis for Regulatory Alternative

Waste Water with Flow Rate => 1.0 l/min and Concentration => 500 ppm or any Flow Rate or Concentration =>10,000 ppm

	Facility #	Flow Rate (1/min)	Uncontrolled load (tpy)	Uncontrolled HAP emissions (tpy)	Control Device	MACT	Baseline HAP emissions (tpy)	HAP reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	1	71.2	5,782	1,369	SS/DP	X	672	0	$0	$0	$0
2	10	219.5	1,008	330			330	250	$693,546	$248,226	$993
3	11	14.4	31	26			26	25	$449,606	$162,373	$6,412
4	15	37.9	12	10			10	10	$477,495	$172,189	$17,439
5	19	2.2	6	5	O	X	0	0	$0	$0	$0
6	20	2.9	8	7			7	7	$435,901	$157,550	$23,296
7	21	2.5	7	6			6	6	$435,447	$157,390	$26,828
8	22	1.4	4	3			3	3	$434,126	$156,925	$48,148
9	23	1.4	4	3			3	3	$434,126	$156,925	$48,148
10	24	1.9	5	4	O(onsite)	X	0	0	$0	$0	$0
11	27	2.0	35	6			6	1	$434,895	$157,196	$109,794
12	29	3.5	90	16			16	4	$436,681	$157,825	$37,027
13	31	2.3	24	20			20	19	$435,216	$157,309	$8,133
14	34	15.3	836	564	O-Onsite	X	27	0	$0	$0	$0
15	34	41.6	698	119			119	29	$481,997	$173,773	$6,048
16	35	2.9	7	2			2	1	$435,901	$157,550	$203,906
17	36	10.1	20	16	SS	X	0	0	$0	$0	$0
18	43	0.0	17	5	OF	X	2	0	$0	$0	$0
19	44	1,892.7	821	140			140	34	$2,683,481	$948,565	$28,084
20	45	318.0	1,030	182			182	50	$810,704	$289,458	$5,748
21	53	1.5	111	45			45	32	$434,301	$156,987	$4,842
22	54	423.8	1,915	444			444	218	$936,522	$333,739	$1,530
23	57	94.6	219	65			65	45	$545,025	$195,955	$4,374

	Facility #	Flow Rate (1/min)	Uncontrolled load (tpy)	Uncontrolled HAP emissions (tpy)	Control Device	MACT	Baseline HAP emissions (tpy)	HAP reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
24	58	144.0	171	137	SS, DP	X	2	0	$0	$0	$0
25	63	466.1	7,685	1,380			1,380	404	$986,817	$351,440	$869
26	65	435.3	1,133	193	Equalization	X	146	0	$0	$0	$0
27	67	65.7	57	10			10	2	$510,633	$183,851	$78,384
28	71	1.7	7	1			1	0	$434,445	$157,037	$542,826
29	73	7.2	2	2	AS	X	0	0	$0	$0	$0
30	74	1.3	23	4	O-Onsite	X	3	0	$0	$0	$0
31	75	10.1	136	23			23	6	$444,466	$160,564	$28,601
32	81	0.0	2	1			1	1	$432,481	$156,346	$127,983
33	82	78.9	50	9			9	2	$526,267	$189,353	$91,736
34	83	1,798.1	1,040	177			177	43	$2,570,931	$908,954	$21,245
35	86	12.4	156	27			27	6	$447,210	$161,530	$25,181
36	88	6.6	63	11			11	3	$440,277	$159,090	$61,048
37	89	0.3	5	1			1	0	$432,821	$156,466	$754,103
38	91	2.1	46	9			9	3	$435,019	$157,239	$56,401
39	92	11.3	96	37	HT,CL,	X	8	0	$0	$0	$0
40	94	26.5	8	7			7	7	$463,989	$167,435	$25,477
41	105	165.6	958	460			460	326	$629,438	$225,664	$692
42	106	22.6	295	165	TT, AS	X	5	0	$0	$0	$0
43	108	17.4	151	53			53	34	$453,184	$163,633	$4,828
44	109	6.7	12	10			10	10	$440,424	$159,142	$16,465
45	112	4.2	5	1			1	0	$437,477	$158,105	$833,904
46	128	94.6	438	280	SS, DP	X	13	0	$0	$0	$0
47	130	11.4	2,365	1,892	AS, TT,	X	23	0	$0	$0	$0
48	130	0.1	19	15			15	15	$432,604	$156,389	$10,278
49	133	48.3	230	99	0 (after	X	26	0	$0	$0	$0

	Facility #	Flow Rate (1/min)	Uncontrolled load (tpy)	Uncontrolled HAP emissions (tpy)	Control Device	MACT	Baseline HAP emissions (tpy)	HAP reduction (tpy)	TCI ($)	TAC ($/yr)	CE ($/ton)
50	136	0.4	60	42			42	40	$432,969	$156,518	$3,912
51	138	1.6	159	29	SS	X	20	0	$0	$0	$0
52	143	23.0	133	107	TT, OF	X	1	0	$0	$0	$0
53	153	179.8	1,881	487			487	288	$646,321	$231,605	$803
54	155	1.5	3	1			1	1	$434,256	$156,971	$247,665
55	158	15.5	515	88			88	21	$450,890	$162,825	$7,684
Batch Total:			30,594	9,138			5,180	1,951	$23,477,889	$8,420,092	$4,317
Continuous Total:			52,010	15,535			8,805	3,316	$39,912,411	$14,314,156	$4,317
National Total:			82,605	24,674			13,985	5,267	$63,390,300	$22,734,248	$4,317

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: March 28, 2000

Subject: MACT Floor, Regulatory Alternatives, and Nationwide Impacts for Transfer Operations at Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Brenda Shine, North State Engineering

To: MON Project File

I. Introduction

This memorandum describes existing and new source MACT floors and regulatory alternatives for transfer operations at chemical manufacturing facilities. This memorandum also presents the resulting emission reductions and costs for the regulatory alternatives.

II. MACT Floor and Regulatory Alternatives

Standards for loading operations regulate the transfer of materials containing HAP. Although the products of MON organic chemical manufacturing processes are not expected to contain HAPs, generally, it is possible that products will be transferred in solutions of HAPs. Therefore, there is a need to establish requirements for loading operations for the MON organic chemicals source category. In the data gathering effort used to establish standards for the MON, we did not collect information on transfer operations. Therefore, we established the floors and regulatory alternatives based on existing available data.

A. Existing Source MACT Floor

We decided to base the transfer requirements for the MON on the transfer requirements contained in the HON. The rationale for this decision is based on the fact that many facilities with HON applicability also contain processes which will be regulated by the MON. Therefore, loading racks at these facilities will be used for both MON and HON products. We established the MACT floor for MON facilities using information on the number of facilities expected to contain both MON and HON processes.

Based on a review of facilities in Texas and Louisiana, we found that approximately 60 percent of facilities containing processes subject to the MON also contain processes subject to the HON.[1-3] In developing the HON, EPA estimated that the transfer standards would reduce baseline HAP emissions by 56 percent using a model plant analysis.[4] At 98 percent control, this means that approximately 55 percent of the racks are controlled. Assuming a linear correlation between the emissions reductions and the number of affected transfer racks that would be required to install controls at 98 percent control, we can assume that 56 percent of the transfer racks at HON facilities would require controls according to HON requirements. Therefore, the MACT floor for MON transfer operations can be calculated to be 60 percent of 56 percent, or approximately 30 percent, which is enough to set the MACT floor.

Therefore, the MACT floor for transfer operations is based on the requirements of the HON, which is 98 percent control for loading racks with a throughout greater than or equal to 0.65 Million L/yr at a rack-weighted HAP partial pressure greater than or equal to 10.3 kPa (1.5 psia). In selecting this floor, we also stress that the selection of the same requirements will streamline the compliance process for those colocated MON processes, since only one set of requirements will apply for transfer operations.

B. <u>New Source MACT Floor and Above the Floor Options</u>

The HON requirements are the most stringent known requirements for transfer racks. Therefore, the new source MACT floor is equivalent to the existing source MACT floor, which was also the case for the HON. Based on the HON impacts, which showed that the average cost effectiveness for the transfer standards was $10,000 per ton, we did not select an above the floor option for either new or existing sources that was more stringent because the cost effectiveness of the floor was already high (not favorable).

C. <u>Impacts</u>

No MON-specific cost analysis was developed for transfer operations in this source category. We reviewed the MON database to determine how many products might meet the HAP partial pressure characteristic of 1.5 psia, and found only a few. Additionally, no single product or group of products that met the partial pressure cutoff at any one facility was found to be produced in quantities that would trigger transfer rack controls (0.65 MM liters/yr). These data indicate that a standard based on application of the HON controls to all MON loading operations above the cutoff would result in no impacts for colocated facilities, and we expect impacts for other facilities to be minimal.

III. <u>References</u>

1. Briefing package and status and approach for MACT determination. Alpha-Gamma Technologies. February 12, 1996.

2. Memorandum and attachments from P. Birla and R. Howle, Alpha-Gamma Technologies, Inc., to R. McDonald, EPA:ESD. Data Obtained from Louisiana Department of Environmental Quality. September 29, 1995.

3. Memorandum and attachments from P. Birla and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP project file. January 24, 1996. Data Obtained from Texas Natural Resource Conservation Commission.

4. U.S. Environmental Protection Agency. Hazardous Air Pollutant Emissions From Process Units in the Synthetic Organic Chemical Manufacturing Industry–Background Information for Proposed Standards. November 1992. Table 5-1.

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: June 2, 2000

Subject: Determination of TRE, MACT Floor, and Control Costs for Continuous Process Vents at Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Jennifer Fields
Brenda Shine
David Randall

To: MON Project File

I. Introduction

This memorandum revises information presented in earlier memoranda regarding the existing and new source MACT floors for continuous process vents at chemical manufacturing facilities. This memorandum also presents the emissions and cost impacts of the MACT floor and a regulatory alternative for existing sources.

II. Review of MACT Floor

The basic procedure for determining the MACT floor is unchanged from the previous approach.[1] However, we made a few changes and corrections in the database and in the calculation of the TRE. These changes and corrections resulted in a different TRE threshold for the MACT floor; details are provided in the remainder of this section.

A. Corrections to Data base and Calculations

One change is in the data obtained from state permits. Upon review, we determined that the VOC emissions data in the previous analysis had been duplicated for each HAP for vents that contain multiple HAPs. This duplication was eliminated, reducing the total VOC emissions for vents at several facilities. The second change is in the TRE calculations. The original analysis used an incorrect conversion factor, 7.18 MJ/kg, in the heat content calculation. The correct conversion factor, 34.8 MJ/kg, was substituted in the new calculations. Another minor change was the deletion of a duplicated entry for Facility M44.

B. TRE Calculation

After deleting the duplicated entry for Facility M44, the database contained records for 613 vents from 91 product processes at 56 facilities. We reduced the data using the following sequence of steps:

- Deleted all records containing inorganic compounds.
- Assigned a control efficiency of 0 percent to all scrubber controls.
- Assigned a flow rate of 183 m^3/min (6,450 scfm) if flow was unavailable.
- Assumed the VOC emission rate was equal to the HAP emission rate unless other data were available.
- Calculated the mass flow rate of halogen atoms (i.e., chlorine) due to each HAP.
- Calculated the HAP concentration based on the documented emission stream flow rate and HAP emission rate.
- Determined the vent stream characteristics by summing the HAP, VOC, and halogen atom mass emission rates and the HAP concentrations for records with identical facility, product process, emission point, emission stream flow rate, and hours of operation.
- Excluded vents with estimated HAP concentrations #50 or > 1,000,000 ppmv.
- Calculated the overall HAP control efficiency for the vent, and identified those vents controlled to the performance level of the MACT floor (i.e., 98 percent).
- Calculated the heating value of the emission stream assuming the average heating value of VOC in the vent stream is 15,000 Btu/lb.
- Calculated TREs for the vent stream using the equation in section 63.115(d)(3) of the HON with each of the four sets of coefficients in Table 1 of subpart G.
- Selected as the TRE for the vent the halogenated TRE if the halogen atom emission rate exceeded 0.45 kg/hr; otherwise, selected the lowest of the other three TREs.

Using this procedure we calculated TRE values for 202 vents from 55 processes at 44 facilities. A total of 89 vents had a TRE less than or equal to 2.6, and 98 vents had a TRE less than or equal to 5.0.

C. MACT Floor Performance Level and TRE Threshold

The MACT floor performance level is unchanged from the previous analysis (i.e., a HAP emission reduction efficiency of 98 percent because more than 18 percent of the 202 vent streams are controlled to this level). In addition, the procedure used to calculate the TRE threshold is unchanged from the previous analysis.[1] However, because emissions streams with estimated HAP concentrations > 1,000,000 ppmv were excluded when calculating the TREs, the number of facilities in the analysis dropped from 48 to 44. As a result, the top 12 percent is now

5 facilities instead of 6. Because of this change, as well as the corrections to the database and TRE calculation procedures described in section II.A of this memorandum, the TRE threshold is now 2.6 instead of 2.8. The facility ranking is presented in Attachment 1.

As in the previous analysis, the TRE threshold for each facility was used to determine the best performing facility.[2] The Mobil Chemical Company in Beaumont, Texas is still the best performing facility. This facility is controlling all continuous process vents with a TRE of 5.0 or less at a level of 98 percent. Therefore, this is the MACT floor for new sources.

III. Emissions and Cost Impacts

Emissions and cost impacts were estimated for both the MACT floor and a regulatory alternative. The regulatory alternative consists of the same 98 percent emission reduction requirement, but the TRE threshold was raised to 5.0 to be consistent with the MACT floor threshold for new sources.

Uncontrolled and baseline emissions were estimated by extrapolating the information for MON processes in permits from seven states (i.e., all 202 vents in the MACT floor analysis as well as all vents with calculated HAP concentrations >1,000,000 ppmv). These processes have actual HAP emissions of 2,080 Mg/yr. As noted in a previous analysis, these facilities were assumed to represent half of the nationwide population of MON processes.[3] Thus, nationwide baseline emissions were estimated to be 4,170 Mg/yr. The permits also identified the permitted control efficiencies. Using these values and the baseline emissions, we estimated uncontrolled HAP emissions at the facilities in the seven states to be 82,000 Mg/yr; nationwide uncontrolled emissions were estimated to be 164,000 Mg/yr. The HAP emission reductions were estimated based on the difference between the current control efficiency and 98 percent. Nationwide HAP emission reductions that would be achieved by the MACT floor and the regulatory alternative were estimated to be 3,310 Mg/yr and 3,359 Mg/yr, respectively. Attachments 2 and 3 show the uncontrolled emissions, baseline emissions, and HAP reductions for each vent with a TRE below the threshold for the MACT floor and regulatory alternative, respectively.

As described in a previous analysis, costs were estimated using standard OAQPS procedures for flares, incinerators without heat recovery, and incinerators with 70 percent heat recovery.[3,4] However, we made a few minor changes to labor rates, cost indexes, and some other factors. We also added costs for performance tests and parameter (temperature) monitoring. Attachments 2 and 3 present the total capital investment and total annual costs for each vent under the MACT floor and regulatory alternative, respectively, and attachment 4 presents the algorithms used to estimate the costs for each type of control device. The control device selected for a particular vent was the one that provided the lowest total annual cost for the vent. To be consistent with the emissions estimates, nationwide costs were estimated by doubling the costs for vents at facilities in the seven states for which permits were available. The nationwide totals are summarized in Table 1.

TABLE 1. IMPACTS OF REGULATORY ALTERNATIVES FOR EXISTING SOURCES

Regulatory alternative	Total capital investment, $	Total annual cost, $/yr	Emission reduction, Mg/yr	Cost effectiveness, $/Mg	
				Relative to baseline	Incremental
MACT floor	29,200,000	30,700,000	3,310	9,281	N/A
Regulatory alternative	32,260,000	33,700,000	3,359	10,039	61,224

V. References

1. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. May 20, 1999. Existing Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

2. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. June 7, 1999. New Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

3. Memorandum from C. Zukor, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. July 27, 1999. National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes.

4. U. S. Environmental Protection Agency. OAQPS Control Cost Manual. EPA Publication No. EPA 450/3-90-006. Chapters 3 and 7. Incinerators and Flares.

Attachment 1
Revised MACT Floor for Continuous Process Vents

REVISED MACT FLOOR FOR CONTINUOUS PROCESS VENTS

Rank	Plant Name	City	State	TRE	Avg TRE
1	MOBIL CHEMICAL COMPANY/JEFFERSON/JE0065M	BEAUMONT	TX	5.05	5.05
2	Amoco Petroleum Additives Co./Wood River	WOOD RIVER	IL	4.16	4.60
3	HOECHST CELANESE CHEMICAL GROUP, INC/MATAGORDA/MH0009H	BAY CITY	TX	1.79	3.67
4	DOW U.S.A., PLAQUEMINE SITE	PLAQUEMINE	LA	1.42	3.10
5	CF INDUSTRIES, INC.	DONALDSONVILLE	LA	0.70	2.62
6	E.I. DU PONT DE NEMOURS & COMPANY/HARRIS/HG0218K	PASADENA	TX	0.62	2.29
7	CHEVRON CHEMICAL COMPANY/ORANGE/OC0012Q	ORANGE	TX	0.61	2.05
8	KOCH NITROGEN COMPANY	STERLINGTON	LA	0.53	1.86
9	BASF Corporation - Freeport Works	Freeport	TX	0.34	1.69
10	AMOCO CHEMICAL COMPANY/BRAZORIA/BL0002S	ALVIN	TX	0.20	1.54
11	UNION CARBIDE CORPORATION/CALHOUN/CB0028T	PORT LAVACA	TX	0.18	1.42
12	Quantum - USI Division/Tuscola	TUSCOLA	IL	0.13	1.31
13	LYONDELL PETROLEUM COMPANY/MATAGORDA/MH0040N			0.12	1.22
14	PHILLIPS CHEMICAL COMPANY/HARRIS/HG0566H	PASADENA	TX	0.12	1.14
15	LYONDELL PETROCHEMICAL COMPANY/VICTORIA/VC0065E			0.06	1.07
16				-0.78	0.95
17	EXXON CHEMICAL AMERICAS/CHAMBERS/CI0009P			-2.99	0.72
18	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	BORGER	TX	no threshold	
19	DuPont Sabine River Works	Orange	TX	no threshold	
20	Exxon Chemical Americas - Baton Rouge Chemical Plant	Baton Rouge	LA	no threshold	
21	ADVANCED AROMATICS CHEMICAL CO./HARRIS/HG0132V	BAYTOWN	TX	no threshold	
22	AGRICO CHEMICAL COMPANY	SAINT JAMES	LA	no threshold	
23	AIR PRODUCTS - NEW ORLEANS	NEW ORLEANS	LA	no threshold	
24	AMPRO FERTILIZER, INC.	DONALDSONVILLE	LA	no threshold	
25	CHEVRON CHEMICAL COMPANY/HARRIS/HG0310V	BAYTOWN	TX	no threshold	
26	E.I. DU PONT DE NEMOURS AND COMPANY/VICTORIA/VC0008Q	VICTORIA	TX	no threshold	
27	EASTMAN CHEMICAL COMPANY/HARRISON/HH0042M			no threshold	
28	EXXON CHEMICAL AMERICAS/HARRIS/HG0229F	BAYTOWN	TX	no threshold	
29	EXXON CHEMICAL CO. PLASTICS PL	BATON ROUGE	LA	no threshold	
30	FARMLAND INDUSTRIES, INC.	POLLOCK	LA	no threshold	
31	GOODYEAR TIRE AND RUBBER CO THE/JEFFERSON/JE0039N	BEAUMONT	TX	no threshold	
32	HOECHST CELANESE ENGINEERING RESINS,/NUECES/NE0022I	CORPUS CHRISTI	TX	no threshold	
33	HUNTSMAN CORPORATION/JEFFERSON/JE0135Q			no threshold	
34	HUNTSMAN CORPORATION/MONTGOMERY/MQ0012Q			no threshold	
35	MONSANTO AGRICULTURAL COMPANY	LULING	LA	no threshold	
36	QUANTUM CHEMICAL CORPORATION/HARRIS/HG0770G	LA PORTE	TX	no threshold	
37	QUANTUM CHEMICAL CORPORATION/JEFFERSON/JE0011M	PORT ARTHUR	TX	no threshold	
38	REICHHOLD CHEMICALS INC/OXNARD	OXNARD	CA	no threshold	
39	REXENE CORPORATION/ECTOR/EB0108J	ODESSA	TX	no threshold	
40	THE DOW CHEMICAL COMPANY/HARRIS/HG0769O	LA PORTE	TX	no threshold	
41	TRIAD CHEMICAL	DONALDSONVILLE	LA	no threshold	
42	UNIROYAL CHEMICAL COMPANY, INC	GEISMAR	LA	no threshold	
43	WESTVACO	DE RIDDER	LA	no threshold	
44	DIXIE CHEMICAL COMPANY	PASADENA	TX	no threshold	

Attachment 2
MACT floor option, TRE #2.6

Continuous Process Vents – MACT Floor Option TRE<=2.6

	MFID	Flow rate (scfm)	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
1	M107	0.03	2,600,000	26,000	0	$0	$0	$0	None
2	M107	4.4043610	16,000	16,000	15,680	$29,306	$54,888	$7,001	Flare
3	M117	2.9345094	13,154	13,154	12,891	$29,104	$50,134	$7,778	Flare
4	M117	2.9345094	7,150	1,430	1,287	$29,065	$50,128	$77,899	Flare
5	M117	0.4695215	37,471,000	149,884	0	$0	$0	$0	None
6	M126	8.5161290	11,283	11,283	11,057	$29,062	$50,146	$9,070	Flare
7	M126		83,246	83,246	81,581	$491,846	$322,087	$7,896	Incinerator 70%
8	M126		68,909	68,909	67,531	$491,855	$323,034	$9,567	Incinerator 70%
9	M126		60,260	60,260	59,055	$491,861	$323,601	$10,959	Incinerator 70%
10	M146		306,000	31	0	$0	$0	$0	None
11	M23	35.31	13,226	13,226	12,961	$35,233	$94,926	$14,647	Flare
12	M255	6160	57,300	57,300	56,154	$486,589	$308,049	$10,972	Incinerator 70%
13	M256		54,880	54,880	53,782	$491,804	$317,892	$11,821	Incinerator 70%
14	M258	4.14744	12,440	12,440	12,191	$29,312	$54,954	$9,015	Flare
15	M258	496	1,188,000	11,880	0	$0	$0	$0	None
16	M258	496	3,288,000	32,880	0	$0	$0	$0	None
17	M258	999.99	292,000	2,920	0	$0	$0	$0	None
18	M259		840,000	8,400	0	$0	$0	$0	None
19	M259	4250.8474	270,820	2,708	0	$0	$0	$0	None
20	M260		163,194	163,194	159,930	$491,613	$298,838	$3,737	Incinerator 70%
21	M262	0.1	60,000	180	0	$0	$0	$0	None
22	M262	0.1	1,313,333	3,940	0	$0	$0	$0	None
23	M262	0.1	11,980,000	35,940	0	$0	$0	$0	None
24	M269	22116.430	77,200	77,200	75,656	$656,122	$805,163	$21,285	Incinerator 70%
25	M269	193352.11	1,999,992	8,000	0	$0	$0	$0	None
26	M269	22116.430	77,600	77,600	76,048	$656,121	$805,093	$21,173	Incinerator 70%
27	M269	25859.364	92,200	92,200	90,356	$680,817	$917,700	$20,313	Incinerator 70%
28	M269	25859.364	93,200	93,200	91,336	$680,816	$917,524	$20,091	Incinerator 70%
29	M269	193352.11	1,999,992	8,000	0	$0	$0	$0	None
30	M271	0.0501840	16,200,000	16,200	0	$0	$0	$0	None
31	M271	0.0501840	2,000	2	0	$0	$0	$0	None
32	M271	281.93	97,700	1,954	0	$0	$0	$0	None
33	M271	203.22456	620,000	620	0	$0	$0	$0	None
34	M271	203.22456	2,200,000	2,200	0	$0	$0	$0	None
35	M271	0.0501840	7,600,000	7,600	0	$0	$0	$0	None
36	M271	0.0501840	2,000,000	2,000	0	$0	$0	$0	None
37	M271	0.0501840	5,600,000	5,600	0	$0	$0	$0	None
38	M271		160,000	160	0	$0	$0	$0	None
39	M271	0.0501840	2,000,000	2,000	0	$0	$0	$0	None
40	M271	0.0501840	12,620,000	12,620	0	$0	$0	$0	None
41	M271		160,000	160	0	$0	$0	$0	None
42	M271	0.0501840	6,200,000	6,200	0	$0	$0	$0	None
43	M277	114.26865	19,157	19,157	18,774	$48,803	$195,475	$20,824	Flare
44	M277		66,000	660	0	$0	$0	$0	None
45	M277	3.7214457	316,200	3,162	0	$0	$0	$0	None
46	M277	304.43243	2,960	740	681	$68,890	$436,414	$1,282,062	Flare
47	M277	304.43243	2,960	740	681	68,890	$436,414	$1,282,062	Flare
48	M279		53,500	535	0	$0	$0	$0	None
49	M279		1,514,040	15,140	0	$0	$0	$0	None
50	M279	51.056603	33,091	33,091	32,429	$47,569	$113,863	$7,022	Flare
51	M279		157,180	1,572	0	$0	$0	$0	None
52	M279	50.458867	18,779	18,779	18,403	$47,556	$114,253	$12,416	Flare
53	M280	0.54	146,670	2,933	0	$0	$0	$0	None
54	M280	165871.67	1,654,000	165	0	$0	$0	$0	None
55	M280	0.05	298	298	292	$29,022	$50,165	$343,549	Flare
56	M280	42461.885	483,350	9,667	0	$0	$0	$0	None
57	M281	323.10790	13,142	13,142	12,879	$68,798	$24,522	$3,808	Flare
58	M281	8969.2377	591,320	591,320	579,494	$530,572	$350,000	$1,208	Incinerator 70%
59	M281	0.3	26,000	260	0	$0	$0	$0	None
60	M283	1.97	196,210	3,924	0	$0	$0	$0	None
61	M283	0.13	2,150,000	21,492	0	$0	$0	$0	None
62	M285	472.47619	144,867	30,422	27,525	$141,297	$102,850	$7,473	Incinerator
63	M285	779.18552	56,433	56,433	55,304	$304,834	$127,042	$4,594	Incinerator 70%
64	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator
65	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator
66	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator
67	M287		292,115	292,115	286,273	$491,386	$276,160	$1,929	Incinerator 70%

Continuous Process Vents – MACT Floor Option TRE<=2.6

(continued)

	MFID	Flow rate (scfm)	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
68	M293	0.3	100,680	1,007	0	$0	$0	$0	None
69	M293	0.07	2,927	2,927	2,869	$29,036	$50,137	$34,953	Flare
70	M297		52,000	5	0	$0	$0	$0	None
71	M299		245,200	12,260	7,356	$491,440	$281,525	$76,543	Incinerator 70%
72	M299		530,034	10,634	33	$490,966	$234,306	$14,063,986	Incinerator 70%
73	M300	0.023565	7,120	71	0	$0	$0	$0	None
74	M300	0.023565	7,120	71	0	$0	$0	$0	None
75	M300	0.06	550	11	0	$0	$0	$0	None
76	M300	0.15	25,300	506	0	$0	$0	$0	None
77	M301	275.43624	28,600	2,860	2,288	$67,767	$397,771	$347,702	Flare
78	M301	275.43624	26,400	2,640	2,112	$67,769	$397,868	$376,769	Flare
79	M301	275.43624	39,000	3,900	3,120	$67,758	$397,314	$254,688	Flare
80	M301	275.43624	81,760	8,176	6,541	$67,720	$395,435	$120,913	Flare
81	M301	275.43624	81,760	8,176	6,541	$67,720	$395,435	$120,913	Flare
82	M301	275.43624	42,300	4,230	3,384	$67,755	$397,169	$234,733	Flare
83	M301	275.43624	17,720	1,772	1,418	$67,777	$398,249	$561,864	Flare
84	M303		87,800	87,800	86,044	$491,746	$312,101	$7,254	Incinerator 70%
85	M303		54,831	54,831	53,734	$491,804	$317,900	$11,832	Incinerator 70%
86	M303		474,007	474	0	$0	$0	$0	None
87	M303		189,003	189	0	$0	$0	$0	None
88	M306	5.1130892	14,060	14,060	13,779	$29,280	$32,043	$4,651	Flare
89	M306	60	726,000	14,520	0	$0	$0	$0	None
90	M306	5.1130892	62,360	62,360	61,113	$29,289	$50,669	$1,658	Flare
91	M306		130,000	2,600	0	$0	$0	$0	None
92	M307		45,720	4,572	3,658	$491,870	$324,556	$177,469	Incinerator 70%
93	M307		204,988	16,399	12,299	$491,766	$314,154	$51,085	Incinerator 70%
94	M307		1,180,300	23,606	0	$0	$0	$0	None
95	M311	0.01	32,900	658	0	$0	$0	$0	None
96	M311	0.18	3,700	74	0	$0	$0	$0	None
97	M314	171185.93	559,009	559	0	$0	$0	$0	None
98	M314	9782.2569	466,100	9,468	146	$541,483	$381,896	$5,231,452	Incinerator 70%
99	M314	968.21511	34,660	3,466	2,773	$319,719	$131,999	$95,210	Incinerator 70%
100	M315	2.3261264	29,184,000	145,920	0	$0	$0	$0	None
101	M320	0.7	214,000	3,210	0	$0	$0	$0	None
102	M320	0.67	372,000	5,580	0	$0	$0	$0	None
103	M320	1.23	335,867	5,038	0	$0	$0	$0	None
104	M320	2276.8158	840,000	12,600	0	$0	$0	$0	None
105	M322		1,066,000	10,660	0	$0	$0	$0	None
106	M325	0.4394903	8,280	8,280	8,114	$29,075	$50,423	$12,428	Flare
107	M325	1658.976	274,000	274,000	268,520	$360,334	$146,978	$1,095	Incinerator 70%
108	M325	1658.976	104,600	104,600	102,508	$360,642	$158,098	$3,085	Incinerator 70%
109	M328		742,000	742,000	727,160	$491,407	$278,305	$765	Incinerator 70%
110	M330	2.6815344	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
111	M330	0.1110921	30,620	30,620	30,008	$29,109	$49,280	$3,285	Flare
112	M330	2.6815117	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
113	M330	2.6815117	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
114	M337	0.72	799,600	7,996	0	$0	$0	$0	None
115	M343	0.2777303	1,400,000	140	0	$0	$0	$0	None
116	M343	0.4839173	200,000	20	0	$0	$0	$0	None
117	M343	0.2777303	9,000,000	900	0	$0	$0	$0	None
118	M343	2.8439588	10,000	10,000	9,800	$29,049	$50,251	$10,255	Flare
119	M347		77,915	77,915	76,357	$491,763	$313,840	$8,220	Incinerator 70%
120	M350	2422.57	495,200	9,904	0	$0	$0	$0	None
121	M351	18.188976	149,900	29,980	26,982	$34,850	$69,690	$5,166	Flare
122	M351	2.1712149	11,857	166	0	$0	$0	$0	None
123	M351	8.4689108	26,555	5,311	4,780	$29,508	$60,156	$25,170	Flare
124	M351	57.891428	86,300	17,260	15,534	$47,917	$122,997	$15,836	Flare
125	M351	14.343307	76,720	15,344	13,810	$34,767	$65,822	$9,533	Flare
126	M358	210.16470	1,184,680	59,234	35,540	$65,863	$285,551	$16,069	Flare
127	M359	1.2	84,550	1,691	0	$0	$0	$0	None
128	M44	0.01	41,000	820	0	$0	$0	$0	None
129	M44	1.5575941	16,140	16,140	15,817	$29,142	$50,788	$6,422	Flare
130	M44	1.0981038	89,000	8,900	7,120	$29,314	$50,513	$14,189	Flare
Totals:			180,505,390	4,440,807	3,641,388	$14,595,342	$15,365,740	$8,439	
All Continuous Totals:			361,010,781	8,881,613	7,282,776	$29,190,684	$30,731,480	$8,439	

Attachment 3
Regulatory Alternative Option – TRE #5.0

Continuous Process Vents – Above the Floor Option

	MFID	Flow rate (scfm)	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
1	M107	0.03	2,600,000	26,000	0	$0	$0	$0	None
2	M107	4.4043610	16,000	16,000	15,680	$29,306	$54,888	$7,001	Flare
3	M117	2.9345094	13,154	13,154	12,891	$29,104	$50,134	$7,778	Flare
4	M117	2.9345094	7,150	1,430	1,287	$29,065	$50,128	$77,899	Flare
5	M117	0.4695215	37,471,000	149,884	0	$0	$0	$0	None
6	M126		60,260	60,260	59,055	$491,861	$323,601	$10,959	Incinerator 70%
7	M126	8.5161290	11,283	11,283	11,057	$29,062	$50,146	$9,070	Flare
8	M126		68,909	68,909	67,531	$491,855	$323,034	$9,567	Incinerator 70%
9	M126		83,246	83,246	81,581	$491,846	$322,087	$7,896	Incinerator 70%
10	M126	89.399993	8,400	420	252	$48,726	$164,155	$1,302,817	Flare
11	M146		306,000	31	0	$0	$0	$0	None
12	M23	35.31	13,226	13,226	12,961	$35,233	$94,926	$14,647	Flare
13	M255	6160	57,300	57,300	56,154	$486,589	$308,049	$10,972	Incinerator 70%
14	M256		54,880	54,880	53,782	$491,804	$317,892	$11,821	Incinerator 70%
15	M258	4.14744	12,440	12,440	12,191	$29,312	$54,954	$9,015	Flare
16	M258	496	1,188,000	11,880	0	$0	$0	$0	None
17	M258	496	3,288,000	32,880	0	$0	$0	$0	None
18	M258	999.99	292,000	2,920	0	$0	$0	$0	None
19	M259		840,000	8,400	0	$0	$0	$0	None
20	M259	1100	13,540	135	0	$0	$0	$0	None
21	M259	4250.8474	270,820	2,708	0	$0	$0	$0	None
22	M260		163,194	163,194	159,930	$491,613	$298,838	$3,737	Incinerator 70%
23	M262	0.1	60,000	180	0	$0	$0	$0	None
24	M262	0.1	1,313,333	3,940	0	$0	$0	$0	None
25	M262	0.1	11,980,000	35,940	0	$0	$0	$0	None
26	M269	22116.430	77,600	77,600	76,048	$656,121	$805,093	$21,173	Incinerator 70%
27	M269	193352.11	1,999,992	8,000	0	$0	$0	$0	None
28	M269	22116.430	77,200	77,200	75,656	$656,122	$805,163	$21,285	Incinerator 70%
29	M269	25859.364	92,200	92,200	90,356	$680,817	$917,700	$20,313	Incinerator 70%
30	M269	25859.364	93,200	93,200	91,336	$680,816	$917,524	$20,091	Incinerator 70%
31	M269	193352.11	1,999,992	8,000	0	$0	$0	$0	None
32	M271	0.0501840	16,200,000	16,200	0	$0	$0	$0	None
33	M271	281.93	97,700	1,954	0	$0	$0	$0	None
34	M271	203.22456	620,000	620	0	$0	$0	$0	None
35	M271	203.22456	2,200,000	2,200	0	$0	$0	$0	None
36	M271	0.0501840	7,600,000	7,600	0	$0	$0	$0	None
37	M271	0.0501840	2,000	2	0	$0	$0	$0	None
38	M271	0.0501840	2,000,000	2,000	0	$0	$0	$0	None
39	M271	0.0501840	5,600,000	5,600	0	$0	$0	$0	None
40	M271	0.0501840	2,000,000	2,000	0	$0	$0	$0	None
41	M271	0.0501840	12,620,000	12,620	0	$0	$0	$0	None
42	M271		160,000	160	0	$0	$0	$0	None
43	M271		160,000	160	0	$0	$0	$0	None
44	M271	0.0501840	6,200,000	6,200	0	$0	$0	$0	None
45	M277	114.26865	19,157	19,157	18,774	$48,803	$195,475	$20,824	Flare
46	M277		66,000	660	0	$0	$0	$0	None
47	M277	3.7214457	316,200	3,162	0	$0	$0	$0	None
48	M277	304.43243	2,960	740	681	$68,890	$436,414	$1,282,062	Flare
49	M277	304.43243	2,960	740	681	$68,890	$436,414	$1,282,062	Flare
50	M279		53,500	535	0	$0	$0	$0	None
51	M279		1,514,040	15,140	0	$0	$0	$0	None
52	M279	50.458867	18,779	18,779	18,403	$47,556	$114,253	$12,416	Flare
53	M279	51.056603	33,091	33,091	32,429	$47,569	$113,863	$7,022	Flare
54	M279		157,180	1,572	0	$0	$0	$0	None
55	M279	105.33101	7,057	7,057	6,916	$48,717	$184,034	$53,219	Flare
56	M280	0.54	146,670	2,933	0	$0	$0	$0	None
57	M280	165871.67	1,654,000	165	0	$0	$0	$0	None
58	M280	0.05	298	298	292	$29,022	$50,165	$343,549	Flare
59	M280	42461.885	483,350	9,667	0	$0	$0	$0	None
60	M281	323.10790	13,142	13,142	12,879	$68,798	$24,522	$3,808	Flare
61	M281	8969.2377	591,320	591,320	579,494	$530,572	$350,000	$1,208	Incinerator 70%
62	M281	0.3	26,000	260	0	$0	$0	$0	None
63	M283	1.97	196,210	3,924	0	$0	$0	$0	None
64	M283	0.13	2,150,000	21,492	0	$0	$0	$0	None
65	M285	472.47619	144,867	30,422	27,525	$141,297	$102,850	$7,473	Incinerator
66	M285	779.18552	56,433	56,433	55,304	$304,834	$127,042	$4,594	Incinerator 70%
67	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator
68	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator

Continuous Process Vents – Above the Floor Option
(continued)

	MFID	Flow rate (scfm)	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
69	M285	472.47619	31,782	31,782	31,146	$141,513	$110,272	$7,081	Incinerator
70	M287		292,115	292,115	286,273	$491,386	$276,160	$1,929	Incinerator 70%
71	M293	0.3	100,680	1,007	0	$0	$0	$0	None
72	M293	0.07	2,927	2,927	2,869	$29,036	$50,137	$34,953	Flare
73	M297		52,000	5	0	$0	$0	$0	None
74	M299		245,200	12,260	7,356	$491,440	$281,525	$76,543	Incinerator 70%
75	M299		21,800	872	436	$491,862	$323,690	$1,484,817	Incinerator 70%
76	M299		530,034	10,634	33	$490,966	$234,306	$14,063,986	Incinerator 70%
77	M300	0.023565	7,120	71	0	$0	$0	$0	None
78	M300	0.023565	7,120	71	0	$0	$0	$0	None
79	M300	0.06	550	11	0	$0	$0	$0	None
80	M300	0.15	25,300	506	0	$0	$0	$0	None
81	M301	275.43624	26,400	2,640	2,112	$67,769	$397,868	$376,769	Flare
82	M301	275.43624	17,720	1,772	1,418	$67,777	$398,249	$561,864	Flare
83	M301	275.43624	28,600	2,860	2,288	$67,767	$397,771	$347,702	Flare
84	M301	275.43624	42,300	4,230	3,384	$67,755	$397,169	$234,733	Flare
85	M301	275.43624	81,760	8,176	6,541	$67,720	$395,435	$120,913	Flare
86	M301	275.43624	81,760	8,176	6,541	$67,720	$395,435	$120,913	Flare
87	M301	275.43624	39,000	3,900	3,120	$67,758	$397,314	$254,688	Flare
88	M303		87,800	87,800	86,044	$491,746	$312,101	$7,254	Incinerator 70%
89	M303		54,831	54,831	53,734	$491,804	$317,900	$11,832	Incinerator 70%
90	M303		474,007	474	0	$0	$0	$0	None
91	M303		189,003	189	0	$0	$0	$0	None
92	M306	5.1130892	62,360	62,360	61,113	$29,289	$50,669	$1,658	Flare
93	M306		130,000	2,600	0	$0	$0	$0	None
94	M306	5.1130892	14,060	14,060	13,779	$29,280	$32,043	$4,651	Flare
95	M306	60	726,000	14,520	0	$0	$0	$0	None
96	M307		45,720	4,572	3,658	$491,870	$324,556	$177,469	Incinerator 70%
97	M307		204,988	16,399	12,299	$491,766	$314,154	$51,085	Incinerator 70%
98	M307		1,180,300	23,606	0	$0	$0	$0	None
99	M311	0.01	32,900	658	0	$0	$0	$0	None
100	M311	0.18	3,700	74	0	$0	$0	$0	None
101	M314	1640.3545	18,020	901	541	$359,824	$161,143	$596,164	Incinerator 70%
102	M314	171185.93	559,009	559	0	$0	$0	$0	None
103	M314	968.21511	34,660	3,466	2,773	$319,719	$131,999	$95,210	Incinerator 70%
104	M314	9782.2569	466,100	9,468	146	$541,483	$381,896	$5,231,452	Incinerator 70%
105	M315	2.3261264	29,184,000	145,920	0	$0	$0	$0	None
106	M320	0.67	372,000	5,580	0	$0	$0	$0	None
107	M320	1.23	335,867	5,038	0	$0	$0	$0	None
108	M320	2276.8158	840,000	12,600	0	$0	$0	$0	None
109	M320	0.7	214,000	3,210	0	$0	$0	$0	None
110	M322		1,066,000	10,660	0	$0	$0	$0	None
111	M325	0.4394903	8,280	8,280	8,114	$29,075	$50,423	$12,428	Flare
112	M325	1658.976	274,000	274,000	268,520	$360,334	$146,978	$1,095	Incinerator 70%
113	M325	1658.976	104,600	104,600	102,508	$360,642	$158,098	$3,085	Incinerator 70%
114	M328		742,000	742,000	727,160	$491,407	$278,305	$765	Incinerator 70%
115	M330	2.6815117	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
116	M330	2.6815117	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
117	M330	2.6815344	9,000	9,000	8,820	$29,085	$50,130	$11,367	Flare
118	M330	0.1110921	30,620	30,620	30,008	$29,109	$49,280	$3,285	Flare
119	M337	0.72	799,600	7,996	0	$0	$0	$0	None
120	M343	188.85664	9,200	9,200	9,016	$65,032	$291,284	$64,615	Flare
121	M343	0.4839173	200,000	20	0	$0	$0	$0	None
122	M343	0.2777303	9,000,000	900	0	$0	$0	$0	None
123	M343	2.8439588	10,000	10,000	9,800	$29,049	$50,251	$10,255	Flare
124	M343	0.2777303	1,400,000	140	0	$0	$0	$0	None
125	M343	0.1284225	6,560	6,560	6,429	$29,038	$50,282	$15,643	Flare
126	M347		77,915	77,915	76,357	$491,763	$313,840	$8,220	Incinerator 70%
127	M347		30,967	30,967	30,348	$491,846	$322,098	$21,227	Incinerator 70%
128	M350	2422.57	495,200	9,904	0	$0	$0	$0	None
129	M351	57.891428	86,300	17,260	15,534	$47,917	$122,997	$15,836	Flare
130	M351	2.1712149	11,857	166	0	$0	$0	$0	None
131	M351	14.343307	76,720	15,344	13,810	$34,767	$65,822	$9,533	Flare
132	M351	18.188976	149,900	29,980	26,982	$34,850	$69,690	$5,166	Flare
133	M351	8.4689108	26,555	5,311	4,780	$29,508	$60,156	$25,170	Flare
134	M358	210.16470	1,184,680	59,234	35,540	$65,863	$285,551	$16,069	Flare
135	M359	1.2	84,550	1,691	0	$0	$0	$0	None
136	M44	0.01	41,000	820	0	$0	$0	$0	None

Continuous Process Vents – Above the Floor Option

(continued)

	MFID	Flow rate (scfm)	HAP Uncontrolled Emissions (lb/yr)	Baseline HAP Emissions (lb/yr)	HAP Reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control Technology
137	M44	1.5575941	16,140	16,140	15,817	$29,142	$50,788	$6,422	Flare
138	M44	1.0981038	89,000	8,900	7,120	$29,314	$50,513	$14,189	Flare
139	M44	5.6762408	7,880	79	0	$0	$0	$0	None
Totals:			180,628,814	4,496,998	3,695,325	$16,130,387	$16,862,426	$9,126	
All Continuous Totals:			361,257,629	8,993,996	7,390,650	$32,260,774	$33,724,852	$9,126	

Attachment 4
Costing Modules

Flare Costing Module

```
Option Compare Database
Option Explicit

Public Sub FlareCost()
                                ‘Variable declaration section
Dim x As Double
Dim dbs As Database
Dim rst As Recordset
Dim Qe As Variant               ’max emission stream flow rate, scfm
Dim he As Double                ’heat content, Btu/scf
Dim Qflg As Double              ’flare gas flow rate, scfm
Dim ppm As Double               concentration, ppm
Dim Hflg As Double              ’heat content of flare gas
Dim Dtip As Double              ’flare tip dia, in.
Dim Uflg As Double              ’exit velocity of flare gas, ft/sec
Const Umin As Double = 0.03     ’min flare gas exit velocity in ft/sec for a
                                ’stable flame (p 4-22, handbook)
Const MWe As Integer = 100      ’mol wt of emission stream, lb/lb-mole
Dim MWflg As Double             ’mol wt of flare gas, lb/lb-mole
Const Tflg As Integer = 95      ’flare gas temperature, degF
Dim FlAngle As Double           ’flame angle, degrees
Dim h As Double                 ’flare height, ft
Dim Qf As Double                ’natural gas flow rate, scfm
Dim Qs As Double                ’steam requirement, lb/min
Dim Umax As Double              ’maximum flare gas exit velocity
Dim FC As Double                ’flare cost, $
Dim PEC As Double               ’purchased equipment cost, $
Dim TAC As Double               ’total annual cost, $/yr
Dim HRS As Double               ’operating hours per year, hr/yr
Dim Fp As Double                ’power needed for fan, kWh/yr
Const P As Integer = 16         ’system pressure drop, in. H2O
                                ’(table 4.2-9, handbook)
Dim DAC As Double               ’direct annual cost, $/yr
Dim IC As Double                ’indirect cost, $
Dim DC As Double                ’total direct cost, $
Dim IAC As Double               ’indirect annual cost, $/yr
Dim TCC As Double               ’total capital cost, $
Dim AEC As Double               ’auxiliary equipment cost
Dim Cp As Double                ’vent stream piping costs
Dim Ck As Double                ’knock-out drum costs
Dim d As Double                 ’knock-out drum diameter, inches
Dim dh As Double                ’knock-out drum height, inches
Dim t As Double                 ’knock-out drum thickness, inches
Dim Udo As Double               ’drop-out velocity for drum, ft/sec
Dim A As Double                 ’knock-out drum area, ft2
Dim EC As Double                ’equipment cost, $
```

Flare Costing Module (continued)

```
Dim DIC As Double                    'direct installation cost, involves
                                     'foundation and supports, handling and
                                     'erection, electrical, piping,
                                     'insulation for ductwork and painting
Dim Fuel As Double                   'fuel charges
Dim Electric As Double               'electrical expenses
Dim StCost As Double                 'annual steam cost, $/yr
Dim Labor As Double                  'labor cost
Dim Superv As Double                 'supervisory cost
Dim Maint As Double                  'maintenance cost
Dim MaintMat As Double               'Maintenance material cost
Dim Overhead As Double               'overhead cost is 60% oflabor and maintenance
Dim Admin As Double                  'administrative cost is 2% of TCC
Dim PropTax As Double                'property tax is 1% of TCC
Dim Insur As Double                  'insurance is 1% of TCC
Dim CapRecov As Double               'capital recovery
Dim DaysPerYear As Variant
Dim HoursPerDay As Variant
Dim HoursOfOperation As Variant
Dim ProType As String
Dim y As Double
Dim Reduc As Double                  'HAP reduction, lb/yr
Dim Steam As Double                  'steam requirement, lb/yr
Dim NatGas As Double                 'natural gas requirement, mmscf/yr
Dim OandM As Double                  'operating and maintenance cost
Const M As Single = 10000            'Assumed compliance assessment cost, $
                                     '(inital)
Dim CAR As Double                    'capital recovery
Const RC As Single = 0               'recovery credit is 0 because no recovery
Dim ppmw As Double

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForContVents")

'Opens the Table "MasterTableForContVent" from the database and reads out the values listed
'below

rst.MoveFirst
Do While Not rst.EOF
                                     'DaysPerYear = rst![Days/yr]
                                     'HoursPerDay = rst![Hrs/day]
                                     'HoursOfOperation = rst![Hours of Operation]
                                     'ProType = rst![Type]
  If IsNull(rst![Hours of Operation]) Then
    HRS = 8760
  Else
    HRS = rst![Hours of Operation]
  End If
```

Flare Costing Module (continued)

```
   Reduc = rst![HAP Reduction (lb/yr)]

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
   Qe = 6450
Else
   Qe = rst![Flow (scfm)]
End If

If IsNull(rst!Conc) Then
      ppm = 0
Else
      ppm = rst!Conc
End If

‘Calculates the heat content (he) in BTU/scf
                                          ’ppmw = ppm * 100 / 29
he = ((15000 * 0.0753) * ppm) / 1000000
                                          ’15000 Btu/lb is decided by CMA, 0.0753
                                          ’lb/scf is density of emission
                                          ’stream at 68 degF
If he >= 300 Then
   Qf = 0                                 ‘Qf is the natural gas flow rate, scfm
Else
   Qf = ((300 - he) * Qe) / (882 - 300)   ’where 882 is the lower heating
                                          ’value of natural gas
End If

Qflg = Qe + Qf                            ’flare gas flow rate, scfm calculation for
                                          ’98% HAP reduction, where Qe is the max emission
                                          ‘stream flow rate

If he > 300 Then                          ’Hflg, the heat content of the flare gas,
                                          ‘ is dependent on whether
                                          ’supplementary fuel is
                                          ’added to the emission stream
   Hflg = he
Else
   Hflg = 300
End If

If Hflg >= 300 And Hflg < 1000 Then
   Umax = 3.28 * (10 ^ (0.00118 * Hflg + 0.908))
                                          ‘Umax is the max flare gas exit velocity
ElseIf Hflg > 1000 Then
   Umax = 400
End If
```

Flare Costing Module (continued)

```
'Calculation of the Dtip (flare tip diameter, inches)

Dtip = 1.96 * ((Qflg / Umax) ^ 0.5)
   Select Case Dtip
      Case Is < 1
         x = 1

      Case 1 To 2
        x = 2

      Case 2 To 24
         y = Dtip
            If y / 2 = 0 Then
               x = y
            Else
               x = Int(y) - (Int(y) Mod 2) + 2   'rounds diameter
                                                 'to next commercially
                                                 'available size
            End If

     Case 24 To 60
         y = Dtip
            If y / 6 = 0 Then
               x = y
            Else
              x = Int(y) - (Int(y) Mod 6) + 6
            End If
   End Select

Uflg = (0.005766 * Qflg * (Tflg + 460)) / (x) ^ 2

If Umin > Uflg Or Uflg > Umax Then        'because 98% destruction efficiency
                                          'can be achieved-
   rst.Edit                               'under these conditions and no additional cost
   rst!Flare_TAC = 0                      'is required
   rst!Flare_TCC = 0
   rst![Flare_Electricity (kWh/yr)] = 0
   rst![Flare_Steam (lb/yr)] = 0
   rst![Flare_NatGas (mmscf/yr)] = 0
   rst![Flare_O&M ($)] = 0
   rst![Flare_MRR ($)] = 0
   rst![Flare_ACR ($)] = 0
   rst![Flare_RC ($)] = 0
   rst.Update
   GoTo nextrecord
Else
   MWflg = ((Qf * 16.7) + (Qe * MWe)) / Qflg
                                          'MWflg is the molecular flow rate of the flare gas
```

Flare Costing Module (continued)

```
Qs = 0.00103 * Qflg * MWflg
                                                    ‘Qs is the steam requirement in lb/min
FlAngle = Atn(88.2 / Uflg) * 180 / 3.1416
                                                    ‘FlAngle is the flame angle in degrees
                                                       ’assuming wind velocity 60 mph
h = 0.02185 * ((Qflg * Hflg) ^ 0.5) - (0.00605 * x * Uflg * (cos(FlAngle)))
                                                       ‘h is the flare height, in feet
                                                       ‘The height determines the type of tower, which
                                                       ‘Is assigned below
If h <= 100 Then                                       ’self support tower
   FC = (78 + (9.14 * x) + (0.749 * h)) ^ 2
ElseIf h > 100 And h = 300 Then                        ’guy support tower
   FC = (103 + (8.68 * x) + (0.47 * h)) ^ 2
ElseIf h > 300 Then                                    ’derrick support tower
   FC = (76.4 + (2.72 * x) + (1.64 * h)) ^ 2
End If
                        ’For all three cases, FC includes the flare stack and support, burner
                        ’tip, pilots, utility piping, 100 ft of vent stream piping, utility
                        ’metering and control, water and gas seals, and platform and ladders.
If x < 24 Then
   Cp = (127 * x) ^ 1.21                               ’vent stream piping costs (Cp)
Else
   Cp = (139 * x) ^ 1.07
End If

                                                       ’Knock-out drum calculations:

Udo = 0.2 * ((41.203 - 2.97) / 2.97) ^ 1 / 2           ’assumed design vapor velocity
                                                       ’G=0.2
A = Qe / (60 * Udo)                                    ’used densities for hexane

d = 12 * (4 * A / 3.14) ^ 1 / 2                        ’diameter of knock-out drum

If d < 36 Then                                         ‘t is the knock-out drum thickness, which is
   t = 0.25                                            ‘dependent on the diameter
Else
   If d < 72 Then
      t = 0.375
   End If
End If

dh = 3 * d                                             ‘dh is the knockout drum height in inches

Ck = 14.2 * (d * t * (dh + 0.812 * d)) ^ 0.737          ’knock-out drum cost

AEC = Cp + Ck                                           ’auxillary equipment costs
EC = FC + AEC                                           ‘total equipment costs
PEC = 1.18 * EC                                         ’include EC, instrumentation,
```

Flare Costing Module (continued)

```
                                          'sales tax and freight
   DC = 1.56 * PEC                        'include foundation and support,
                                          'handling and erection,
                                          'elecrical, piping, painting
                                          'and insulation
   IC = 0.35 * PEC                        'Indirect costs
   TCC = (DC + IC) * (106.7 / 100) * (99.4 / 100) + M
                                          'Total Capital Cost -
                                          'multiplying by cost indexes to
                                          'get 1st quarter 99$ relative to
                                          'April 1988

   Fp = 0.000181 * Qflg * P * HRS         'Power needed for fan,
                                          'assuming a fan motor efficiency
                                          'of 65% and a fluid sp gr of
                                          '1 and the fan is installed
                                          'downstream of the
                                          'incinerator
   Steam = Qs * 60 * HRS                  'Steam requirement, lb/yr

   StCost = Qs * 60 * HRS * 6 / 1000      ' annual steam cost, assuming $6.0/1000 lb
   NatGas = Qf * 60 * HRS / 1000000       'Annual natural gas cost
   Fuel = Qf * 60 * HRS * 3.3 / 1000      'factor $3.30/1000 ft3 is for
                                          'fuel (natural gas)
   Electric = 0.059 * Fp                  'electricity cost, assuming $0.059/kWh
   Labor = 0.5 / 8 * HRS * 15.64          '0.5 hr labor in 8 hr shift at
                                          '$15.64/hr
   Superv = 0.15 * Labor                  '15% of labor cost
   Maint = 0.5 / 8 * HRS * 17.2           '0.5 hr maintenance per 8 hr
                                          'shift with $17.20/hr
   MaintMat = Maint                       'maintenance material cost is
                                          '100% of maintenance charges
   DAC = Fuel + Electric + StCost + Labor + Superv + Maint + MaintMat
   Overhead = 0.6 * (Labor + Superv + Maint + MaintMat)
   Admin = 0.02 * TCC
   PropTax = 0.01 * TCC
   Insur = 0.01 * TCC
   CAR = 0.1098 * TCC                     'based on i(1+i)^n/(((1+i)^n)-1)
                                          'where i=7% and n=15 yr life
   IAC = Overhead + Admin + PropTax + Insur + CAR
   TAC = (DAC + IAC)
   OandM = TAC - CAR + RC
End If

   rst.Edit

   If Reduc = 0 Then                      'If reduction is 0, then no costs are incurred
      rst!Flare_TAC = 0
```

```
        rst!Flare_TCC = 0
        rst![Flare_Electricity (kWh/yr)] = 0
        rst![Flare_Steam (lb/yr)] = 0
        rst![Flare_NatGas (mmscf/yr)] = 0
        rst![Flare_O&M ($)] = 0
        rst![Flare_MRR ($)] = 0
        rst![Flare_ACR ($)] = 0
        rst![Flare_RC ($)] = 0
    Else                                        'Puts calculated costs back into table in db
        rst!Flare_TAC = TAC
        rst!Flare_TCC = TCC
        rst![Flare_Electricity (kWh/yr)] = Fp
        rst![Flare_Steam (lb/yr)] = Steam
        rst![Flare_NatGas (mmscf/yr)] = NatGas
        rst![Flare_O&M ($)] = OandM
        rst![Flare_MRR ($)] = M
        rst![Flare_ACR ($)] = CAR
        rst![Flare_RC ($)] = RC
    End If

    rst.Update

nextrecord:

    rst.MoveNext
Loop
End Sub
```

Incinerator (0% heat recovery) Costing Module

```
Option Compare Database
Option Explicit

Public Sub IncineratorCost()            ’for 98% destruction efficiency

    ‘Variable declaraion
Dim dbs As Database
Dim rst As Recordset
Dim Qe As Variant                       ’max emission stream flow rate, scfm
Const Te As Integer = 100               ’temperature of emission stream entering
                                        ’the incinerator, 68 degF
Dim he As Double                        ’heat content, Btu/lb
Dim O2 As Double                        ’oxygen content, %
Dim ppm As Variant                      ’concentration, ppm
Dim Qd As Double                        ’dilution air required, scfm
Dim hd As Double                        ’desired heat content of emission stream,
                                        ’<=13 Btu/scf
Const Tc As Integer = 1600              ’combustion temperature, degF
Const tr As Double = 0.75               ’residence time, sec
Dim Qf As Double                        ’supplementary natural gas flow rate,scfm
Const De As Double = 0.0753             ’density of flue gas stream, lb/scf
Const Df As Double = 0.0417             ’density of fuel gas, 0.0417 lb/scf for
                                        ’methane at 68 degF
Const CPair As Double = 0.248           ’mean heat capacity of between Tc and Tr
                                        ’(77 degF), Btu/lb-degF
                                        ’(p 3-32 OAQPS manual)
Dim The As Double                       ’emission stream temperature after heat
                                        ’recovery, degF
Const hf As Double = 21600              ’lower heating value of natural gas,
                                        ’Btu/lb
Const HR As Integer = 0                 ’heat recovery in the exchanger, %
Const Tref As Integer = 68              ’reference temperature, 68 degF
Dim Qfg As Double                       ’flue gas flow rate, scfm
Dim Qfga As Double                      ’actual flue gas flow rate, acfm
Dim Vc As Double                        ’combustion chamber volume, ft3
Dim TIC As Double                       ’thermal incinerator cost, $
Dim PEC As Double                       ’purchased equipment cost, $
Dim TAC As Double                       ’total annual cost, $/yr
Dim HRS As Double                       ’operating hours per year, hr/yr
Dim Fp As Double                        ’power needed for fan, kWh/yr
Const P As Integer = 4                  ’system pressure drop, in. H2O for 0% HR
                                        ’(table 3.11 OAQPS manual)
Dim DAC As Double                       ’direct annual cost, $/yr
Dim IC As Double                        ’indirect cost, $
Dim DC As Double                        ’total direct cost, $
Dim IAC As Double                       ’indirect annual cost, $/yr
Dim TCC As Double                       ’total capital cost, $
Const AEC As Integer = 0                ’auxiliary equipment cost, assumed $0
```

Incinerator (0% heat recovery) Costing Module (continued)

```
Dim EC As Double                        'equipment cost, $
Dim DIC As Double                       'direct installation cost, involves
                                        'foundation and supports,handling and
                                        'erection, electrical, piping,
                                        'insulation for duct work and
                                        'painting
Dim Fuel As Double                      'fuel charges
Dim Electric As Double                  'electrical expenses
Dim Labor As Double                     'labor cost
Dim Superv As Double                    'supervisory cost
Dim Maint As Double                     'maintenance cost
Dim MaintMat As Double                  'Maintenance material cost
Dim Overhead As Double                  'overhead cost is 60% oflabor and
                                        'maintenance
Dim Admin As Double                     'administrative cost is 2% of TCC
Dim PropTax As Double                   'property tax is 1% of TCC
Dim Insur As Double                     'insurance is 1% of TCC
Dim DaysPerYear As Variant
Dim HoursPerDay As Variant
Dim HoursOfOperation As Variant
Dim ProType As String
Dim Concv As Double                     'concentration in ppmv
Dim ConcW As Double                     'concentration in ppmw
Dim Reduction As Double                 'HAP reduction, lb/yr
Dim Electricity As Double               'electricity requirement, kWh/yr
Dim Steam As Double                     'steam requirement, lb/yr
Dim NatGas As Double                    'natural gas requirement, mmscf/yr
Dim OandM As Double                     'operating and maintenance cost
Dim M As Double                         'Assumed compliance assessment cost, $
Dim CAR As Double                       'capital recovery, .1315 of TCC
Const RC As Single = 0                  'recovery credit is 0 because no recovery
Const MonitLabor As Double = 9422       'Monitoring labor
Const Monitmat As Double = 500          'Monitoring materials
Dim EquipTCC As Double                  'Equipment Capital Cost
Const MonitEquip As Double = 6250       'Monitoring equipment cost
Const MT As Double = 24420              'Monitoring Testing cost
Dim MonitE As Double                    'Monitoring equipment costs, inc. tax, etc.

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForContVents")

'Reading data into module from table (MasterTableForContVents) in database
rst.MoveFirst
Do While Not rst.EOF
   If IsNull(rst![Hours of Operation]) Then
      HRS = 8760
   Else
      HRS = rst![Hours of Operation]
```

Incinerator (0% heat recovery) Costing Module (continued)

```
   End If

   Reduction = rst![HAP Reduction (lb/yr)]

    If IsNull(rst!Conc) Then
      ConcW = 0
   Else
      Concv = rst!Conc
      ConcW = Concv * 100 / 29              '100 is avg MW of HAP and 29 MW of air
   End If                                   'in lb/lb-mole

   O2 = (1 - ConcW / 1000000) * 0.21 * 100
   he = 15000 * ConcW / 1000000             'He is heat content, BTU/scf
                                            '15000 Btu/lb is decided by CMA

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
   Qe = 6450                                'Qe is the max emission stream flow rate
Else
   Qe = rst![Flow (scfm)]
End If

If Qe < 415 Or Qe > 50000 Then              'because TCC calculator are designed
   rst.Edit                                 'for given range only-
   rst!Incin_TAC = 0                        '(table 3.7 manual)
   rst!Incin_TCC = 0
   rst![Incin_Electricity (kWh/yr)] = 0
   rst![Incin_Steam (lb/yr)] = 0
   rst![Incin_NatGas (mmscf/yr)] = 0
   rst![Incin_O&M ($)] = 0
   rst![Incin_MRR ($)] = 0
   rst![Incin_ACR ($)] = 0
   rst![Incin_RC ($)] = 0
   rst.Update
   GoTo nextrecord
ElseIf O2 < 20 And (he * 0.0753) >= 13 Then         'he is in Btu/lb, multiplying
    Qd = ((he * 0.0753 / 13) - 1) * Qe               'it by 0.0753 lb/scf will
                                                     'make it Btu/scf
                                                     'If O2<20 and heat content>13,
                                                     'use this equation to
                                                     'determine auxillary air
Else
   Qd = 0
End If

   The = (HR / 100) * Tc + (1 - (HR / 100)) * Te    'since thermal incinerator
                                                     'is with 0% heat recovery
                                                     'The = Te
```

Incinerator (0% heat recovery) Costing Module (continued)

```
   If O2 > 20 Then
      Qf = De * Qe * (CPair * (1.1 * Tc - The - (0.1 * Tref)) - he) / (Df * (hf - 1.1 * CPair * (Tc - Tref)))
                                                        'Qf is the natural gas flow rate
                                                        'the factor of 1.1 in above equation is to
                                                        'account for 10% of heat losses
                                                        'in the incinerator
   Else
      Qf = 0
   End If

   If Qf > 0 Then
      Qfg = Qe + Qf + Qd                                'Qflg is the flow rate of the flare gas
   Else
      Qfg = Qe + Qd
   End If

   Qfga = Qfg * ((Tc + 460) / 528)                      '68F + 460 = 528 degR
   Vc = ((Qfga / 60) * tr) * 1.05                       'the factor of 1.05 is used for
                                                        'minor fluctuation in flow rate
                                                        'and follows industry practice
   TIC = 10294 * (Qfg ^ 0.2355)                         'for HR = 0% and Qe range from 500
                                                        'to 50,000 scfm
   EC = TIC + AEC                                       'Equipment costs
   PEC = 1.08 * EC                                      'purchased equipment costs
   DIC = 0.3 * PEC                                      'Direct installation cost
   DC = 1.3 * PEC                                       'Direct costs
   IC = 0.31 * PEC                                      'Indirect costs

   EquipTCC = (DC + IC) * (352.4 / 340.1) * (120.5 / 100) * (109.3 / 100)
                                                        'Equipment Capital costs,
                                                        'multiplying by cost indexes for
                                                        '1st quarter 99$ relative
                                                        'to April 1988 -
                                                        '352.4/340.1 is April 88 to
                                                        '1st quarter 89
                                                        '120.5/100 is Vatavuk Index for
                                                        '1st quarter 94 vs 89
                                                        '109.3/100 is Vatavuk Index for
                                                        '1st quarter 99 vs 94

   MonitE = MonitEquip * 1.08 * 1.8                     'Monitoring equipment costs,
                                                        'Add cost of tax, freight and shipping

               M = MonitE + MT                          'M is the assumed compliance assessment
                                                        'cost

   TCC = EquipTCC + M                                   'Total capital cost
```

Incinerator (0% heat recovery) Costing Module (continued)

```
Fp = 0.000181 * Qfga * P * HRS             'Fan power requirement, found by
                                           'assuming a fan motor efficiency of
                                           '65% and a fluid sp gr of 1 and
                                           'the fan is installed downstream
                                           'of the incinerator
If Qf > 0 Then                             'Qf - Flow of the supplementary gas stream
 Fuel = Qf * 60 * HRS * 3.3 / 1000         'factor $3.30/1000 ft3 is for fuel
                                           '(natural gas)
Else
   Fuel = 0
End If

If Fuel = 0 Then
   NatGas = 0
Else
   NatGas = Qf * 60 * HRS / 1000000
End If

Electric = 0.059 * Fp                      'electricity is $0.059/kWh
Labor = 0.5 / 8 * HRS * 15.64              '0.5 hr labor in 8 hr shift at
                                           '$15.64/hr
Superv = 0.15 * Labor                      '15% of labor cost
Maint = 0.5 / 8 * HRS * 17.2               '0.5hr maintenance per 8 hr shift
                                           'with $17.20/hr
MaintMat = Maint                           'maintenance material cost is 100%
                                           'of maintenance charges
DAC = Fuel + Electric + Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat
Overhead = 0.6 * (Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat)
Admin = 0.02 * TCC
PropTax = 0.01 * TCC
Insur = 0.01 * TCC
CAR = 0.1098 * TCC                         'based on i(1+i)^n/(((1+i)^n)-1)
                                           'where i=7% and n=15 yr life
IAC = Overhead + Admin + PropTax + Insur + CAR
TAC = (DAC + IAC)                          '24500 is monitoring costs
OandM = TAC - CAR + RC
rst.Edit

'If reduction is 0, there are no costs associated with it, and 0s are put back into the table
  If Reduction = 0 Then
    rst!Incin_TAC = 0
    rst!Incin_TCC = 0
    rst![Incin_Electricity (kWh/yr)] = 0
    rst![Incin_Steam (lb/yr)] = 0
    rst![Incin_NatGas (mmscf/yr)] = 0
    rst![Incin_O&M ($)] = 0
    rst![Incin_MRR ($)] = 0
```

Incinerator (0% heat recovery) Costing Module (continued)

```
        rst![Incin_ACR ($)] = 0
        rst![Incin_RC ($)] = 0
    Else
'if there are costs associated with a control device, they are put back into the table here
        rst!Incin_TAC = TAC
        rst!Incin_TCC = TCC
         rst![Incin_Electricity (kWh/yr)] = Fp
        rst![Incin_Steam (lb/yr)] = 0
        rst![Incin_NatGas (mmscf/yr)] = NatGas
        rst![Incin_O&M ($)] = OandM
        rst![Incin_MRR ($)] = M
        rst![Incin_ACR ($)] = CAR
        rst![Incin_RC ($)] = RC
    End If

    rst.Update

nextrecord:

    rst.MoveNext
Loop
End Sub
```

Incinerator (70% heat recovery) Costing Module

```
Option Compare Database
Option Explicit

Public Sub IncineratorCost70()

'Variable declaration section
Dim dbs As Database
Dim rst As Recordset
Dim Qe As Variant                 'max emission stream flow rate, scfm
Const Te As Integer = 100         'temperature of emission stream entering the
                                  'incinerator, degF
Dim he As Double                  'heat content, Btu/lb
Dim O2 As Double                  'oxygen content, %
Dim Qd As Double                  'dilution air required, scfm
Dim hd As Double                  'desired heat content of emission stream,
                                  '<=13 Btu/scf
Const Tc As Integer = 1600        'combustion temperature, degF
Const tr As Double = 0.75         'residence time, sec
Dim Qf As Double                  'supplementary natural gas flow rate, scfm
Const De As Double = 0.0753       'density of flue gas stream, lb/scf
Const Df As Double = 0.0417       'density of fuel gas, 0.0417 lb/scf for
                                  'methane at 68 degF
Const CPair As Double = 0.255     'mean heat capacity of between Tc and Tr
                                  '(77 degF), Btu/lb-degF
                                  '(p 3-32 of manual)
Dim The As Double                 'emission stream temperature after heat
                                  'recovery, degF
Const hf As Double = 21600        'lower heating value of natural gas,  Btu/lb
Const HR As Integer = 70          'heat recovery in the exchanger, %
Const Tref As Integer = 68        'reference temperature, 68 degF
Dim Qfg As Double                 'flue gas flow rate, scfm
Dim Qfga As Double                'actual flue gas flow rate, acfm
Dim Vc As Double                  'combustion chamber volume, ft3
Dim TIC As Double                 'thermal incinerator cost, $
Dim PEC As Double                 'purchased equipment cost, $
Dim TAC As Double                 'total annual cost, $/yr
Dim HRS As Double                 'operating hours per year, hr/yr
Dim Fp As Double                  'power needed for fan, kWh/yr
Const P As Integer = 19           'system pressure drop, in. H2O for 70%
                                  'HR(table 3.11, manual)
Dim DAC As Double                 'direct annual cost, $/yr
Dim IC As Double                  'indirect cost, $
Dim DC As Double                  'total direct cost, $
Dim IAC As Double                 'indirect annual cost, $/yr
Dim TCC As Double                 'total capital cost, $
Const MW As Integer = 100         'molecular weight, lb/lb-mole
Const AEC As Integer = 0          'auxiliary equipment cost, assumed $0
Dim EC As Double                  'equipment cost, $
```

Incinerator (70% heat recovery) Costing Module (continued)

```
Dim DIC As Double                      'direct installation cost, involves
                                       'foundation and supports,handling and
                                       'erection, electrical, piping,
                                       'insulation for duct work and painting
Dim Fuel As Double                     'fuel charges
Dim Electric As Double                 'electrical expenses
Dim Labor As Double                    'labor cost
Dim Superv As Double                   'supervisory cost
Dim Maint As Double                    'maintenance cost
Dim MaintMat As Double                 'Maintenance material cost
Dim Overhead As Double                 'overhead cost is 60% of labor and
                                       'maintenance
Dim Admin As Double                    'administrative cost is 2% of TCC
Dim PropTax As Double                  'property tax is 1% of TCC
Dim Insur As Double                    'insurance is 1% of TCC
Dim DaysPerYear As Variant             'days per year of operation
Dim HoursPerDay As Variant             'hours per day of operation
Dim HoursOfOperation As Variant        'hours of operation per year
Dim ProType As String                  'process type - c (continuous) or b (batch)
Dim Concv As Double                    'concentration in ppmv
Dim ConcW As Double                    'concentration in ppmw
Dim Reduction As Double                'HAP reduction, lb/yr
Dim Steam As Double                    'steam requirement, lb/yr
Dim Electrcity As Double               'electricity requirement, kWh/yr
Dim NatGas As Double                   'natural gas requirement, mmscf/yr
Dim OandM As Double                    'operating and maintenance cost
Dim M As Double                        'Assumed compliance assessment cost, $
Dim CAR As Double                      'capital recovery. 0.1315 of TCC
Const RC As Single = 0                 'recovery credit is 0 because no recovery
Const MonitLabor As Double = 9422      'Monitoring labor
Const Monitmat As Double = 500         'Monitoring materials
Dim EquipTCC As Double                 'Equipment Capital Cost
Const MonitEquip As Double = 6250      'Monitoring equipment cost
Const MT As Double = 24420             'Monitoring Testing cost
Dim MonitE As Double                   'Monitoring equipment costs, inc. tax, etc.


Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForContVents")

'Reading in values from the table, MasterTableForContVents
rst.MoveFirst
Do While Not rst.EOF

   If IsNull(rst![Hours of Operation]) Then
      HRS = 8760
   Else
      HRS = rst![Hours of Operation]
```

Incinerator (70% heat recovery) Costing Module (continued)

```
   End If

Reduction = rst![HAP Reduction (lb/yr)]

   If IsNull(rst!Conc) Then
      ConcW = 0
   Else
      Concv = rst!Conc
      ConcW = Concv * 100 / 29            '100 is avg MW of HAP and 29 MW of air in
                                          'lb/lb-mole
   End If

   O2 = (1 - ConcW / 1000000) * 0.21 * 100
   he = 15000 * ConcW / 1000000           'He is heat content where 15000 Btu/lb is decided by
                                          'CMA

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
   Qe = 6450                              'Qe is the max emission stream flow rate
Else
   Qe = rst![Flow (scfm)]
End If

If Qe < 415 Or Qe > 50000 Then            'because TCC calculator are designed for
                                          'this range only-see manual, table 3.7-
                                          'Therefore costs are assigned to be 0 in the table
                                          'when the flow is outside applicable ranges
   rst.Edit
   rst!Incin70_TAC = 0
   rst!Incin70_TCC = 0
   rst![Incin70_Electricity (kWh/yr)] = 0
   rst![Incin70_Steam (lb/yr)] = 0
   rst![Incin70_NatGas (mmscf/yr)] = 0
   rst![Incin70_O&M ($)] = 0
   rst![Incin70_MRR ($)] = 0
   rst![Incin70_ACR ($)] = 0
   rst![Incin70_RC ($)] = 0
   rst.Update
   GoTo nextrecord
ElseIf O2 < 20 And (he * 0.0753) >= 13 Then
   Qd = ((he * 0.0753 / 13) - 1) * Qe     'he is in Btu/lb, multiplying it by
                                          '0.0753 lb/scf will make it Btu/scf
                                          'If O2 <20 and heat content >13 Btu/scf
Else
   Qd = 0
End If

   The = (HR / 100) * Tc + (1 - (HR / 100)) * Te
                                          'The is emission stream temp after heat recovery
```

Incinerator (70% heat recovery) Costing Module (continued)

```
                                            'since thermal incinerator is with 70%
                                            'heat recovery
  Qf = De * Qe * (CPair * (1.1 * Tc - The - (0.1 * Tref)) - he) / (Df * (hf - 1.1 * CPair * (Tc -
Tref)))
                                            'the factor of 1.1 in above equation is to account for
                                            '10% of heat
                                            'losses in the incinerator
  If Qf > 0 Then                            'Qf is the flow rate of the supplementary natural gas
    Qfg = Qe + Qf + Qd                      'Qfg is the flow rate of the flue gas
  Else
    Qfg = Qe + Qd
  End If

  Qfga = Qfg * ((Tc + 460) / 528)           '68F + 460 = 528 degR
  Vc = ((Qfga / 60) * tr) * 1.05            'the factor of 1.05 is used for minor
                                            'fluctuation in flow rate
                                            'and follows industry practice
  TIC = 21342 * (Qfg ^ 0.25)                'for HR = 70% and Qe range from 500
                                            'to 50,000 scfm
  EC = TIC + AEC                            'Equipment cost
  PEC = 1.08 * EC                           'Purchased equipment cost
  DIC = 0.3 * PEC                           'Direct installation cost
  DC = 1.3 * PEC                            'Direct costs
  IC = 0.31 * PEC                           'Indirect costs
  EquipTCC = (DC + IC) * (352.4 / 340.1) * (120.5 / 100) * (109.3 / 100)
                                            'multiplying by cost indexes for
                                            '1st quarter 99$ relative
                                            'to April 1988 -
                                            '352.4/340.1 is April 88 to
                                            '1st quarter 89
                                            '120.5/100 is Vatavuk Index for
                                            '1st quarter 94 vs 89
                                            '109.3/100 is Vatavuk Index for
                                            '1st quarter 99 vs 94
  MonitE = MonitEquip * 1.08 * 1.8          'Add cost of tax, freight and shipping
  M = MonitE + MT                           'total monitoring costs

  TCC = EquipTCC + M                        'total capital costs

  Fp = 0.000181 * Qfga * P * HRS            'Fan power required,
                                            'assuming a fan motor efficiency of
                                            '65% and a fluid sp gr of 1
                                            'and the fan is installed
                                            'downstream of the incinerator
  If Qf > 0 Then                            'supplementary natural gas flow rate
   Fuel = Qf * 60 * HRS * 3.3 / 1000        'factor $3.30/1000 ft3 is for fuel
                                            '(natural gas)

  Else
```

Incinerator (70% heat recovery) Costing Module (continued)

```
    Fuel = 0
  End If

  If Fuel = 0 Then
    NatGas = 0
  Else
    NatGas = Qf * 60 * HRS / 1000000
  End If

  Electric = 0.059 * Fp                ’electricity is $0.059/kWh
  Labor = 0.5 / 8 * HRS * 15.64        ’0.5 hr labor in 8 hr shift at
                                       ’$15.64/hr
  Superv = 0.15 * Labor                ’15% of labor cost
  Maint = 0.5 / 8 * HRS * 17.2         ’0.5 hr maintenance per 8 hr shift
                                       ’with $17.20/hr
  MaintMat = Maint                     ’maintenance material cost is 100%
                                       ’of maintenance charges
  DAC = Fuel + Electric + Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat
  Overhead = 0.6 * (Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat)
  Admin = 0.02 * TCC
  PropTax = 0.01 * TCC
  Insur = 0.01 * TCC
  CAR = 0.1098 * TCC                   ’based on i(1+i)^n/(((1+i)^n)-1)
                                       ’where i=7% and n=15 yr life
  IAC = Overhead + Admin + PropTax + Insur + CAR
  TAC = (DAC + IAC)

  OandM = TAC - CAR + RC

  rst.Edit

‘With reduction =0 no control device was added and costs are therefore 0, this is read into the
‘table below
   If Reduction = 0 Then
    rst!Incin70_TAC = 0
    rst!Incin70_TCC = 0
    rst![Incin70_Electricity (kWh/yr)] = 0
    rst![Incin70_Steam (lb/yr)] = 0
    rst![Incin70_NatGas (mmscf/yr)] = 0
    rst![Incin70_O&M ($)] = 0
    rst![Incin70_MRR ($)] = 0
    rst![Incin70_ACR ($)] = 0
    rst![Incin70_RC ($)] = 0

‘If a reduction is achieved, a control device was added, and costs are imported to the table with
‘the following code
  Else
    rst!Incin70_TAC = TAC
```

Incinerator (70% heat recovery) Costing Module (continued)

```
      rst!Incin70_TCC = TCC
      rst![Incin70_Electricity (kWh/yr)] = Fp
      rst![Incin70_Steam (lb/yr)] = 0
      rst![Incin70_NatGas (mmscf/yr)] = NatGas
      rst![Incin70_O&M ($)] = OandM
      rst![Incin70_MRR ($)] = M
      rst![Incin70_ACR ($)] = CAR
      rst![Incin70_RC ($)] = RC
   End If

   rst.Update

nextrecord:

   rst.MoveNext
Loop
End Sub
```

Control Technology Selection Costing Module

```
Option Compare Database
Option Explicit

Public Sub MinVal()

'This module selects the control technology with the smallest costs

'Variable declaration section
Dim dbs As Database
Dim rst As Recordset
Dim FTCC As Long            'flare total capital cost
Dim FTAC As Long            'flare total annual cost
Dim ITCC As Long            'incinerator with 0% heat recovery total capital cost
Dim ITAC As Long            'incinerator with 0% heat recovery total annual cost
Dim RTCC As Long            'incinerator with 70% heat recovery total capital cost
Dim RTAC As Long            'incinerator with 70% heat recovery total annual cost
Dim CtrlTech As String      'control technology suggested to select on TCC and TAC basis
Dim AC As Long              'lowest annual cost from three technologies
Dim CC As Long              'capital cost of corresponding lowest annual cost
Dim best As Long            'minimum annual for the three technology
Dim Reduction As Long       'HAP Reduction in lb/yr
Dim Electricity As Double   'electricity requirement, kWh/hr
Dim Steam As Double         'steam requirement, lb/yr
Dim NatGas As Double        'natural gas requirement, mmscf/yr
Dim OnM As Double           'operating and maintenance cost
Dim CR As Double            'capital recovery
Dim Mirr As Single          'Assumed compliance assessment cost, $
Const RC As Single = 0      'recovery credit

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForContVents")

'Reading data from table "MasterTableForContVents"
rst.MoveFirst
Do While Not rst.EOF

FTCC = rst![Flare_TCC]
FTAC = rst![Flare_TAC]
ITCC = rst![Incin_TCC]
ITAC = rst![Incin_TAC]
RTCC = rst![Incin70_TCC]
RTAC = rst![Incin70_TAC]
Reduction = rst![HAP Reduction (lb/yr)]


'The following selects the lowest cost and sets it equal to best
If ITAC = 0 Then
   best = FTAC
```

Control Technology Selection Costing Module (continued)

```
ElseIf FTAC < ITAC And FTAC < RTAC Then
   best = FTAC
ElseIf ITAC <> 0 And ITAC < RTAC Then
   best = ITAC
Else
   best = RTAC
End If

'The following sets the proper costs to the best techonology
   Select Case best
      Case Is = FTAC
         AC = FTAC
         CC = FTCC
         Electricity = rst![Flare_Electricity (kWh/yr)]
         Steam = rst![Flare_Steam (lb/yr)]
         NatGas = rst![Flare_NatGas (mmscf/yr)]
         CtrlTech = "Flare"
         OnM = rst![Flare_O&M ($)]
         Mirr = rst![Flare_MRR ($)]
         CR = rst![Flare_ACR ($)]
                  ' RC = rst![Flare_RC ($)]
      Case Is = ITAC
         AC = ITAC
         CC = ITCC
         Electricity = rst![Incin_Electricity (kWh/yr)]
         Steam = rst![Incin_Steam (lb/yr)]
         NatGas = rst![Incin_NatGas (mmscf/yr)]
         CtrlTech = "Incinerator"
         OnM = rst![Incin_O&M ($)]
         Mirr = rst![Incin_MRR ($)]
         CR = rst![Incin_ACR ($)]
                                          ' RC = rst![Incin_RC ($)]

      Case Is = RTAC
         AC = RTAC
         CC = RTCC
         Electricity = rst![Incin70_Electricity (kWh/yr)]
         Steam = rst![Incin70_Steam (lb/yr)]
         NatGas = rst![Incin70_NatGas (mmscf/yr)]
         CtrlTech = "Incinerator 70%"
         OnM = rst![Incin70_O&M ($)]
         Mirr = rst![Incin70_MRR ($)]
         CR = rst![Incin70_ACR ($)]
                                          'RC = rst![Incin70_RC ($)]
   End Select

   rst.Edit
```

Control Technology Selection Costing Module (continued)

```
'If there is no reduction (and no costs) 0 is imported back to the table for costing
   If Reduction = 0 Then
      rst!TAC = 0
      rst!TCC = 0
      rst![Electricity (kWh/yr)] = 0
      rst![Steam (lb/yr)] = 0
      rst![Nat Gas (mmscf/yr)] = 0
      rst![Control Technology] = "None"
      rst![O&M ($)] = 0
      rst![MRR ($)] = 0
      rst![ACR ($)] = 0
      rst![RC ($)] = 0
'otherwise, the actual values for the best technology are exported back to the table
   Else
      rst!TAC = AC
      rst!TCC = CC
      rst![Electricity (kWh/yr)] = Electricity
      rst![Steam (lb/yr)] = Steam
      rst![Nat Gas (mmscf/yr)] = NatGas
      rst![Control Technology] = CtrlTech
      rst![O&M ($)] = OnM
      rst![MRR ($)] = Mirr
      rst![ACR ($)] = CR
      rst![RC ($)] = RC
   End If

   rst.Update

   rst.MoveNext
Loop

End Sub
```

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: July 12, 2000

Subject: Pollution Prevention (P2) Alternative Compliance Option
Miscellaneous Organic Chemical Manufacturing NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Brenda Shine, North State Engineering

To: MON Project File

I. Introduction

This memorandum describes the basis of the pollution prevention (P2) option that is being proposed for the Miscellaneous Organic Chemical Manufacturing source category NESHAP (Subpart FFFF). The option allows for an alternative compliance method to the add-on control requirements of the NESHAP. The P2 alternative standard was originally developed for the Pharmaceuticals Production NESHAP and is being applied to the miscellaneous organic chemical NESHAP because of the similarities in the two industries.

II. Description of the P2 Alternative

The P2 alternative is applied to any individual process that is producing a MON-affected material, and it takes the place of all of the conventional control requirements for process vents, storage tanks, wastewater, and equipment leaks. The option consists of establishing a baseline level of HAP consumed per unit of product produced, and demonstrating reductions from this baseline on a continuous basis. Consumption of HAP, the critical parameter, means the quantity of all HAP raw materials (i.e., reactant, solvent, or any other additives) entering a process in excess of the amount used as reactant (assuming 100 percent stoichiometric conversion). This consumed material ultimately is lost via treatment, air emissions, water discharges, and as solid waste. Any HAP generated in the process is included in the amount consumed if the same HAP is also added as a raw material; otherwise, it is excluded from the amount consumed, and it must be controlled according to conventional requirements. In demonstrating compliance, the facility is responsible for proposing methods for tracking HAP consumption.

III. Basis for the P2 Alternative

The basis for this alternative was first discussed in the Pharmaceuticals MACT proposal and is essentially the same basis for the proposed alternative standard in Subpart FFFF.[1] Briefly, the alternative credits reduction in losses to all media (air, water, and hazardous waste) and applies these credits towards compliance with the MACT standard. Since the alternative considers only consumption, credit is also given for reductions in losses from changes in operating practices, improved material recovery, and processing efficiency. The rationale for the alternative is rooted in the concept that limiting losses ultimately results not only in savings of material but in overall environmental benefit that can be linked directly to reductions in air emissions.

To maintain consistency with the Pharmaceutical MACT standard, the same approach was used to set the required annual reduction target and the baseline year. The target reduction is based on the air emission reductions anticipated to be achieved from implementation of the MACT, as in the Pharmaceuticals MACT standard. Therefore, the P2 alternative proposed in Subpart FFFF requires that the HAP consumption be reduced by 65 percent from a 3-year baseline period beginning no earlier than the period consisting of the 1994 through 1996 calendar years. These values correspond to the estimated nationwide impacts of implementing the MACT standard and the year in which the baseline data was collected, 1994. In addition, to prevent the substitution of one type of pollutant for another, if the HAP is also a VOC, the P2 alternative requires that the VOC reduction be equivalent to the HAP reduction on a mass basis. If the HAP is not a VOC, the VOC emissions must not be increased.

IV. Implementation of the P2 Alternative

For any given process for which the owner or operator decides to use the P2 alternative standard, the baseline factor, in kg HAP consumed/kg product produced, must be developed using three full year's worth of data (or at least 1 year of data if the process has not been operated for 3 years); the calculations must be based on accurate inventory and production records. Next, the owner or operator must develop a system to track kg HAP consumed/kg product on a continuous basis. The facility must submit a P2 compliance demonstration summary at least 6 months prior to the compliance date identifying applicable processes and providing adequate documentation of the baseline factor and of the tracking methods.

For continuous processes the factor must be verified on a rolling twelve month average calculated every 30 days. For batch processes, the factor must be verified over a 12 month period every 10 batches. To be in compliance, the annual kg HAP consumed/kg product factor must be at least 65 percent less than the established baseline using the methods approved in the P2 compliance demonstration.

If an owner complies with the P2 alternative, emission sources within the processes complying with the alternative are not required to be controlled according to the conventional standards for process vents, storage tanks, wastewater, and equipment leaks.

V. References

1. Memorandum from B. Shine, MRI, to R. McDonald, EPA:ESD. October 13, 1995. P2 Alternative Standard.

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: July 31, 2000

Subject: Determination of MACT Floor, Regulatory Alternative, and Nationwide Impacts for Batch Process Vents at Miscellaneous Organic Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Brenda Shine
Jennifer Fields
David Randall

To: MON Project File

I. Introduction

This memorandum presents the results of a review of the MACT floor determination for batch process vents and presents emissions and cost impacts of the MACT floor and regulatory alternative for existing processes.

II. Review of the MACT Floor

Our review of the MACT floor comprised an effort to duplicate the work previously conducted and to evaluate the method used to generate the resulting MACT floor. To evaluate the MACT floor for batch process vents, we started with the complete database generated from the Section 114 information requests, and we reproduced the steps taken in the previous analysis to determine the MACT floor.[1] A summary of these steps is as follows:

- Deleted all records containing inorganic compounds
- Deleted vents with less than 50 ppmv HAP
- Deleted records for which the HAP was reported as desmondur, multiple, NA, or vinyl resin
- Assigned scrubbers a control efficiency of 0 percent and accepted the control efficiency for all other control devices
- Summed the remaining batch vents within each process
- Sorted processes according to uncontrolled HAP emissions and control efficiency

The resulting database contained 731 processes at 144 facilities. The number of processes making up the best 12 percent was 88. The control level for the MACT floor was determined to be 98 percent because 132 processes (i.e., more than 12 percent of the 731 processes in the database) were controlled by this amount. The best performing sources are considered to be those with the lowest uncontrolled emissions from the sum of all vents within the process. The median uncontrolled emissions rate for the best performing 88 processes is 10,000 lb/yr (rounded up from 9,860 lb/yr). Therefore, we concur with the MACT floor that was developed in the previous analysis (i.e., 98 percent control for the sum of all process vents within a process that has uncontrolled HAP emissions greater than or equal to 10,000 lb/yr). A list of the 132 processes with control levels greater than or equal to 98 percent, ranked with the best performing source at the top of the list, is presented in Attachment 1.

The new source MACT floor also is unchanged from previous analyses.[2] The best performing source is considered to be the process with the lowest uncontrolled emissions that is controlled to 98 percent at a facility that would not otherwise be required to control any batch or continuous process vents by 98 percent under the MACT floors for existing sources (i.e., no continuous vents with a TRE less than or equal to 2.6, and no batch processes with uncontrolled HAP emissions greater than or equal to 10,000 lb/yr). Applying these criteria, the best performing source is a process at the CCP facility in Marshall, Texas that has uncontrolled HAP emissions of approximately 3,000 lb/yr (rounded up from 2,880 lb/yr). Thus, the new source MACT floor is 98 percent control for the sum of all vents within a process with uncontrolled emissions greater than or equal to 3,000 lb/yr.

III. <u>Emissions and Cost Impacts</u>

Emissions and cost impacts were estimated for the MACT floor and for a regulatory alternative, which has the same performance level (98 percent) but an uncontrolled emissions cutoff of 5,000 lb/yr.

Nationwide uncontrolled and baseline emissions for the source category were estimated using data for the 731 processes in the Section 114 database. Nationwide uncontrolled emissions from these processes were estimated to be approximately 29,980 Mg/yr (33,040 tons/yr), and baseline emissions were estimated to be approximately 7,088 Mg/yr (7,806 tons/year), almost twice as high as previous estimates.[3] The difference is attributed to differences in the assumptions regarding vents controlled with scrubbers. The previous analysis used the reported scrubber control efficiencies, but for this analysis, we assumed control efficiencies of 0 percent, as in the MACT floor analysis. Emission reductions attributable to the MACT floor and regulatory alternative were estimated by determining the emissions after controlling affected processes to 98 percent and subtracting the result from the baseline emissions. The emission reductions per facility were estimated by summing the emission reductions for each process. The emission reductions for each facility are shown in Attachments 2 and 3.

We used the following procedures to estimate the cost impacts:

- As part of the MACT floor analysis described above, we assigned an average flow rate of 415 scfm to any vent for which a flow rate was not reported, and we summed the flows of all vents within a process.

- Excluded processes for which uncontrolled emissions were less than 10,000 lb/yr (this left 287 of the 731 processes).
- Summed the uncontrolled emissions, controlled emissions, HAP reductions, and flows for all of the remaining processes at each facility.
- Calculated the HAP concentration in the aggregated emission stream for each facility using the aggregated uncontrolled emissions, a default HAP molecular weight of 100, and the hours of operation for the process at the facility with the maximum hours of operation (or 8,760 hr/yr for two facilities that did not report annual hours of operation).
- Estimated the cost to control the aggregated emission stream with a flare, incinerator with no heat recovery, and an incinerator with 70 percent heat recovery.
- Selected the control with the lowest total annual cost.

As described in previous analyses, control costs were estimated using standard OAQPS procedures.[3,4] However, we made some minor changes to labor rates, cost indices, and other factors. We also added costs for performance tests and parameter (temperature) monitoring. Table 1 presents the impacts associated with the MACT floor and regulatory alternative. Attachments 2 and 3 present the costs and cost effectiveness as calculated on a facility basis for the MACT floor and the regulatory alternative. Attachment 4 presents the algorithms used to estimate costs for each type of control device and the algorithm that selects the lowest cost from among the three control devices.

TABLE 1. IMPACTS OF REGULATORY ALTERNATIVES FOR EXISTING SOURCES

Regulatory alternative	Total capital investment, $	Total annual cost, $	Emission reduction, Mg/yr	Cost effectiveness relative to baseline, $/Mg	Incremental cost effectiveness, $/Mg
MACT Floor	25,340,000	16,510,000	6,290	2,624	NA
Regulatory Alternative	28,650,000	18,660,000	6,435	2,900	14,800

IV. References

1. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. May 20, 1999. Existing Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

2. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. June 7, 1999. New Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

3. Memorandum from C. Zukor and R. Howle, Alpha Gamma Technologies, Inc. to Miscellaneous Organic NESHAP Project File. July 27, 1999. National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes.

4. U.S. Environmental Protection Agency. OAQPS Control Cost Manual. EPA Publication No. EPA 450/3-90-006. Chapters 3 and 7. Incinerators and Flares.

ATTACHMENT 1

MACT Floor Processes

MACT Floor Processes

Rank	Plant name	City	State	HAP emissions (lb/yr)	Control efficiency (%)
1	BASF Corp - Freeport Works	Freeport	TX	200	99.90
2	Ciba Specialty Chemicals Corp	McIntosh	AL	424	98.00
3	Ciba Specialty Chemicals Corp	McIntosh	AL	503	98.00
4	Morton International Inc. - Paterson Facility	Paterson	NJ	521	98.00
5	Ciba Specialty Chemicals Corp	McIntosh	AL	554	98.00
6	BASF Corp - Freeport Works	Freeport	TX	600	99.90
7	CCP- Houston Facility	Houston	TX	620	99.00
8	Huls America, Inc.	Theodore	AL	758	99.00
9	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	765	98.00
10	Huls America, Inc.	Theodore	AL	902	99.00
11	Ciba Specialty Chemicals Corp	McIntosh	AL	1,004	98.00
12	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1,016	98.00
13	Witco Corp.	Harvey	LA	1,100	99.00
14	Ciba Specialty Chemicals Corp	McIntosh	AL	1,124	98.00
15	Ciba Specialty Chemicals Corp	McIntosh	AL	1,242	98.00
16	Ciba Specialty Chemicals Corp	McIntosh	AL	1,381	98.00
17	DIXIE CHEMICAL COMPANY	PASADENA	TX	1,500	98.00
18	Dow Corning Corp - Midland Plant	Midland	MI	1,500	99.00
19	Ciba Specialty Chemicals Corp	McIntosh	AL	1,881	98.00
20	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	1,893	99.00
21	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	1,920	98.00
22	Ciba Specialty Chemicals Corp	McIntosh	AL	1,958	98.00
23	Huls America, Inc.	Theodore	AL	2,095	99.00
24	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	2,135	98.00
25	Ciba Specialty Chemicals Corp	McIntosh	AL	2,183	98.00
26	Allco Chemical Corp - Jayhawk Plant	Galena	KS	2,240	99.99
27	Morton International Inc. - Paterson Facility	Paterson	NJ	2,261	98.00
28	Ciba Specialty Chemicals Corp	McIntosh	AL	2,678	99.98
29	CCP-Marshall Facility	Marshall	TX	2,880	99.00
30	Morton International Inc. - Paterson Facility	Paterson	NJ	3,041	98.00
31	Ciba Specialty Chemicals Corp	McIntosh	AL	3,207	98.00
32	DIXIE CHEMICAL COMPANY	PASADENA	TX	3,600	98.00
33	Ciba Specialty Chemicals Corp	McIntosh	AL	3,629	98.00
34	BASF Corp - Freeport Works	Freeport	TX	3,800	99.99
35	Morton International Inc. - Paterson Facility	Paterson	NJ	4,167	98.00
36	Morton International Inc. - Paterson Facility	Paterson	NJ	4,333	98.00
37	Morton International Inc. - Paterson Facility	Paterson	NJ	4,763	98.00
38	The Lubrizol Corp	Painesville	OH	5,918	100.00
39	Ciba Specialty Chemicals Corp	McIntosh	AL	6,578	98.00
40	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	6,610	98.00
41	Allco Chemical Corp - Jayhawk Plant	Galena	KS	7,460	99.99
42	The Lubrizol Corp - Bayport Plant	Pasadena	TX	8,000	98.00
43	Rohm & Haas Texas, Rohm & Haas Lone Star, RohMax	Deer Park	TX	8,900	98.00
44	Ciba Specialty Chemicals Corp	McIntosh	AL	9,860	99.00
45	Kalama Chemical, Inc.	Kalama	WA	10,000	99.90
46	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	10,300	99.00
47	The Lubrizol Corp	Painesville	OH	10,480	99.00
48	Albemarle Corp - South Plant	Magnolia	AR	12,508	98.00
49	Velsicol Chemical Corp	Chattanooga	TN	13,100	99.00
50	The Glidden Company	Huron	OH	13,333	98.50
51	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	13,900	98.00
52	Huntsman Petrochemical Corp - Dayton Manufacturing Facility	Dayton	TX	13,945	98.00
53	Hilton Davis Co.	Cincinnati	OH	14,100	99.00
54	Huntsman Petrochemical Corp - Dayton Manufacturing Facility	Dayton	TX	14,987	98.00
55	The Lubrizol Corp	Painesville	OH	15,800	100.00
56	Ciba Specialty Chemicals Corp	McIntosh	AL	16,000	99.90
57	Flexsys Nitro Plant	Nitro	WV	16,400	99.00

MACT Floor Processes (continued)

Rank	Plant name	City	State	HAP emissions (lb/yr)	Control efficiency (%)
58	The Lubrizol Corp	Painesville	OH	17,200	100.00
59	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	17,939	99.00
60	Ciba Specialty Chemicals Corp	McIntosh	AL	18,130	98.00
61	Ciba Specialty Chemicals Corp	McIntosh	AL	21,547	98.00
62	CCP- Houston Facility	Houston	TX	21,600	99.00
63	Buffalo Color Company	Buffalo	NY	25,000	98.00
64	The Glidden Company	Huron	OH	26,667	98.50
65	The Glidden Company	Huron	OH	26,667	98.50
66	Ciba Specialty Chemicals Corp	McIntosh	AL	27,006	98.29
67	Allco Chemical Corp - Jayhawk Plant	Galena	KS	27,011	99.99
68	CCP-North Kansas City Facility	North Kansas City	MO	27,760	99.00
69	The Lubrizol Corp	Painesville	OH	28,200	98.00
70	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	28,800	99.90
71	Ciba Specialty Chemicals Corp	McIntosh	AL	30,914	98.00
72	Morton International Inc. - Paterson Facility	Paterson	NJ	31,713	98.00
73	Allco Chemical Corp - Jayhawk Plant	Galena	KS	33,116	99.99
74	CCP-Chatham Facility	Chatham	VA	33,312	99.00
75	The Glidden Company	Huron	OH	33,333	98.50
76	Huntsman Petrochemical Corp - Dayton Manufacturing Facility	Dayton	TX	34,253	98.00
77	DynaChem, Inc.	Georgetown	IL	35,579	98.59
78	The Lubrizol Corp	Painesville	OH	36,040	100.00
79	Allco Chemical Corp - Jayhawk Plant	Galena	KS	39,270	99.99
80	Henkel Corp	Kankakee	IL	40,400	99.70
81	Ciba Specialty Chemicals Corp	McIntosh	AL	40,960	99.90
82	The Lubrizol Corp	Painesville	OH	43,280	98.05
83	Arkansas Eastman Division	Batesville	AR	45,000	98.00
84	Ciba Specialty Chemicals Corp	McIntosh	AL	47,693	99.97
85	BFG Henry Plant	Henry	IL	49,200	99.00
86	Ciba Specialty Chemicals Corp	McIntosh	AL	49,238	98.00
87	Air Products Manufacturing Corp	Wichita	KS	50,400	98.00
88	Zeneca Specialties, Inc. - Mt. Pleasant Site	Mt. Pleasant	TN	51,000	99.90
89	Arkansas Eastman Division	Batesville	AR	55,000	98.00
90	Monsanto	Gonzalez	FL	55,626	99.00
91	The Lubrizol Corp - Bayport Plant	Pasadena	TX	60,000	99.00
92	Ashland Chemical Co - Petrochem Div. - Neville Island Plant	Pittsburgh	PA	60,000	99.50
93	BFGoodrich Co.	Akron	OH	65,015	99.00
94	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	75,500	99.00
95	CCP- Houston Facility	Houston	TX	78,708	99.00
96	Ashland Chemical Co - Composite Polymers Div. - Colton Facility	Colton	CA	82,040	98.00
97	Abemarle Coporation	Orangeburg	SC	84,000	98.00
98	Para-Chem, Inc.- Simpsonville Plant	Simpsonville	SC	84,000	98.00
99	Ciba Specialty Chemicals Corp	McIntosh	AL	86,657	98.00
100	The Lubrizol Corp - Bayport Plant	Pasadena	TX	87,200	99.00
101	Velsicol Chemical Corp	Chattanooga	TN	87,600	99.00
102	ARCO Chemical Co - Bayport Plant	Pasadena	TX	91,200	99.00
103	The Lubrizol Corp - Bayport Plant	Pasadena	TX	93,000	99.00
104	The Lubrizol Corp	Painesville	OH	97,840	100.00
105	Ciba Specialty Chemicals Corp	McIntosh	AL	113,305	98.34
106	Akzo Nobel Chemicals Inc.	Morris	IL	114,370	98.90
107	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	114,905	98.00
108	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	134,500	99.90
109	Arkansas Eastman Division	Batesville	AR	142,500	98.00
110	The Lubrizol Corp	Painesville	OH	146,680	100.00
111	Arkansas Eastman Division	Batesville	AR	150,000	98.00
112	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	160,000	99.90

MACT Floor Processes (continued)

Rank	Plant name	City	State	HAP emissions (lb/yr)	Control efficiency (%)
113	Ashland Chemical Company - Los Angeles - Composite Polymers	Los Angeles	CA	171,400	99.15
114	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	176,000	99.98
115	The Lubrizol Corp	Painesville	OH	178,020	98.00
116	Ciba Specialty Corp. Newport Plant	Newport	DE	186,800	98.44
117	BFG Henry Plant	Henry	IL	189,200	99.00
118	The Lubrizol Corp - Deer Park Plant	Deer Park	TX	209,600	99.90
119	Flexsys Nitro Plant	Nitro	WV	235,944	98.16
120	DuPont Sabine River Works	Orange	TX	237,634	98.00
121	Abemarle Coporation	Orangeburg	SC	246,000	98.00
122	Keil Chemical Division	Hammond	IN	266,667	98.50
123	The Lubrizol Corp - Bayport Plant	Pasadena	TX	407,922	99.00
124	Ciba Specialty Chemicals Corp	McIntosh	AL	529,213	98.80
125	Phillips Petroleum Company - PHILTEX/ RYTON COMPLEX	Borger	TX	746,006	98.00
126	BFGoodrich Co.	Akron	OH	819,150	99.00
127	Akzo Nobel Chemicals Inc.	Morris	IL	1,558,880	99.10
128	Niacet Corp	Niagara Falls	NY	1,584,000	99.90
129	Novartis Crop Protection, Inc. - St. Gabriel Plant Site	St. Gabriel	LA	1,740,068	99.50
130	Elf Atochem North America, Inc. - Channelview Complex	Channelview	TX	2,448,885	98.00
131	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	3,700,000	99.00
132	Novartis Crop Protection, Inc. - St. Gabriel Plant Site	St. Gabriel	LA	4,529,306	99.49

ATTACHMENT 2

MACT Floor Impacts

Batch Process Vents – MACT Floor Option

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
1	1	11,407	11,407	11,179	$65,728	$220,200	$39,396	Flare
2	3	38,000	38,000	37,240	$47,534	$83,331	$4,475	Flare
3	4	84,000	1,680	0	$0	$0	$0	None
4	5	44,000	44,000	43,120	$156,367	$80,222	$3,721	Incinerator
5	6	100,000	1,500	0	$0	$0	$0	None
6	9	2,043,850	44,137	3,260	$406,596	$139,739	$85,730	Incinerator 70%
7	10	226,803	226,803	222,267	$672,498	$704,193	$6,336	Incinerator 70%
8	11	11,170	2,234	2,011	$138,355	$60,521	$60,202	Incinerator
9	12	337,205	49,104	42,360	$330,448	$125,943	$5,946	Incinerator 70%
10	13	22,200	11,100	10,656	$47,546	$114,903	$21,566	Flare
11	14	331,766	30,957	24,533	$145,417	$76,531	$6,239	Incinerator
12	15	33,860	13,544	12,867	$47,523	$50,783	$7,894	Flare
13	17	102,000	102,000	99,960	$559,799	$459,275	$9,189	Incinerator 70%
14	18	100,700	1,007	0	$0	$0	$0	None
15	19	33,312	333	0	$0	$0	$0	None
16	20	100,308	1,003	0	$0	$0	$0	None
17	22	103,483	76,001	74,209	$151,627	$118,497	$3,194	Incinerator
18	24	37,982	11,610	10,850	$90,433	$546,158	$100,676	Flare
19	27	270,400	27,400	21,992	$65,630	$286,510	$26,056	Flare
20	28	70,448	13,385	11,976	$395,756	$186,594	$31,161	Incinerator 70%
21	29	392,500	7,850	0	$0	$0	$0	None
22	31	25,400	1,270	762	$156,434	$107,042	$280,946	Incinerator
23	32	304,820	150,209	144,800	$500,648	$323,716	$4,471	Incinerator 70%
24	34	6,269,374	31,733	0	$0	$0	$0	None
25	36	28,659	5,295	4,722	$395,443	$178,747	$75,710	Incinerator 70%
26	38	87,542	86,123	84,373	$480,072	$217,816	$5,163	Incinerator 70%
27	39	42,857	3,000	2,143	$138,142	$54,621	$50,980	Incinerator
28	43	12,885	12,885	12,627	$49,530	$240,349	$38,068	Flare
29	44	186,800	2,921	0	$0	$0	$0	None
30	45	222,536	213,538	209,087	$467,040	$264,678	$2,532	Incinerator 70%
31	47	6,840,000	2,806,800	2,670,000	$226,448	$99,272	$74	Incinerator
32	48	1,855,000	1,142,200	1,105,100	$408,209	$143,025	$259	Incinerator 70%
33	49	884,165	8,842	0	$0	$0	$0	None
34	50	11,522	11,522	11,292	$352,749	$158,632	$28,097	Incinerator 70%
35	52	52,856	38,873	37,816	$143,645	$112,319	$5,940	Incinerator
36	54	32,036	12,956	12,315	$156,375	$71,682	$11,641	Incinerator
37	56	965,098	59,458	40,702	$454,529	$212,836	$10,458	Incinerator 70%
38	57	27,522	27,027	26,477	$406,122	$161,586	$12,206	Incinerator 70%
39	58	31,713	634	0	$0	$0	$0	None
40	59	68,413	35,486	34,118	$48,897	$176,385	$10,340	Flare
41	60	3,899,000	43,497	6,096	$67,021	$268,981	$88,248	Flare
42	62	24,616	24,616	24,124	$156,440	$118,035	$9,786	Incinerator
43	63	1,799,812	450,550	421,247	$621,630	$524,309	$2,489	Incinerator 70%
44	64	755,674	120,191	111,475	$479,698	$264,130	$4,739	Incinerator 70%
45	65	481,950	481,950	472,311	$405,446	$168,153	$712	Incinerator 70%
46	66	257,894	257,894	252,736	$409,318	$195,084	$1,544	Incinerator 70%
47	67	63,185	1,264	0	$0	$0	$0	None
48	70	13,580	4,115	3,843	$65,729	$299,542	$155,894	Flare
49	71	55,626	556	0	$0	$0	$0	None
50	72	2,448,885	48,978	0	$0	$0	$0	None
51	73	32,306	835	189	$338,614	$144,483	$1,527,466	Incinerator 70%
52	74	15,000	3,000	2,700	$68,913	$170,700	$126,444	Flare
53	75	70,000	70,000	68,600	$138,287	$104,341	$3,042	Incinerator
54	76	10,865	10,772	10,555	$435,469	$162,207	$30,736	Incinerator 70%
55	78	41,178	41,178	40,354	$341,579	$149,333	$7,401	Incinerator 70%
56	79	262,030	15,136	9,895	$349,375	$142,390	$28,779	Incinerator 70%
57	82	13,520	2,231	1,960	$47,537	$39,132	$39,922	Flare

Batch Process Vents – MACT Floor Option (continued)

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
58	84	62,000	3,100	1,860	$338,255	$144,889	$155,795	Incinerator 70%
59	86	58,070	44,324	43,162	$154,082	$92,010	$4,263	Incinerator
60	87	1,174,594	1,146,670	1,123,178	$402,973	$138,465	$247	Incinerator 70%
61	88	622,300	1,566	0	$0	$0	$0	None
62	89	30,000	4,010	3,600	$65,721	$252,133	$140,074	Flare
63	90	682,323	9,792	2,626	$346,350	$123,357	$93,936	Incinerator 70%
64	91	6,464,566	343,731	214,440	$210,318	$91,217	$851	Incinerator
65	93	18,450	18,450	18,081	$138,380	$107,246	$11,863	Incinerator
66	94	282,006	74,244	68,604	$151,378	$103,553	$3,019	Incinerator
67	95	350,018	35,861	28,860	$155,024	$108,522	$7,520	Incinerator
68	96	37,436	4,861	4,112	$309,185	$130,693	$63,567	Incinerator 70%
69	98	1,396,861	1,146,790	1,118,853	$539,459	$328,394	$587	Incinerator 70%
70	99	1,276,576	455,316	429,784	$603,340	$403,745	$1,879	Incinerator 70%
71	101	139,257	45,144	42,359	$494,948	$151,714	$7,163	Incinerator 70%
72	102	675,261	546,240	532,735	$541,813	$391,238	$1,469	Incinerator 70%
73	103	307,500	14,419	8,269	$334,972	$127,023	$30,724	Incinerator 70%
74	104	171,400	1,465	0	$0	$0	$0	None
75	105	220,336	20,313	15,906	$366,946	$153,710	$19,328	Incinerator 70%
76	106	114,248	100,289	98,145	$228,568	$59,613	$1,215	Incinerator
77	109	99,397	10	0	$0	$0	$0	None
78	110	709,470	709,470	695,281	$48,980	$145,850	$420	Flare
79	111	941,836	98,143	79,307	$49,882	$186,085	$4,693	Flare
80	112	2,153,536	587,812	544,741	$193,971	$86,326	$317	Incinerator
81	113	91,200	912	0	$0	$0	$0	None
82	114	82,040	1,641	0	$0	$0	$0	None
83	115	417,383	21,837	13,490	$429,767	$209,870	$31,116	Incinerator 70%
84	116	12,264	12,264	12,019	$335,586	$143,730	$23,918	Incinerator 70%
85	117	135,600	60,780	58,968	$435,368	$225,987	$7,665	Incinerator 70%
86	118	88,416	4,421	2,652	$325,591	$133,663	$100,783	Incinerator 70%
87	119	71,571	11,577	10,146	$48,899	$169,286	$33,371	Flare
88	121	258,962	252,152	246,973	$68,946	$424,362	$3,437	Flare
89	124	2,143,465	202,998	162,512	$545,284	$291,999	$3,594	Incinerator 70%
90	125	1,584,000	1,584	0	$0	$0	$0	None
91	127	17,760	17,760	17,405	$138,382	$107,285	$12,328	Incinerator
92	128	266,667	4,000	0	$0	$0	$0	None
93	129	11,080	554	332	$47,550	$110,734	$666,270	Flare
94	130	65,400	771	432	$341,534	$147,963	$685,014	Incinerator 70%
95	131	237,634	4,753	0	$0	$0	$0	None
96	132	320,510	74,019	67,609	$337,635	$117,973	$3,490	Incinerator 70%
97	133	2,631,640	159,046	124,591	$224,992	$103,272	$1,658	Incinerator
98	136	11,994	11,994	11,754	$90,616	$36,458	$6,203	Flare
99	137	94,246	94,246	92,361	$168,307	$86,453	$1,872	Incinerator
100	138	575,645	74,963	63,450	$397,853	$110,489	$3,483	Incinerator 70%
101	139	209,381	85,799	81,611	$354,737	$141,476	$3,467	Incinerator 70%
102	141	175,666	136,474	132,961	$379,257	$170,490	$2,565	Incinerator 70%
103	142	16,270	16,270	15,945	$66,201	$352,952	$44,272	Flare
104	143	43,481	35,420	34,550	$149,708	$120,959	$7,002	Incinerator
105	146	32,740	1,637	982	$65,721	$280,757	$571,690	Flare
106	149	702,730	57,907	43,852	$446,931	$130,254	$5,941	Incinerator 70%
107	150	29,000	29,000	28,420	$138,361	$106,651	$7,505	Incinerator
108	153	17,939	179	0	$0	$0	$0	None
109	154	758,304	735,406	720,239	$37,258	$13,469	$37	Flare
110	155	299,859	18,678	12,681	$214,741	$61,024	$9,625	Incinerator
111	156	2,213,675	121,787	77,513	$216,885	$101,347	$2,615	Incinerator

Batch Process Vents – MACT Floor Option (continued)

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
112	157	160,430	160,430	157,221	$67,492	$21,009	$267	Flare
113	158	53,900	53,900	52,822	$327,699	$127,369	$4,823	Incinerator 70%
114	159	94,178	4,238	2,354	$328,750	$65,675	$55,788	Incinerator
115	160	14,058	1,125	843	$167,474	$41,525	$98,461	Incinerator
116	161	64,950	3,052	1,753	$229,706	$51,499	$58,743	Incinerator
117	163	68,458	38,221	36,852	$418,795	$216,099	$11,728	Incinerator 70%
118	164	47,697	47,697	46,743	$47,536	$114,253	$4,889	Flare
119	166	287,500	18,000	12,250	$439,059	$121,061	$19,765	Incinerator 70%
	Totals	65,084,847	14,932,099	13,869,088	$25,337,762	$16,510,102	$2,381	

ATTACHMENT 3

Regulatory Alternative Impacts

Batch Process Vents – Above Floor Option (>=5,000 lb/yr)

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
1	1	11,407	11,407	11,179	$65,728	$220,200	$39,396	Flare
2	2	11,940	9,100	8,861	$317,115	$123,190	$27,804	Incinerator 70%
3	3	38,000	38,000	37,240	$47,534	$83,331	$4,475	Flare
4	4	84,000	1,680	0	$0	$0	$0	None
5	5	44,000	44,000	43,120	$156,367	$80,222	$3,721	Incinerator
6	6	100,000	1,500	0	$0	$0	$0	None
7	9	2,043,850	44,137	3,260	$406,596	$139,739	$85,730	Incinerator 70%
8	10	286,258	286,258	280,533	$721,791	$1,130,788	$8,062	Incinerator 70%
9	11	11,170	2,234	2,011	$138,355	$60,521	$60,202	Incinerator
10	12	337,205	49,104	42,360	$330,448	$125,943	$5,946	Incinerator 70%
11	13	22,200	11,100	10,656	$47,546	$114,903	$21,566	Flare
12	14	331,766	30,957	24,533	$145,417	$76,531	$6,239	Incinerator
13	15	33,860	13,544	12,867	$47,523	$50,783	$7,894	Flare
14	17	118,300	118,300	115,934	$578,168	$508,659	$8,775	Incinerator 70%
15	18	100,700	1,007	0	$0	$0	$0	None
16	19	33,312	333	0	$0	$0	$0	None
17	20	100,308	1,003	0	$0	$0	$0	None
18	22	103,483	76,001	74,209	$151,627	$118,497	$3,194	Incinerator
19	23	8,616	862	689	$48,876	$124,090	$360,057	Flare
20	24	37,982	11,610	10,850	$90,433	$546,158	$100,676	Flare
21	27	270,400	27,400	21,992	$65,630	$286,510	$26,056	Flare
22	28	78,549	14,924	13,353	$434,099	$227,580	$34,086	Incinerator 70%
23	29	392,500	7,850	0	$0	$0	$0	None
24	31	25,400	1,270	762	$156,434	$107,042	$280,946	Incinerator
25	32	304,820	150,209	144,800	$500,648	$323,716	$4,471	Incinerator 70%
26	34	6,269,374	31,733	0	$0	$0	$0	None
27	36	41,943	11,275	10,436	$454,170	$240,975	$46,181	Incinerator 70%
28	38	87,542	86,123	84,373	$480,072	$217,816	$5,163	Incinerator 70%
29	39	42,857	3,000	2,143	$138,142	$54,621	$50,980	Incinerator
30	43	12,885	12,885	12,627	$49,530	$240,349	$38,068	Flare
31	44	186,800	2,921	0	$0	$0	$0	None
32	45	238,968	222,515	217,735	$483,407	$289,908	$2,663	Incinerator 70%
33	47	6,840,000	2,806,800	2,670,000	$226,448	$99,272	$74	Incinerator
34	48	1,855,000	1,142,200	1,105,100	$408,209	$143,025	$259	Incinerator 70%
35	49	884,165	8,842	0	$0	$0	$0	None
36	50	11,522	11,522	11,292	$352,749	$158,632	$28,097	Incinerator 70%
37	52	52,856	38,873	37,816	$143,645	$112,319	$5,940	Incinerator
38	54	53,380	34,300	33,232	$422,103	$126,870	$7,635	Incinerator 70%
39	56	965,098	59,458	40,702	$454,529	$212,836	$10,458	Incinerator 70%
40	57	27,522	27,027	26,477	$406,122	$161,586	$12,206	Incinerator 70%
41	58	31,713	634	0	$0	$0	$0	None
42	59	68,413	35,486	34,118	$48,897	$176,385	$10,340	Flare
43	60	3,899,000	43,497	6,096	$67,021	$268,981	$88,248	Flare
44	62	24,616	24,616	24,124	$156,440	$118,035	$9,786	Incinerator
45	63	1,852,542	470,212	439,953	$659,257	$661,070	$3,005	Incinerator 70%
46	64	761,592	120,191	111,475	$487,435	$277,316	$4,975	Incinerator 70%
47	65	499,550	499,550	489,559	$430,340	$193,607	$791	Incinerator 70%
48	66	257,894	257,894	252,736	$409,318	$195,084	$1,544	Incinerator 70%
49	67	63,185	1,264	0	$0	$0	$0	None
50	70	13,580	4,115	3,843	$65,729	$299,542	$155,894	Flare
51	71	55,626	556	0	$0	$0	$0	None
52	72	2,448,885	48,978	0	$0	$0	$0	None
53	73	41,006	1,270	450	$395,791	$188,256	$836,359	Incinerator 70%
54	74	15,000	3,000	2,700	$68,913	$170,700	$126,444	Flare
55	75	70,000	70,000	68,600	$138,287	$104,341	$3,042	Incinerator
56	76	10,865	10,772	10,555	$435,469	$162,207	$30,736	Incinerator 70%
57	78	41,178	41,178	40,354	$341,579	$149,333	$7,401	Incinerator 70%

Batch Process Vents – Above Floor Option (>=5,000 lb/yr) (continued)

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
58	79	262,030	15,136	9,895	$349,375	$142,390	$28,779	Incinerator 70%
59	82	13,520	2,231	1,960	$47,537	$39,132	$39,922	Flare
60	83	15,400	7,480	7,172	$48,878	$170,244	$47,475	Flare
61	84	71,600	3,580	2,148	$360,769	$159,911	$148,893	Incinerator 70%
62	86	58,070	44,324	43,162	$154,082	$92,010	$4,263	Incinerator
63	87	1,194,216	1,166,292	1,142,408	$439,246	$172,275	$302	Incinerator 70%
64	88	622,300	1,566	0	$0	$0	$0	None
65	89	41,000	8,410	7,780	$370,167	$152,266	$39,143	Incinerator 70%
66	90	690,323	9,952	2,626	$349,080	$124,113	$94,512	Incinerator 70%
67	91	6,477,988	357,153	227,593	$221,392	$102,806	$903	Incinerator
68	92	9,526	9,526	9,336	$138,344	$53,738	$11,512	Incinerator
69	93	18,450	18,450	18,081	$138,380	$107,246	$11,863	Incinerator
70	94	298,940	90,321	84,342	$331,766	$121,205	$2,874	Incinerator 70%
71	95	358,819	38,677	31,501	$310,019	$111,972	$7,109	Incinerator 70%
72	96	37,436	4,861	4,112	$309,185	$130,693	$63,567	Incinerator 70%
73	98	1,396,861	1,146,790	1,118,853	$539,459	$328,394	$587	Incinerator 70%
74	99	1,282,658	461,398	435,745	$621,440	$450,981	$2,070	Incinerator 70%
75	101	144,862	50,749	47,852	$515,105	$165,000	$6,896	Incinerator 70%
76	102	675,261	546,240	532,735	$541,813	$391,238	$1,469	Incinerator 70%
77	103	307,500	14,419	8,269	$334,972	$127,023	$30,724	Incinerator 70%
78	104	171,400	1,465	0	$0	$0	$0	None
79	105	220,336	20,313	15,906	$366,946	$153,710	$19,328	Incinerator 70%
80	106	114,248	100,289	98,145	$228,568	$59,613	$1,215	Incinerator
81	107	12,100	6,365	6,123	$168,467	$101,212	$33,060	Incinerator
82	109	106,857	11	0	$0	$0	$0	None
83	110	709,470	709,470	695,281	$48,980	$145,850	$420	Flare
84	111	948,446	98,275	79,307	$65,293	$242,468	$6,115	Flare
85	112	2,164,461	590,538	547,248	$448,680	$140,573	$514	Incinerator 70%
86	113	91,200	912	0	$0	$0	$0	None
87	114	82,040	1,641	0	$0	$0	$0	None
88	115	417,383	21,837	13,490	$429,767	$209,870	$31,116	Incinerator 70%
89	116	12,264	12,264	12,019	$335,586	$143,730	$23,918	Incinerator 70%
90	117	135,600	60,780	58,968	$435,368	$225,987	$7,665	Incinerator 70%
91	118	88,416	4,421	2,652	$325,591	$133,663	$100,783	Incinerator 70%
92	119	71,571	11,577	10,146	$48,899	$169,286	$33,371	Flare
93	121	258,962	252,152	246,973	$68,946	$424,362	$3,437	Flare
94	123	7,127	7,127	6,984	$48,875	$124,127	$35,544	Flare
95	124	2,143,465	202,998	162,512	$545,284	$291,999	$3,594	Incinerator 70%
96	125	1,584,000	1,584	0	$0	$0	$0	None
97	127	26,640	26,640	26,107	$309,213	$131,305	$10,059	Incinerator 70%
98	128	266,667	4,000	0	$0	$0	$0	None
99	129	11,080	554	332	$47,550	$110,734	$666,270	Flare
100	130	65,400	771	432	$341,534	$147,963	$685,014	Incinerator 70%
101	131	237,634	4,753	0	$0	$0	$0	None
102	132	320,510	74,019	67,609	$337,635	$117,973	$3,490	Incinerator 70%
103	133	2,631,640	159,046	124,591	$224,992	$103,272	$1,658	Incinerator
104	134	5,408	5,408	5,300	$156,209	$41,108	$15,513	Incinerator
105	136	11,994	11,994	11,754	$90,616	$36,458	$6,203	Flare
106	137	94,246	94,246	92,361	$168,307	$86,453	$1,872	Incinerator
107	138	575,645	74,963	63,450	$397,853	$110,489	$3,483	Incinerator 70%
108	139	216,681	93,099	88,765	$405,585	$182,671	$4,116	Incinerator 70%
109	141	187,184	147,991	144,248	$409,390	$199,074	$2,760	Incinerator 70%
110	142	16,270	16,270	15,945	$66,201	$352,952	$44,272	Flare
111	143	43,481	35,420	34,550	$149,708	$120,959	$7,002	Incinerator

Batch Process Vents – Above Floor Option (>=5,000 lb/yr) (continued)

	Facil. ID	HAP uncontrolled emissions (lb/yr)	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)	Control technology
112	146	32,740	1,637	982	$65,721	$280,757	$571,690	Flare
113	147	8,000	8,000	7,840	$138,393	$85,251	$21,748	Incinerator
114	149	702,730	57,907	43,852	$446,931	$130,254	$5,941	Incinerator 70%
115	150	29,000	29,000	28,420	$138,361	$106,651	$7,505	Incinerator
116	153	17,939	179	0	$0	$0	$0	None
117	154	758,304	735,406	720,239	$37,258	$13,469	$37	Flare
118	155	305,706	24,525	18,411	$219,011	$104,553	$11,358	Incinerator
119	156	2,219,075	127,187	82,805	$216,989	$101,380	$2,449	Incinerator
120	157	169,330	160,608	157,221	$213,859	$52,226	$664	Incinerator
121	158	60,130	60,130	58,927	$340,340	$133,905	$4,545	Incinerator 70%
122	159	94,178	4,238	2,354	$328,750	$65,675	$55,788	Incinerator
123	160	22,128	1,770	1,328	$379,436	$131,657	$198,326	Incinerator 70%
124	161	64,950	3,052	1,753	$229,706	$51,499	$58,743	Incinerator
125	163	73,841	42,913	41,436	$441,457	$243,910	$11,773	Incinerator 70%
126	164	47,697	47,697	46,743	$47,536	$114,253	$4,889	Flare
127	166	287,500	18,000	12,250	$439,059	$121,061	$19,765	Incinerator 70%
	Totals	65,574,416	15,259,472	14,187,035	$28,647,796	$18,658,468	$2,630	

ATTACHMENT 4

Costing Modules for

- Flares
- Incinerators with 0 percent heat recovery
- Incinerators with 70 percent heat recovery
- Selecting least costly device

Flare Costing Module

```
Option Compare Database
Option Explicit

Public Sub FlareCost()
                                  'Variable declaration section
Dim x As Double
Dim dbs As Database
Dim rst As Recordset
Dim Qe As Variant                 'max emission stream flow rate, scfm
Dim he As Double                  'heat content, Btu/scf
Dim Qflg As Double                'flare gas flow rate, scfm
Dim ppm As Double                 'concentration, ppm
Dim Hflg As Double                'heat content of flare gas
Dim Dtip As Double                'flare tip dia, in.
Dim Uflg As Double                'exit velocity of flare gas, ft/sec
Const Umin As Double = 0.03       'min flare gas exit velocity in ft/sec for a
                                  'stable flame (p 4-22, handbook)
Const MWe As Integer = 100        'mol wt of emission stream, lb/lb-mole
Dim MWflg As Double               'mol wt of flare gas, lb/lb-mole
Const Tflg As Integer = 95        'flare gas temperature, degF
Dim FlAngle As Double             'flame angle, degrees
Dim h As Double                   'flare height, ft
Dim Qf As Double                  'natural gas flow rate, scfm
Dim Qs As Double                  'steam requirement, lb/min
Dim Umax As Double                'maximum flare gas exit velocity
Dim FC As Double                  'flare cost, $
Dim PEC As Double                 'purchased equipment cost, $
Dim TAC As Double                 'total annual cost, $/yr
Dim HRS As Double                 'operating hours per year, hr/yr
Dim Fp As Double                  'power needed for fan, kWh/yr
Const P As Integer = 16           'system pressure drop, in. H2O
                                  '(table 4.2-9, handbook)
Dim DAC As Double                 'direct annual cost, $/yr
Dim IC As Double                  'indirect cost, $
Dim DC As Double                  'total direct cost, $
Dim IAC As Double                 'indirect annual cost, $/yr
Dim TCC As Double                 'total capital cost, $
Dim AEC As Double                 'auxiliary equipment cost
Dim Cp As Double                  'vent stream piping costs
Dim Ck As Double                  'knock-out drum costs
Dim d As Double                   'knock-out drum diameter, inches
Dim dh As Double                  'knock-out drum height, inches
Dim t As Double                   'knock-out drum thickness, inches
Dim Udo As Double                 'drop-out velocity for drum, ft/sec
```

Flare Costing Module (continued)

```
Dim A As Double                     'knock-out drum area, ft2
Dim EC As Double                    'equipment cost, $
Dim DIC As Double                   'direct installation cost, involves
                                    'foundation and supports, handling and
                                    'erection, electrical, piping,
                                    'insulation for ductwork and painting
Dim Fuel As Double                  'fuel charges
Dim Electric As Double              'electrical expenses
Dim StCost As Double                'annual steam cost, $/yr
Dim Labor As Double                 'labor cost
Dim Superv As Double                'supervisory cost
Dim Maint As Double                 'maintenance cost
Dim MaintMat As Double              'Maintenance material cost
Dim Overhead As Double              'overhead cost is 60% oflabor and maintenance
Dim Admin As Double                 'administrative cost is 2% of TCC
Dim PropTax As Double               'property tax is 1% of TCC
Dim Insur As Double                 'insurance is 1% of TCC
Dim CapRecov As Double              'capital recovery
Dim DaysPerYear As Variant
Dim HoursPerDay As Variant
Dim HoursOfOperation As Variant
Dim ProType As String
Dim y As Double
Dim Reduc As Double                 'HAP reduction, lb/yr
Dim Steam As Double                 'steam requirement, lb/yr
Dim NatGas As Double                'natural gas requirement, mmscf/yr
Dim OandM As Double                 'operating and maintenance cost
Const M As Single = 10000           'Assumed compliance assessment cost, $
                                    '(inital)
Dim CAR As Double                   'capital recovery
Const RC As Single = 0              'recovery credit is 0 because no recovery
Dim ppmw As Double

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForBatchVents")

'Opens the Table "MasterTableForBatchVent" from the database and reads out the values listed
'below

rst.MoveFirst
Do While Not rst.EOF
                                    'DaysPerYear = rst![Days/yr]
                                    'HoursPerDay = rst![Hrs/day]
                                    'HoursOfOperation = rst![Hours of Operation]
```

Flare Costing Module (continued)

```
                                        'ProType = rst![Type]
  If IsNull(rst![Hours of Operation]) Then
    HRS = 8760
  Else
    HRS = rst![Hours of Operation]
  End If

  Reduc = rst![HAP Reduction (lb/yr)]

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
  Qe =415
Else
  Qe = rst![Flow (scfm)]
End If

If IsNull(rst!Conc) Then
    ppm = 0
Else
    ppm = rst!Conc
End If

'Calculates the heat content (he) in BTU/scf
                                    'ppmw = ppm * 100 / 29
he = ((15000 * 0.0753) * ppm) / 1000000
                                    '15000 Btu/lb is decided by CMA, 0.0753
                                    'lb/scf is density of emission
                                    'stream at 68 degF
If he >= 300 Then
  Qf = 0                            'Qf is the natural gas flow rate, scfm
Else
  Qf = ((300 - he) * Qe) / (882 - 300)   'where 882 is the lower heating
                                    'value of natural gas
End If

Qflg = Qe + Qf                      'flare gas flow rate, scfm calculation for
                                    '98% HAP reduction, where Qe is the max emission
                                    'stream flow rate

If he > 300 Then                    'Hflg, the heat content of the flare gas,
                                    ' is dependent on whether
                                    'supplementary fuel is
                                    'added to the emission stream
  Hflg = he
Else
```

Flare Costing Module (continued)

```
   Hflg = 300
End If

If Hflg >= 300 And Hflg < 1000 Then
   Umax = 3.28 * (10 ^ (0.00118 * Hflg + 0.908))
                                                    'Umax is the max flare gas exit velocity
ElseIf Hflg > 1000 Then
   Umax = 400
End If

'Calculation of the Dtip (flare tip diameter, inches)

Dtip = 1.96 * ((Qflg / Umax) ^ 0.5)
   Select Case Dtip
      Case Is < 1
         x = 1

      Case 1 To 2
        x = 2

      Case 2 To 24
         y = Dtip
            If y / 2 = 0 Then
               x = y
            Else
               x = Int(y) - (Int(y) Mod 2) + 2    'rounds diameter
                                                  'to next commercially
                                                  'available size
            End If

     Case 24 To 60
         y = Dtip
            If y / 6 = 0 Then
               x = y
            Else
              x = Int(y) - (Int(y) Mod 6) + 6
            End If
   End Select

Uflg = (0.005766 * Qflg * (Tflg + 460)) / (x) ^ 2

If Umin > Uflg Or Uflg > Umax Then          'because 98% destruction efficiency
                                            'can be achieved-
   rst.Edit                                 'under these conditions and no additional cost
```

Flare Costing Module (continued)

```
    rst!Flare_TAC = 0                        ‘is required
    rst!Flare_TCC = 0
    rst![Flare_Electricity (kWh/yr)] = 0
    rst![Flare_Steam (lb/yr)] = 0
    rst![Flare_NatGas (mmscf/yr)] = 0
    rst![Flare_O&M ($)] = 0
    rst![Flare_MRR ($)] = 0
    rst![Flare_ACR ($)] = 0
    rst![Flare_RC ($)] = 0
    rst.Update
    GoTo nextrecord
Else
    MWflg = ((Qf * 16.7) + (Qe * MWe)) / Qflg
                                             ‘MWflg is the molecular flow rate of the flare gas
    Qs = 0.00103 * Qflg * MWflg
                                             ‘Qs is the steam requirement in lb/min
    FlAngle = Atn(88.2 / Uflg) * 180 / 3.1416
                                               ‘FlAngle is the flame angle in degrees
                                               ’assuming wind velocity 60 mph
    h = 0.02185 * ((Qflg * Hflg) ^ 0.5) - (0.00605 * x * Uflg * (cos(FlAngle)))
                                               ‘h is the flare height, in feet
                                               ‘The height determines the type of tower, which
                                               ‘Is assigned below
    If h <= 100 Then                           ’self support tower
      FC = (78 + (9.14 * x) + (0.749 * h)) ^ 2
    ElseIf h > 100 And h = 300 Then            ’guy support tower
      FC = (103 + (8.68 * x) + (0.47 * h)) ^ 2
    ElseIf h > 300 Then                        ’derrick support tower
      FC = (76.4 + (2.72 * x) + (1.64 * h)) ^ 2
    End If
                             ’For all three cases, FC includes the flare stack and support, burner
                             ’tip, pilots, utility piping, 100 ft of vent stream piping, utility
                             ’metering and control, water and gas seals, and platform and ladders.
    If x < 24 Then
      Cp = (127 * x) ^ 1.21                    ’vent stream piping costs (Cp)
    Else
      Cp = (139 * x) ^ 1.07
    End If

                                               ’Knock-out drum calculations:

    Udo = 0.2 * ((41.203 - 2.97) / 2.97) ^ 1 / 2   ’assumed design vapor velocity
                                               ’G=0.2
    A = Qe / (60 * Udo)                        ’used densities for hexane
```

Flare Costing Module (continued)

```
d = 12 * (4 * A / 3.14) ^ 1 / 2               'diameter of knock-out drum

If d < 36 Then                                't is the knock-out drum thickness, which is
   t = 0.25                                   'dependent on the diameter
Else
   If d < 72 Then
      t = 0.375
   End If
End If

dh = 3 * d                                    'dh is the knockout drum height in inches

Ck = 14.2 * (d * t * (dh + 0.812 * d)) ^ 0.737   'knock-out drum cost

AEC = Cp + Ck                                    'auxillary equipment costs
EC = FC + AEC                                    'total equipment costs
PEC = 1.18 * EC                                  'include EC, instrumentation,
                                                 'sales tax and freight
DC = 1.56 * PEC                                  'include foundation and support,
                                                 'handling and erection,
                                                 'elecrical, piping, painting
                                                 'and insulation
IC = 0.35 * PEC                                  'Indirect costs
TCC = (DC + IC) * (106.7 / 100) * (99.4 / 100) + M
                                                 'Total Capital Cost -
                                                 'multiplying by cost indexes to
                                                 'get 1st quarter 99$ relative to
                                                 'April 1988

Fp = 0.000181 * Qflg * P * HRS                   'Power needed for fan,
                                                 'assuming a fan motor efficiency
                                                 'of 65% and a fluid sp gr of
                                                 '1 and the fan is installed
                                                 'downstream of the
                                                 'incinerator
Steam = Qs * 60 * HRS                            'Steam requirement, lb/yr

StCost = Qs * 60 * HRS * 6 / 1000                'annual steam cost, assuming $6.0/1000 lb
NatGas = Qf * 60 * HRS / 1000000                 'Annual natural gas cost
Fuel = Qf * 60 * HRS * 3.3 / 1000                'factor $3.30/1000 ft3 is for
                                                 'fuel (natural gas)
Electric = 0.059 * Fp                            'electricity cost, assuming $0.059/kWh
Labor = 0.5 / 8 * HRS * 15.64                    '0.5 hr labor in 8 hr shift at
```

Flare Costing Module (continued)

```
                                              '$15.64/hr
   Superv = 0.15 * Labor                      '15% of labor cost
   Maint = 0.5 / 8 * HRS * 17.2               '0.5 hr maintenance per 8 hr
                                              'shift with $17.20/hr
   MaintMat = Maint                           'maintenance material cost is
                                              '100% of maintenance charges
   DAC = Fuel + Electric + StCost + Labor + Superv + Maint + MaintMat
   Overhead = 0.6 * (Labor + Superv + Maint + MaintMat)
   Admin = 0.02 * TCC
   PropTax = 0.01 * TCC
   Insur = 0.01 * TCC
   CAR = 0.1098 * TCC                         'based on i(1+i)^n/(((1+i)^n)-1)
                                              'where i=7% and n=15 yr life
   IAC = Overhead + Admin + PropTax + Insur + CAR
   TAC = (DAC + IAC)
   OandM = TAC - CAR + RC
End If

   rst.Edit

   If Reduc = 0 Then                          'If reduction is 0, then no costs are incurred
      rst!Flare_TAC = 0
      rst!Flare_TCC = 0
      rst![Flare_Electricity (kWh/yr)] = 0
      rst![Flare_Steam (lb/yr)] = 0
      rst![Flare_NatGas (mmscf/yr)] = 0
      rst![Flare_O&M ($)] = 0
      rst![Flare_MRR ($)] = 0
      rst![Flare_ACR ($)] = 0
      rst![Flare_RC ($)] = 0
   Else                                       'Puts calculated costs back into table in db
     rst!Flare_TAC = TAC
     rst!Flare_TCC = TCC
     rst![Flare_Electricity (kWh/yr)] = Fp
     rst![Flare_Steam (lb/yr)] = Steam
     rst![Flare_NatGas (mmscf/yr)] = NatGas
     rst![Flare_O&M ($)] = OandM
     rst![Flare_MRR ($)] = M
     rst![Flare_ACR ($)] = CAR
     rst![Flare_RC ($)] = RC
   End If
```

Flare Costing Module (continued)

```
    rst.Update

nextrecord:

    rst.MoveNext
Loop
End Sub
```

Incinerator (0% heat recovery) Costing Module

```
Option Compare Database
Option Explicit

Public Sub IncineratorCost()            'for 98% destruction efficiency

    'Variable declaraion
Dim dbs As Database
Dim rst As Recordset
Dim Qe As Variant                       'max emission stream flow rate, scfm
Const Te As Integer = 100               'temperature of emission stream from the process, degF
Dim he As Double                        'heat content, Btu/lb
Dim O2 As Double                        'oxygen content, %
Dim ppm As Variant                      'concentration, ppm
Dim Qd As Double                        'dilution air required, scfm
Dim hd As Double                        'desired heat content of emission stream,
                                        '<=13 Btu/scf
Const Tc As Integer = 1600              'combustion temperature, degF
Const tr As Double = 0.75               'residence time, sec
Dim Qf As Double                        'supplementary natural gas flow rate,scfm
Const De As Double = 0.0753             'density of flue gas stream, lb/scf
Const Df As Double = 0.0417             'density of fuel gas, 0.0417 lb/scf for
                                        'methane at 68 degF
Const CPair As Double = 0.248           'mean heat capacity of between Tc and Tr
                                        '(77 degF), Btu/lb-degF
                                        '(p 3-32 OAQPS manual)
Dim The As Double                       'emission stream temperature after heat
                                        'recovery (entering incinerator), degF
Const hf As Double = 21600              'lower heating value of natural gas,
                                        'Btu/lb
Const HR As Integer = 0                 'heat recovery in the exchanger, %
Const Tref As Integer = 68              'reference temperature, 68 degF
Dim Qfg As Double                       'flue gas flow rate, scfm
Dim Qfga As Double                      'actual flue gas flow rate, acfm
Dim Vc As Double                        'combustion chamber volume, ft3
Dim TIC As Double                       'thermal incinerator cost, $
Dim PEC As Double                       'purchased equipment cost, $
Dim TAC As Double                       'total annual cost, $/yr
Dim HRS As Double                       'operating hours per year, hr/yr
Dim Fp As Double                        'power needed for fan, kWh/yr
Const P As Integer = 4                  'system pressure drop, in. H2O for 0% HR
                                        '(table 3.11 OAQPS manual)
Dim DAC As Double                       'direct annual cost, $/yr
Dim IC As Double                        'indirect cost, $
Dim DC As Double                        'total direct cost, $
```

Incinerator (0% heat recovery) Costing Module (continued)

```
Dim IAC As Double                       'indirect annual cost, $/yr
Dim TCC As Double                       'total capital cost, $
Const AEC As Integer = 0                'auxiliary equipment cost, assumed $0
Dim EC As Double                        'equipment cost, $
Dim DIC As Double                       'direct installation cost, involves
                                        'foundation and supports,handling and
                                        'erection, electrical, piping,
                                        'insulation for duct work and
                                        'painting
Dim Fuel As Double                      'fuel charges
Dim Electric As Double                  'electrical expenses
Dim Labor As Double                     'labor cost
Dim Superv As Double                    'supervisory cost
Dim Maint As Double                     'maintenance cost
Dim MaintMat As Double                  'Maintenance material cost
Dim Overhead As Double                  'overhead cost is 60% oflabor and
                                        'maintenance
Dim Admin As Double                     'administrative cost is 2% of TCC
Dim PropTax As Double                   'property tax is 1% of TCC
Dim Insur As Double                     'insurance is 1% of TCC
Dim DaysPerYear As Variant
Dim HoursPerDay As Variant
Dim HoursOfOperation As Variant
Dim ProType As String
Dim Concv As Double                     'concentration in ppmv
Dim ConcW As Double                     'concentration in ppmw
Dim Reduction As Double                 'HAP reduction, lb/yr
Dim Electricity As Double               'electricity requirement, kWh/yr
Dim Steam As Double                     'steam requirement, lb/yr
Dim NatGas As Double                    'natural gas requirement, mmscf/yr
Dim OandM As Double                     'operating and maintenance cost
Dim M As Double                         'Assumed compliance assessment cost, $
Dim CAR As Double                       'capital recovery, .1315 of TCC
Const RC As Single = 0                  'recovery credit is 0 because no recovery
Const MonitLabor As Double = 9422       'Monitoring labor
Const Monitmat As Double = 500          'Monitoring materials
Dim EquipTCC As Double                  'Equipment Capital Cost
Const MonitEquip As Double = 6250       'Monitoring equipment cost
Const MT As Double = 24420              'Monitoring Testing cost
Dim MonitE As Double                    'Monitoring equipment costs, inc. tax, etc.

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForBatchVents")
```

Incinerator (0% heat recovery) Costing Module (continued)

```
'Reading data into module from table (MasterTableForBatchVents) in database
rst.MoveFirst
Do While Not rst.EOF
   If IsNull(rst![Hours of Operation]) Then
      HRS = 8760
   Else
      HRS = rst![Hours of Operation]
   End If

   Reduction = rst![HAP Reduction (lb/yr)]

    If IsNull(rst!Conc) Then
      ConcW = 0
   Else
      Concv = rst!Conc
      ConcW = Concv * 100 / 29             '100 is avg MW of HAP and 29 MW of air
   End If                                  'in lb/lb-mole

   O2 = (1 - ConcW / 1000000) * 0.21 * 100
   he = 15000 * ConcW / 1000000            'He is heat content, BTU/scf
                                           '15000 Btu/lb is decided by CMA

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
   Qe = 415                                'Qe is the max emission stream flow rate
Else
   Qe = rst![Flow (scfm)]
End If

If Qe < 415 Or Qe > 50000 Then             'because TCC calculator are designed
   rst.Edit                                'for given range only-
   rst!Incin_TAC = 0                       '(table 3.7 manual)
   rst!Incin_TCC = 0
   rst![Incin_Electricity (kWh/yr)] = 0
   rst![Incin_Steam (lb/yr)] = 0
   rst![Incin_NatGas (mmscf/yr)] = 0
   rst![Incin_O&M ($)] = 0
   rst![Incin_MRR ($)] = 0
   rst![Incin_ACR ($)] = 0
   rst![Incin_RC ($)] = 0
   rst.Update
   GoTo nextrecord
```

Incinerator (0% heat recovery) Costing Module (continued)

```
ElseIf O2 < 20 And (he * 0.0753) >= 13 Then      'he is in Btu/lb, multiplying
     Qd = ((he * 0.0753 / 13) - 1) * Qe          'it by 0.0753 lb/scf will
                                                 'make it Btu/scf
                                                 'If O2<20 and heat content>13,
                                                 'use this equation to
                                                 'determine auxillary air
Else
   Qd = 0
End If

   The = (HR / 100) * Tc + (1 - (HR / 100)) * Te   'since thermal incinerator
                                                   'is with 0% heat recovery
                                                   'The = Te

   If O2 > 20 Then
      Qf = De * Qe * (CPair * (1.1 * Tc - The - (0.1 * Tref)) - he) / (Df * (hf - 1.1 * CPair * (Tc -
Tref)))
                                                 'Qf is the natural gas flow rate
                                                 'the factor of 1.1 in above equation is to
                                                 'account for 10% of heat losses
                                                 'in the incinerator
   Else
      Qf = 0
   End If

   If Qf > 0 Then
      Qfg = Qe + Qf + Qd                         'Qflg is the flow rate of the flare gas
   Else
      Qfg = Qe + Qd
   End If

   Qfga = Qfg * ((Tc + 460) / 528)               '68F + 460 = 528 degR
   Vc = ((Qfga / 60) * tr) * 1.05                'the factor of 1.05 is used for
                                                 'minor fluctuation in flow rate
                                                 'and follows industry practice
   TIC = 10294 * (Qfg ^ 0.2355)                  'for HR = 0% and Qe range from 500
                                                 'to 50,000 scfm
   EC = TIC + AEC                                'Equipment costs
   PEC = 1.08 * EC                               'purchased equipment costs
   DIC = 0.3 * PEC                               'Direct installation cost
   DC = 1.3 * PEC                                'Direct costs
   IC = 0.31 * PEC                               'Indirect costs
```

Incinerator (0% heat recovery) Costing Module (continued)

```
EquipTCC = (DC + IC) * (352.4 / 340.1) * (120.5 / 100) * (109.3 / 100)
                                       'Equipment Capital costs,
                                       'multiplying by cost indexes for
                                       '1st quarter 99$ relative
                                       'to April 1988 -
                                       '352.4/340.1 is April 88 to
                                       '1st quarter 89
                                       '120.5/100 is Vatavuk Index for
                                       '1st quarter 94 vs 89
                                       '109.3/100 is Vatavuk Index for
                                       '1st quarter 99 vs 94

MonitE = MonitEquip * 1.08 * 1.8       'Monitoring equipment costs,
                                       'Add cost of tax, freight and shipping
M = MonitE + MT                        'M is the assumed compliance assessment
                                       'cost

TCC = EquipTCC + M                     'Total capital cost

Fp = 0.000181 * Qfga * P * HRS         'Fan power requirement, found by
                                       'assuming a fan motor efficiency of
                                       '65% and a fluid sp gr of 1 and
                                       'the fan is installed downstream
                                       'of the incinerator
If Qf > 0 Then                         'Qf - Flow of the supplementary gas stream
 Fuel = Qf * 60 * HRS * 3.3 / 1000     'factor $3.30/1000 ft3 is for fuel
                                       '(natural gas)
Else
   Fuel = 0
End If

If Fuel = 0 Then
   NatGas = 0
Else
   NatGas = Qf * 60 * HRS / 1000000
End If

Electric = 0.059 * Fp                  'electricity is $0.059/kWh
Labor = 0.5 / 8 * HRS * 15.64          '0.5 hr labor in 8 hr shift at
                                       '$15.64/hr
Superv = 0.15 * Labor                  '15% of labor cost
Maint = 0.5 / 8 * HRS * 17.2           '0.5hr maintenance per 8 hr shift
                                       'with $17.20/hr
MaintMat = Maint                       'maintenance material cost is 100%
                                       'of maintenance charges
DAC = Fuel + Electric + Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat
```

Incinerator (0% heat recovery) Costing Module (continued)

```
   Overhead = 0.6 * (Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat)
   Admin = 0.02 * TCC
   PropTax = 0.01 * TCC
   Insur = 0.01 * TCC
   CAR = 0.1098 * TCC                  'based on i(1+i)^n/(((1+i)^n)-1)
                                       'where i=7% and n=15 yr life
   IAC = Overhead + Admin + PropTax + Insur + CAR
   TAC = (DAC + IAC)
   OandM = TAC - CAR + RC
   rst.Edit

'If reduction is 0, there are no costs associated with it, and 0s are put back into the table
    If Reduction = 0 Then
      rst!Incin_TAC = 0
      rst!Incin_TCC = 0
      rst![Incin_Electricity (kWh/yr)] = 0
      rst![Incin_Steam (lb/yr)] = 0
      rst![Incin_NatGas (mmscf/yr)] = 0
      rst![Incin_O&M ($)] = 0
      rst![Incin_MRR ($)] = 0
      rst![Incin_ACR ($)] = 0
      rst![Incin_RC ($)] = 0
   Else
'if there are costs associated with a control device, they are put back into the table here
      rst!Incin_TAC = TAC
      rst!Incin_TCC = TCC
       rst![Incin_Electricity (kWh/yr)] = Fp
      rst![Incin_Steam (lb/yr)] = 0
      rst![Incin_NatGas (mmscf/yr)] = NatGas
      rst![Incin_O&M ($)] = OandM
      rst![Incin_MRR ($)] = M
      rst![Incin_ACR ($)] = CAR
      rst![Incin_RC ($)] = RC
   End If

   rst.Update

nextrecord:

   rst.MoveNext
Loop
End Sub
```

Incinerator (70% heat recovery) Costing Module

```
Option Compare Database
Option Explicit

Public Sub IncineratorCost70()

Dim dbs As Database
Dim rst As Recordset

'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*              Declare variables used in design calculations
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Dim Qe As Variant                   'max emission stream flow rate, scfm
Dim Concv As Double                 'HAP concentration in ppmv
Dim ConcW As Double                 'HAP concentration in ppmw
Const Te As Integer = 100           'temperature of emission stream from the process, degF
Dim he As Double                    'heat content, Btu/lb
Dim O2 As Double                    'oxygen content, %
Dim Qd As Double                    'dilution air required, scfm
Const Tc As Integer = 1600          'combustion temperature, degF
Dim Qf As Double                    'supplementary natural gas flow rate, scfm
Const De As Double = 0.0753         'density of flue gas stream at 68 degF, lb/scf
Const Df As Double = 0.0417         'density of fuel gas, 0.0417 lb/scf for
                                    'methane at 68 degF
Const CPair As Double = 0.255       'mean heat capacity of between Tref and avg of Tc
                                    'and The, Btu/lb-degF
Dim The As Double                   'emission stream temperature after heat
                                    'recovery, degF
Const hf As Double = 21600          'lower heating value of natural gas,  Btu/lb
Const HR As Integer = 70            'heat recovery in the exchanger, %
Const Tref As Integer = 68          'reference temperature, 68 degF
Dim Qfg As Double                   'flue gas flow rate, scfm
Dim Qfga As Double                  'actual flue gas flow rate, acfm
Const MWhap As Integer = 100        'default HAP molecular weight, lb/lb-mole

'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*              Declare variables used to calculate capital costs
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Dim TIC As Double                   'thermal incinerator cost, $
Dim PEC As Double                   'purchased equipment cost, $
Dim TAC As Double                   'total annual cost, $/yr
Dim Fp As Double                    'power needed for fan, kWh/yr
```

Incinerator (70% heat recovery) Costing Module (continued)

```
Dim DAC As Double                    'direct annual cost, $/yr
Dim IC As Double                     'indirect cost, $
Dim DC As Double                     'total direct cost, $
Dim IAC As Double                    'indirect annual cost, $/yr
Dim TCC As Double                    'total capital cost, $
Dim EC As Double                     'equipment cost, $
Dim DIC As                           'direct installation cost, $
Dim EquipTCC As Double               'Total equipment capital cost, $
Dim MonitE As Double                 'Monitoring equipment costs, inc. tax, etc., $
Dim M As Double                      'Total monitoring capital cost, $
Const AEC As Integer = 0             'auxiliary equipment cost, assumed $0
Const MonitEquip As Double = 6250    'Monitoring equipment cost, $
Const MT As Double = 24420           'Performance test cost, $

'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*
'*              Declare variables used to calculate annual costs
'*
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Dim Fuel As Double                   'natural gas costs
Dim Electric As Double               'electrical expenses
Dim HRS As Double                    'operating hours per year, hr/yr
Dim Labor As Double                  'operating labor cost
Dim Superv As Double                 'supervisory labor cost
Dim Maint As Double                  'maintenance labor cost
Dim MaintMat As Double               'Maintenance material cost
Dim Overhead As Double               'overhead cost is 60% of labor and
                                     'maintenance materials
Dim Admin As Double                  'administrative cost is 2% of TCC
Dim PropTax As Double                'property tax is 1% of TCC
Dim Insur As Double                  'insurance is 1% of TCC
Dim Reduction As Double              'HAP reduction, lb/yr
Dim NatGas As Double                 'natural gas requirement, mmscf/yr
Dim OandM As Double                  'operating and maintenance cost
Dim CAR As Double                    'capital recovery, 0.1098 of TCC
Const P As Integer = 19              'system pressure drop, in. H2O for 70%
                                     'HR (table 3.11, manual)
Const RC As Single = 0               'recovery credit is 0 because no recovery
Const MonitLabor As Double = 9422    'Monitoring labor costs, $/yr
Const Monitmat As Double = 500       'Monitoring materials costs, $/yr
```

Incinerator (70% heat recovery) Costing Module (continued)

```
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*           Open source table
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForBatchVents")

'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*           • Read in values from the source table,
'*           • Calculate O2 content and heat content of vent stream, and
'*           • Calculate dilution air and auxiliary fuel flow rates
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

rst.MoveFirst
Do While Not rst.EOF

   If IsNull(rst![Hours of Operation]) Then
      HRS = 8760
   Else
      HRS = rst![Hours of Operation]
   End If

Reduction = rst![HAP Reduction (lb/yr)]

   If IsNull(rst!Conc) Then
      ConcW = 0
   Else
      Concv = rst!Conc
      ConcW = Concv * MWhap / 29        '100 is default HAP MW and 29 is MW of vent
                                        'stream (i.e., air), lb/lb-mole
   End If

   O2 = (1 - ConcW / 1000000) * 0.21 * 100
   he = 15000 * ConcW / 1000000         'he is heat content of vent stream; according to CMA,
                                        'a typical value for the HAP components is 15,000
                                        'Btu/lb

If IsNull(rst![Flow (scfm)]) Or rst![Flow (scfm)] = 0 Then
   Qe = 415                             'Qe is the max emission stream flow rate
Else
   Qe = rst![Flow (scfm)]
End If

If Qe < 415 Or Qe > 50000 Then          'because TCC equations are designed for
```

Incinerator (70% heat recovery) Costing Module (continued)

```
                                              'this range only (see manual, table 3.7).
                                              'Therefore costs are assigned to be 0 in the table
                                              'when the flow is outside applicable ranges
   rst.Edit
   rst!Incin70_TAC = 0
   rst!Incin70_TCC = 0
   rst![Incin70_Electricity (kWh/yr)] = 0
   rst![Incin70_NatGas (mmscf/yr)] = 0
   rst![Incin70_O&M ($)] = 0
   rst![Incin70_MRR ($)] = 0
   rst![Incin70_ACR ($)] = 0
   rst![Incin70_RC ($)] = 0
   rst.Update
   GoTo nextrecord

ElseIf O2 < 20 And (he * De) >= 13 Then
   Qd = ((he * De/ 13) - 1) * Qe           'A heat content of 13 Btu/scf corresponds to 25%
                                           'of LEL for typical organic/air mixture.
                                           'Note that adding dilution air will introduce error in
                                           'the mass and energy balance used to calculate the
                                           'auxiliary fuel flow rate.
Else
   Qd = 0
End If

   The = (HR / 100) * Tc + (1 - (HR / 100)) * Te
                                           'The is emission stream temp out of preheater

   Qf = De * Qe * (CPair * (1.1 * Tc - The - (0.1 * Tref)) - he) / (Df * (hf - 1.1 * CPair * (Tc -
Tref)))
                                           'auxiliary fuel requirements calculated based on
                                           'mass and energy balance assuming no dilution air,
                                           'energy losses are 10% of total energy impacts,
                                           'inlet and outlet gas heat capacities are equal, and
                                           'mean heat capacities above Tref are equal.

   If Qf > 0 Then
      Qfg = Qe + Qf + Qd                   'Qfg is the flow rate of the flue gas at 68 degF
   Else
      Qfg = Qe + Qd
   End If

   Qfga = Qfg * ((Tc + 460) / 528)         'Calculate flow at incinerator outlet temperature
```

Incinerator (70% heat recovery) Costing Module (continued)

```
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*            Calculate capital costs
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

   TIC = 21342 * (Qfg ^ 0.25)          'for HR = 70% and Qe range from 500
                                       'to 50,000 scfm
   EC = TIC + AEC                      'Equipment cost
   PEC = 1.08 * EC                     'Purchased equipment cost
   DIC = 0.3 * PEC                     'Direct installation cost
   DC = 1.3 * PEC                      'Direct costs
   IC = 0.31 * PEC                     'Indirect costs
   EquipTCC = (DC + IC) * (352.4 / 340.1) * (120.5 / 100) * (109.3 / 100)
                                       'multiplying by cost indexes for
                                       '1st quarter 99$ relative
                                       'to April 1988 -
                                       '352.4/340.1 is April 88 to
                                       '1st quarter 89
                                       '120.5/100 is Vatavuk Index for
                                       '1st quarter 94 vs 89
                                       '109.3/100 is Vatavuk Index for
                                       '1st quarter 99 vs 94
   MonitE = MonitEquip * 1.08 * 1.8    'Add cost of tax, freight and shipping
   M = MonitE + MT                     'total monitoring costs

   TCC = EquipTCC + M                  'total capital costs


'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
'*            Calculate annual costs
'* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

   Fp = 0.000181 * Qfga * P * HRS      'Fan power required, kwh/yr
                                       'assuming a fan motor efficiency of
                                       '65% and a fluid sp gr of 1
                                       'and the fan is installed
                                       'downstream of the incinerator

   If Qf > 0 Then                      'Calculate annual NG costs ($3.30/1000 ft3)
     Fuel = Qf * 60 * HRS * 3.3 / 1000
   Else
     Fuel = 0
   End If

   If Fuel = 0 Then                    'Calculate annual NG consumption
```

Incinerator (70% heat recovery) Costing Module (continued)

```
      NatGas = 0
   Else
      NatGas = Qf * 60 * HRS / 1000000
   End If

   Electric = 0.059 * Fp                ’electricity is $0.059/kWh
   Labor = 0.5 / 8 * HRS * 15.64        ’0.5 hr labor in 8 hr shift at $15.64/hr
   Superv = 0.15 * Labor                ’15% of labor cost
   Maint = 0.5 / 8 * HRS * 17.2         ’0.5 hr maintenance per 8 hr shift with $17.20/hr
   MaintMat = Maint                     ’maintenance material cost is 100%
                                        ’of maintenance labor charges
   DAC = Fuel + Electric + Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat
   Overhead = 0.6 * (Labor + Superv + Maint + MaintMat + MonitLabor + Monitmat)
   Admin = 0.02 * TCC
   PropTax = 0.01 * TCC
   Insur = 0.01 * TCC
   CAR = 0.1098 * TCC                   ’based on i(1+i)^n/(((1+i)^n)-1)
                                        ’where i=7% and n=15 yr life
   IAC = Overhead + Admin + PropTax + Insur + CAR
   TAC = (DAC + IAC)

   OandM = TAC - CAR + RC


‘* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
‘*          Information sent back to the source table
‘* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

   rst.Edit

‘If the reduction from the source table equals 0, no control device was added, and there are no
‘additional control costs.  Therefore, all cost variables are assigned a value of zero before being
‘sent to the output table, as follows:

    If Reduction = 0 Then
      rst!Incin70_TAC = 0
      rst!Incin70_TCC = 0
      rst![Incin70_Electricity (kWh/yr)] = 0
      rst![Incin70_NatGas (mmscf/yr)] = 0
      rst![Incin70_O&M ($)] = 0
      rst![Incin70_MRR ($)] = 0
      rst![Incin70_ACR ($)] = 0
      rst![Incin70_RC ($)] = 0
```

Incinerator (70% heat recovery) Costing Module (continued)

```
'If the reduction from the source table is greater than zero, a control device was added, and costs
'calculated in this module are sent to the output table, as follows:

  Else
      rst!Incin70_TAC = TAC
      rst!Incin70_TCC = TCC
      rst![Incin70_Electricity (kWh/yr)] = Fp
      rst![Incin70_NatGas (mmscf/yr)] = NatGas
      rst![Incin70_O&M ($)] = OandM
      rst![Incin70_MRR ($)] = M
      rst![Incin70_ACR ($)] = CAR
      rst![Incin70_RC ($)] = RC
   End If

   rst.Update

nextrecord:

   rst.MoveNext
Loop
End Sub
```

```
Option Compare Database
Option Explicit

Public Sub MinVal()

'This module selects the control technology with the smallest costs

'Variable declaration section
Dim dbs As Database
Dim rst As Recordset
Dim FTCC As Long             'flare total capital cost
Dim FTAC As Long             'flare total annual cost
Dim ITCC As Long             'incinerator with 0% heat recovery total capital cost
Dim ITAC As Long             'incinerator with 0% heat recovery total annual cost
Dim RTCC As Long             'incinerator with 70% heat recovery total capital cost
Dim RTAC As Long             'incinerator with 70% heat recovery total annual cost
Dim CtrlTech As String       'control technology suggested to select on TCC and TAC basis
Dim AC As Long               'lowest annual cost from three technologies
Dim CC As Long               'capital cost of corresponding lowest annual cost
Dim best As Long             'minimum annual for the three technology
Dim Reduction As Long        'HAP Reduction in lb/yr
Dim Electricity As Double    'electricity requirement, kWh/hr
Dim Steam As Double          'steam requirement, lb/yr
Dim NatGas As Double         'natural gas requirement, mmscf/yr
Dim OnM As Double            'operating and maintenance cost
Dim CR As Double             'capital recovery
Dim Mirr As Single           'Assumed compliance assessment cost, $
Const RC As Single = 0       'recovery credit

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("MasterTableForBatchVents")

'Reading data from table "MasterTableForBatchVents"
rst.MoveFirst
Do While Not rst.EOF

FTCC = rst![Flare_TCC]
FTAC = rst![Flare_TAC]
ITCC = rst![Incin_TCC]
ITAC = rst![Incin_TAC]
RTCC = rst![Incin70_TCC]
RTAC = rst![Incin70_TAC]
Reduction = rst![HAP Reduction (lb/yr)]
```

```
'The following selects the lowest cost and sets it equal to best
If ITAC = 0 Then
   best = FTAC
ElseIf FTAC < ITAC And FTAC < RTAC Then
   best = FTAC
ElseIf ITAC <> 0 And ITAC < RTAC Then
   best = ITAC
Else
   best = RTAC
End If

'The following sets the proper costs to the best techonology
   Select Case best
      Case Is = FTAC
         AC = FTAC
         CC = FTCC
         Electricity = rst![Flare_Electricity (kWh/yr)]
         Steam = rst![Flare_Steam (lb/yr)]
         NatGas = rst![Flare_NatGas (mmscf/yr)]
         CtrlTech = "Flare"
         OnM = rst![Flare_O&M ($)]
         Mirr = rst![Flare_MRR ($)]
         CR = rst![Flare_ACR ($)]
                                       ' RC = rst![Flare_RC ($)]
      Case Is = ITAC
         AC = ITAC
         CC = ITCC
         Electricity = rst![Incin_Electricity (kWh/yr)]
         Steam = rst![Incin_Steam (lb/yr)]
         NatGas = rst![Incin_NatGas (mmscf/yr)]
         CtrlTech = "Incinerator"
         OnM = rst![Incin_O&M ($)]
         Mirr = rst![Incin_MRR ($)]
         CR = rst![Incin_ACR ($)]
                                       ' RC = rst![Incin_RC ($)]

      Case Is = RTAC
         AC = RTAC
         CC = RTCC
         Electricity = rst![Incin70_Electricity (kWh/yr)]
         Steam = rst![Incin70_Steam (lb/yr)]
         NatGas = rst![Incin70_NatGas (mmscf/yr)]
         CtrlTech = "Incinerator 70%"
```

Control Technology Selection Costing Module (continued)

```
        OnM = rst![Incin70_O&M ($)]
        Mirr = rst![Incin70_MRR ($)]
        CR = rst![Incin70_ACR ($)]
                                    'RC = rst![Incin70_RC ($)]
    End Select

    rst.Edit

'If there is no reduction (and no costs) 0 is imported back to the table for costing
    If Reduction = 0 Then
      rst!TAC = 0
      rst!TCC = 0
      rst![Electricity (kWh/yr)] = 0
      rst![Steam (lb/yr)] = 0
      rst![Nat Gas (mmscf/yr)] = 0
      rst![Control Technology] = "None"
      rst![O&M ($)] = 0
      rst![MRR ($)] = 0
      rst![ACR ($)] = 0
      rst![RC ($)] = 0
'otherwise, the actual values for the best technology are exported back to the table
    Else
      rst!TAC = AC
      rst!TCC = CC
      rst![Electricity (kWh/yr)] = Electricity
      rst![Steam (lb/yr)] = Steam
      rst![Nat Gas (mmscf/yr)] = NatGas
      rst![Control Technology] = CtrlTech
      rst![O&M ($)] = OnM
      rst![MRR ($)] = Mirr
      rst![ACR ($)] = CR
      rst![RC ($)] = RC
    End If

    rst.Update

    rst.MoveNext
Loop

End Sub
```

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: July 31, 2000

Subject: MACT Floor, Regulatory Alternatives, and Nationwide Impacts for Storage Tanks at Miscellaneous Organic Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: David Randall
Jennifer Fields

To: MON Project File

I. Introduction

This memorandum describes our review and analysis of previously developed existing and new source MACT floors and regulatory alternatives for storage tanks at miscellaneous organic chemical manufacturing facilities.[1] This memorandum also presents estimated emissions and cost impacts of the MACT floor and a regulatory alternative for existing sources.

II. Review of MACT Floor and Regulatory Alternatives

A. Existing Sources

Our review of the MACT floor analyses began with the Access database created from information obtained in: (1) responses to the information collection requests that were sent to facilities with batch processes and (2) permit information from facilities with continuous processes in seven states. We took the following steps to purge extraneous information from the database:

- Deleted all records containing inorganic compounds.
- Replaced reported scrubber control efficiencies with 0 percent because the fate of the HAP removed from the emission stream is unknown.
- Excluded all pressurized tanks.
- Excluded all tanks with a capacity <10,000 gal because information was not requested for such tanks.
- Excluded tanks storing ethyl chloride and ethylene oxide because these compounds are gaseous at ambient temperatures and are likely to be in pressurized tanks.
- Excluded tanks for which no HAP partial pressure was reported (9 tanks).

- Excluded seven tanks from one facility with an unreasonable number of turnovers (i.e., more than 10 per day).
- Excluded tanks storing o-toluidiene at one facility because the reported partial pressure was several orders of magnitude higher than the vapor pressure at ambient temperature.
- Excluded tanks with reported HAP partial pressures below a de minimis of 0.05 psia (155 tanks with about 1 percent of the total uncontrolled emissions).
- Unlike the previous analysis, tanks storing maleic anhydride and phthalic anhydride were not excluded.

The temperature at which the reported partial pressures were determined is unknown. However, for those tanks that appear to be storing a single HAP, many of the reported partial pressures appear to be equal to the vapor pressure at about 77EF. For some tanks, it appears that partial pressures were determined at higher temperatures. Many, but not all, of these tanks were identified as constant temperature tanks. In other cases, the partial pressures were lower than the vapor pressure at 77EF, which may mean the tank stores a mixture of condensable materials, some of which were not identified because they are not HAP.

The final database contained 1,195 storage tanks at 132 facilities. The MACT floor performance level is unchanged from the previous analysis (i.e., an IFR, EFR, or control device achieving an emission reduction of 95 percent or more) because more than 12 percent of the storage tanks (205 tanks) are controlled using these devices. As in the previous analysis, tanks storing material with the lowest HAP partial pressures were considered to be the most stringently controlled, and a partial pressure threshold was developed for each facility. The top 12 percent of the 132 facilities corresponds to 16 facilities. The average threshold for the top 16 facilities is 1.0 psia (rounded up from (0.9 psia). Thus, the MACT floor for existing sources is unchanged from the previous analysis.[1] Attachment 1 presents the thresholds for each facility.

One regulatory alternative was developed for existing sources. The control level is the same as the 95 percent level for the MACT floor because this is the maximum reasonable control for storage tanks. The size cutoff is 10,000 gal, as for the MACT floor, because storage tanks rarely are smaller than this size. A HAP partial pressure cutoff of 0.5 psia was selected for the regulatory alternative; this value is the midpoint between zero and the 1.0 psia cutoff for the MACT floor.

Table 1 summarizes the MACT floor and regulatory alternative for storage tanks at existing sources.

TABLE 1. MACT FLOOR AND REGULATORY ALTERNATIVES FOR EXISTING AND NEW SOURCES

Regulatory alternative	Control requirement	Applicability cutoffs	
		Tank size, gal	Partial pressure, psia
Existing sources			
MACT floor	IFR, EFR, or 95% reduction	$10,000	$1.0
Regulatory alternative	IFR, EFR, or 95% reduction	$10,000	$0.5
New sources			
MACT floor	IFR, EFR, or 95% reduction	$10,000	$0.1

B. New Sources

The best performing source is the one that achieves the highest level of control for the smallest tanks storing material with the lowest HAP partial pressure. This combination is considered the best because small tanks tend to have lower emissions than large tanks, and tanks storing material with low partial pressures tend to have lower emissions than tanks storing materials with higher partial pressures.

Numerous facilities are controlling all of their tanks to 95 percent. As shown in Attachment 1, the Cyro Industries facility in Wallingford, Connecticut is one of the best performing facilities because it is controlling all of its tanks that store material with a HAP partial pressure greater than 0.09 psia. The tank storing the material with this HAP partial pressure has a capacity of 20,000 gal. The second and third facilities listed in Attachment 1 are not best performing sources because their smallest tanks controlled to 95 percent are larger than 20,000 gal. However, the fourth facility in Attachment 1 (the Morton International facility in Patterson, New Jersey) is the best performing facility for smaller storage tanks. This facility is achieving the same control level on its only storage tank, which has a capacity of 11,200 gal and stores material with essentially the same HAP partial pressure as the Cyro Industries facility (i.e., 0.11 psia). Thus, the new source MACT floor is 95 percent control of HAP emissions from storage tanks with a capacity greater than or equal to 10,000 gal that store material with a HAP partial pressure greater than or equal to 0.1 psia.

No regulatory alternative was developed for storage tanks at new sources. Higher control efficiencies would require the use of add-on control devices, and the incremental cost to use these devices would not be reasonable. A HAP partial pressure cutoff less than 0.1 psia would also be unreasonable.

Table 1 summarizes the new source MACT floor for storage tanks.

III. Emissions Impacts

We estimated annual standing and working losses for the storage tanks that are associated with batch processes using the AP-42 procedures.[2] We set parameter values in the calculations based on the following assumptions and procedures:

- Cylindrical volume with equal tank diameter and height.
- Default breather vent settings.
- Cone roof, tank painted white, and paint in good condition.
- Average liquid height equal 0.6 times the maximum liquid height.
- Shell height equal tank diameter plus one foot.
- Default daily maximum and minimum ambient temperatures were assumed to be 72EF and 60EF, respectively (i.e., representative national average values); these values were used in the equations to estimate the minimum and maximum surface temperatures.
- Daily solar insolation factor equal 1,300 Btu/ft^2/d.
- Vapor pressures at the minimum and maximum surface temperatures were calculated using Antoine's equation or another vapor pressure estimation equation, except for formaldehyde we used actual laboratory data for 37 weight percent formaldehyde in water solutions.[3,4]
- Vapor molecular weight equal to the HAP molecular weight (i.e., because we do not know the total composition of the stored material, we estimated emissions for each HAP as if were the only HAP in the tank, and all other stored material has a negligible vapor pressure).
- Typically, used the reported HAP partial pressures, even though in many cases the value was significantly higher than the estimated vapor pressure at the default average liquid surface temperatures for tanks that were not reported to be heated. One exception was that we replaced the reported partial pressures of 14.7 psia for several tanks at one facility with the estimated vapor pressures at ambient conditions. A second exception was for a tank storing both propionaldehyde and acetaldehyde. The reported partial pressures for this tank appear to have been the pure component vapor pressures. Because the component throughputs were also reported, we calculated the applicable partial pressures.
- Typically, the reported throughput was the same for each HAP associated with a particular tank. However, for some tanks, different throughputs were reported for each HAP. It is not clear if this is because the tank is used for different materials at different times during the year or because the facility elected to identify the component throughput instead of the total. We used the throughput associated with the individual HAPs, consistent with the decision to estimate emissions for each HAP as if it were the only condensable material in the tank.

- Standing losses were set equal to zero if the tank was reported to be maintained at constant temperature.
- Included tanks with reported HAP partial pressures <0.05 psia.

Emissions from storage tanks associated with continuous processes were included in the available permit materials. As noted in previous analyses, the facilities for which permit information was obtained were assumed to represent half of the nationwide number of continuous processes in the source category.[5] Thus, we estimated the nationwide emissions from storage tanks associated with continuous processes by doubling the estimated emissions from the tanks for which data were available.

Nationwide uncontrolled and baseline emissions were estimated to be 846 Mg/yr and 393 Mg/yr, respectively. Uncontrolled and baseline emissions for each tank storing material with HAP partial pressures above the cutoffs for the MACT floor and regulatory alternative are presented in Attachments 2 and 3. The sum of the emissions from the tanks listed in the attachments does not equal the nationwide total because the nationwide emissions include all tanks larger than 10,000 gal, not just those containing material with HAP partial pressures greater than the cutoffs.

IV. Cost Estimates

For tanks that are not already controlled to 95 percent, we estimated the cost impacts associated with both the MACT floor and the regulatory alternative. In both cases, we estimated impacts assuming the vertical tanks would be controlled by installing a floating roof, and that horizontal tanks would be controlled by venting emissions through a closed-vent system to a condenser that reduces the emissions by 95 percent by weight. The estimated costs are presented in Attachments 2 and 3.

The floating roof costs were estimated in July 1989 dollars using procedures described in the HON BID.[6] The total capital investment include costs to clean and degas the tank, install the floating roof, and, if necessary, remove an existing condenser that does not achieve the required control efficiency. The costs were then escalated to February 1999 dollars using the Chemical Engineering Plant Cost Indexes for February 1999 and July 1989.[7,8] Annual costs were estimated for capital recovery, operation and maintenance, administrative charges, property taxes, and insurance. In addition, a credit was estimated for recovered product. Capital recovery was estimated assuming an equipment life of 15 years and an interest rate of 7 percent. Annual maintenance and inspection costs were estimated to be equal to 6 percent of the TCI, and the other charges were estimated to be equal to 4 percent of the TCI. The product recovery credit was estimated assuming the market value of the recovered material is $0.10/lb. The Access module used to calculate the costs is presented in Attachment 4.

Condenser costs were estimated using procedures described in the OAQPS Control Cost Manual.[9] The condenser was sized based on the HAP with the highest partial pressure in the tank. Typically, the tanks contained only one HAP; for tanks with multiple HAP, the secondary HAP had very low partial pressures, well below the cutoffs for the MACT floor and regulatory alternative. The amount of time that the tank was being filled was estimated by dividing the annual throughput by an estimated average fill rate of 150 gal/min. The capital costs for a refrigeration unit, including instrumentation, installation, sales tax, and freight costs, were estimated in third quarter 1990 dollars. These costs were escalated to first quarter 1999 dollars using Vatavuk cost indexes.[10,11] The total capital investment consisted of these costs plus the costs for a temperature monitoring system (i.e., thermocouple and signal wire to connect to an existing data acquisition system for process vent monitors). Annual costs were estimated for labor, electricity, capital recovery, administrative charges, property tax, and insurance. Electricity costs during non-filling periods were estimated to be equal to 10 percent of the costs during filling events. Monitoring labor was estimated to be 0.5 hr/d for 365 d/yr. Capital recovery costs were estimated assuming an equipment life of 15 years and an interest rate of 7 percent. A product recovery credit was estimated as described above for the floating roofs. The Access module used to estimate the costs is presented in Attachment 5.

The nationwide costs and cost effectiveness of the controls to meet the MACT floor and the regulatory alternative are presented in Table 2.

TABLE 2. IMPACTS OF REGULATORY ALTERNATIVES FOR EXISTING SOURCES

Regulatory alternative	Total capital investment, $	Total annual cost, $/yr	Emission reduction, Mg/yr	Cost effectiveness, $/Mg	
				Relative to baseline	Incremental
MACT floor	6,000,000	2,030,000	262	7,700	N/A
Regulatory alternative	7,420,000	2,600,000	292	8,900	19,000

V. References

1. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. May 20, 1999. Existing Source MACT Floors for Batch and Continuous Manufacturing Processes Covered by the MON.

2. U. S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors. Volume I: Stationary Point and Area Sources. Fifth Edition. AP-42. January 1995. Chapter 7.

3. U.S. Environmental Protection Agency. Alternative Control Techniques Document–Control of Volatile Organic Compound Emissions from Batch Processes. EPA Publication No. EPA-453/R-94-020. February 1994. Appendix A.

4. Letter and attachments from M.L. Mullins, Chemical Manufacturers Association, to R. McDonald, EPA:ESD. February 28, 1994. Comments on draft CTG document for control of VOC emissions from batch processes, including laboratory data showing partial

pressure of formaldehyde in water solutions at different temperatures. Page 14 and appendix A.

5. Memorandum from C. Zukor, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. July 27, 1999. National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes.

6. U. S. Environmental Protection Agency. Hazardous Air Pollutant Emissions From Process Units in the Synthetic Organic Chemical Manufacturing Industry–Background Information for Proposed Standards. Research Triangle Park, North Carolina, Office of Air Quality Planning and Standards. EPA Publication No. EPA-453/D-92-016b. November 1992.

7. Economic Indicators. Chemical Engineering. Plant Cost Index for February 1999. June 1999. Page 170.

8. Economic Indicators. Chemical Engineering. Plant Cost Index for July 1989. October 1989. Page 230.

9. U. S. Environmental Protection Agency. OAQPS Control Cost Manual. Fourth Edition. EPA Publication No. EPA-450/3-90-006. Chapter 8. Refrigerated Condensers.

10. U. S. Environmental Protection Agency. Escalation Indexes for Air Pollution Control Costs. EPA Publication No. EPA-452/R-95-006. October 1995. Page 22.

11. Economic Indicators. Chemical Engineering. Vatavuk Air Pollution Control Cost Indexes for First Quarter 1999. Refrigeration Systems. January 2000. Page 138.

ATTACHMENT 1

MACT Floor Ranking of Facilities

MACT Floor Ranking of Facilities

Rank	Plant Name	City	State	Threshold	Total tanks	MACT tanks	Running Avg
1	Cyro Industries - Wallingford	Wallingford	CT	0.09	9	9	0.090
2	CCP-Chatham Facility	Chatham	VA	0.099	1	1	0.095
3	CCP-Marshall Facility	Marshall	TX	0.099	1	1	0.096
4	Morton International Inc. - Paterson Facility	Paterson	NJ	0.11	1	1	0.100
5	Dow Joliet Site	Channahon	IL	0.14	7	7	0.107
6	Exxon Chemical Americas - Baton Rouge Chemical Plant	Baton Rouge	LA	0.18	1	1	0.119
7	Ashland Chemical Company - Los Angeles - Composite Polymers	Los Angeles	CA	0.25	9	3	0.138
8	Ashland Chemical Company - Composite Polymers Div. - Philadelphia Plant	Philadelphia	PA	0.548	20	18	0.189
9	HERCULES FRANKLIN PLANT	Courtland	VA	0.66	4	4	0.241
10	Novartis Crop Protection, Inc. - St. Gabriel Plant Site	St. Gabriel	LA	1.02	2	2	0.319
11	Akzo Nobel Chemicals Inc.	Morris	IL	1.63	3	3	0.438
12	Ciba Specialty Corp. Newport Plant	Newport	DE	1.86	6	6	0.557
13	Troy Chemical Corporation	Newark	NJ	1.87	1	1	0.658
14	AIR PRODUCTS, INCORPORATED/HARRIS/HG0011L	LA PORTE	TX	1.93	5	5	0.749
15	AMOCO CHEMICAL COMPANY/BRAZORIA/BL0002S	ALVIN	TX	1.93	2	2	0.828
16	Monsanto	Gonzalez	FL	2.40	1	1	0.926
17	ARISTECH CHEMICAL CORPORATION/HARRIS/HG0825G	PASADENA	TX	2.93	2	2	1.044
18	CHEVRON CHEMICAL COMPANY/HARRIS/HG0310V	BAYTOWN	TX	2.93	4	1	1.149
19	EXXON CHEMICAL AMERICAS/CHAMBERS/CI0009P			2.93	2	2	1.243
20	FORMOSA PLASTICS CORP. OF TEXAS/CALHOUN/CB0038Q	POINT COMFORT	TX	2.93	5	5	1.327
21	HUNTSMAN CORPORATION/JEFFERSON/JE0135Q			2.93	5	1	1.403
22	BASF Corporation - PVP Plant	Geismar	LA	3.20	1	1	1.485
23	The Lubrizol Corporation - Bayport Plant	Pasadena	TX	3.39	15	12	1.568
24	Kodak Park - Synthetic Chemicals Division	Rochester	NY	NT	4		
25	Akzo Nobel Resins	E. St. Louis	IL	NT	1		
26	PPG Industries, Inc.	Oak Creek	WI	NT	19		
27	PPG - Circleville Resin Plant	Circleville	OH	NT	28		
28	PPG - Delaware Resin Plant	Delaware	OH	NT	5		
29	DUPONT FRONT ROYAL SITE	FRONT ROYAL	VA	NT	25		
30	Witco Corp. - Sistersville Plant	Friendly	WV	NT	7		
31	The NutraSweet Kelco Company	Augusta	GA	NT	3		
32	BFGoodrich Co.	Akron	OH	NT	2		
33	Du Pont - Fort Madison Plant	Fort Madison	IA	NT	15		
34	DynaChem, Inc.	Georgetown	IL	NT	1		
35	Flexsys Nitro Plant	Nitro	WV	NT	4		
36	E. I. Du Pont de Nemours & Co. Inc. - Washington Works	Parkersburg	WV	NT	5	2	
37	Exxon Chemical Americas - Bayway Chemical Plant	Linden	NJ	NT	5		
38	Ciba Specialty Chemicals Corp	McIntosh	AL	NT	51	36	
39	The Lubrizol Corporation	Painesville	OH	NT	15	2	
40	Albright & Wilson Americas Inc.	Charleston	SC	NT	2		
41	Arizona Chemical	Panama City	FL	NT	6		
42	Huntsman Petrochemical Corporation - Dayton Manufacturing Facility	Dayton	TX	NT	43		

MACT Floor Ranking of Facilities
(continued)

Rank	Plant Name	City	State	Threshold	Total tanks	MACT tanks	Running Avg
43	Akzo Nobel Resins	Louisville	KY	NT	2		
44	Albemarle Corporation - South Plant	Magnolia	AR	NT	8	4	
45	Hercules, Inc. - Hattiesburg, MS Plant	Hattiesburg	MS	NT	5		
46	Franklin International - Polymer Division	Columbus	OH	NT	5		
47	The Euclid Chemical Co.	Cleveland	OH	NT	1		
48	Para-Chem, Inc.- Simpsonville Plant	Simpsonville	SC	NT	3		
49	The Glidden Company	Huron	OH	NT	5		
50	Evans Chemetics	Waterloo	NY	NT	1		
51	THE GOODYEAR TIRE & RUBBER COMPANY	NIAGARA FALLS	NY	NT	4		
52	Tennessee Eastman Division	Kingsport	TN	NT	28		
53	BPCI - Sand Springs Manufacturing Plant	Sand Springs	OK	NT	17		
54	Geo Specialty Chemicals	Cedartown	GA	NT	3		
55	Elf Atochem North America, Inc. - Channelview Complex	Channelview	TX	NT	2		
56	Union Camp Corporation	Dover	OH	NT	8		
57	Cytec Industries	Wallingford	CT	NT	1		
58	CCP- Houston Facility	Houston	TX	NT	2	1	
59	CCP-North Kansas City Facility	North Kansas City	MO	NT	5		
60	CCP-Saukville Facility	Saukville	WI	NT	5		
61	HENKEL CORPORATION - LOS ANGELES OPERATIONS	LOS ANGELES	CA	NT	1		
62	Morton International Inc. - Ringwood Plant	Ringwood	IL	NT	5		
63	Arkansas Eastman Division	Batesville	AR	NT	11		
64	ISP Chemicals Inc.	Calvert City	KY	NT	10		
65	Henkel Corporation	Kankakee	IL	NT	6		
66	DIXIE CHEMICAL COMPANY	PASADENA	TX	NT	38	6	
67	Rohm and Haas Company - Bristol Site	Bristol	PA	NT	22		
68	E. I. DuPont de Nemours & Co., Inc. - Chamber Works	Deepwater	NJ	NT	3		
69	BASF Corporation - Freeport Works	Freeport	TX	NT	2		
70	Sigma Chemical Company - Second Street Plant	St. Louis	MO	NT	11		
71	Huls America, Inc.	Theodore	AL	NT	4	2	
72	Union Carbide Corporation - South Charleston Plant	South Charleston	WV	NT	39	1	
73	Zeneca Specialties, Inc. - Mt. Pleasant Site	Mt. Pleasant	TN	NT	4		
74	Sartomer Company, Inc.	West Chester	PA	NT	6		
75	Stepan Millsdale Plant	Elwood	IL	NT	15		
76	Schenectady International, Inc. - Texas Operations	Freeport	TX	NT	3		
77	Unitex Chemical Corporation	Greensboro	NC	NT	6		
78	3M Decatur	Decatur	AL	NT	4		
79	3M Company - Cottage Grove	Cottage Grove	MN	NT	9		
80	3M Company - Cordova	Cordova	IL	NT	13		
81	National Starch and Chemical Company - Meredosia	Meredosia	IL	NT	8	1	
82	Neville Chemical Company - Neville Island Facility	Pittsburgh	PA	NT	6		
83	3M SPRINGFIELD ITSD/TMD / SPRINGFIELD, MO	SPRINGFIELD	MO	NT	13	11	

MACT Floor Ranking of Facilities
(continued)

Rank	Plant Name	City	State	Threshold	Total tanks	MACT tanks	Running Avg
84	THE DOW CHEMICAL COMPANY/HARRIS/HG0769O	LA PORTE	TX	NT	1		
85	REXENE CORPORATION/ECTOR/EB0108J	ODESSA	TX	NT	1		
86	LYONDELL PETROCHEMICAL COMPANY/VICTORIA/VC0065E			NT	3		
87	GOODYEAR TIRE AND RUBBER CO THE/JEFFERSON/JE0039N	BEAUMONT	TX	NT	2		
88	EASTMAN CHEMICAL COMPANY/HARRISON/HH0042M			NT	12		
89	E.I. DU PONT DE NEMOURS AND COMPANY/VICTORIA/VC0008Q	VICTORIA	TX	NT	16	2	
90	ANGUS - STERLINGTON OPERATIONS	STERLINGTON	LA	NT	14		
91	BAYER CORPORATION/CHAMBERS/CI0016S	BAYTOWN	TX	NT	1		
92	Rohm & Haas Texas, Rohm & Haas Lone Star, RohMax	Deer Park	TX	NT	1		
93	Buffalo Color Company	Buffalo	NY	NT	3		
94	Uniroyal Chemical Co., Inc.	Naugatuck	CT	NT	4		
95	Witco Corporation	Mapleton	IL.	NT	1		
96	Hickson DanChem Corporation	Danville	VA	NT	3		
97	The C. P. Hall Company	Bedford Park	IL	NT	3		
98	Niacet Corporation	Niagara Falls	NY	NT	2		
99	E.I. DU PONT DE NEMOURS & COMPANY/HARRIS/HG0218K	PASADENA	TX	NT	18		
100	The Procter & Gamble Manufacturing Company	Sacramento	CA	NT	2		
101	Reilly Industries, Inc.	Indianapolis	IN	NT	80	3	
102	Abemarle Coporation	Orangeburg	SC	NT	13	1	
103	Kalama Chemical, Inc.	Kalama	WA	NT	1		
104	The Lubrizol Corporation - Deer Park Plant	Deer Park	TX	NT	2		
105	Zeeland Chemicals, Inc.	Zeeland	MI	NT	4		
106	DuPont Sabine River Works	Orange	TX	NT	11	8	
107	Blue Ash Polymer/Waterbase Plant	Blue Ash	OH	NT	2		
108	Salsbury Chemicals, Inc.	Charles City	IA	NT	1		
109	Chemol Co.,Inc.	Greensboro	NC	NT	3		
110	DuPont Mt. Clemens Plant	Mt. Clemens	MI	NT	10		
111	Great Lakes Chemical Corporation - South	El Dorado	AR	NT	4		
112	Amerchol-Edison	Edison	NJ	NT	1		
113	Henkel Corporation - Cincinnati Plant	Cincinnati	OH	NT	1		
114	Henkel Corporation - Charlotte, NC Plant	Charlotte	NC	NT	3		
115	Cincinnati Specialties,Inc.	Cincinnati	OH	NT	1		
116	Akzo Nobel Chemicals Inc., Gallipolis Ferry Plant	Gallipolis Ferry	WV	NT	5		
117	BFG Henry Plant	Henry	IL	NT	2		
118	Olin Corporation	Rochester	NY	NT	4		
119	Ashland Chemical Company - Calumet City, Specialty Products and Adhesives	Calumet City	IL	NT	3		
120	Ashland Chemical Company - Petrochem Div. - Neville Island Plant	Pittsburgh	PA	NT	26		
121	Ashland Chemical Company - Ashtabula Composite Polymers	Ashtabula	OH	NT	14		
122	Ashland Chemical Company - Composite Polymers Div. - Bartow Manufacturing Facility	Bartow	FL	NT	8		
123	Dow Corning Corporation - Midland Plant	Midland	MI	NT	3		
124	3V Inc.	Georgetown	SC	NT	22		

MACT Floor Ranking of Facilities
(continued)

Rank	Plant Name	City	State	Threshold	Total tanks	MACT tanks	Running Avg
125	Hercules Incorporated - Jefferson Plant	West Elizabeth	PA	NT	9		
126	Allco Chemical Corporation - Jayhawk Plant	Galena	KS	NT	2		
127	Hercules - Brunswick Plant	Brunswick	GA	NT	1		
128	Hilton Davis Co.	Cincinnati	OH	NT	5		
129	W.G. Krummrich Plant	Sauget	IL	NT	2		
130	Ashland Chemical Company - Jacksonville, AR - Composite Polymers	Jacksonville	AR	NT	9	7	
131	WESTVACO	DE RIDDER	LA	NT	9		
132	Ashland Chemical Company - Composite Polymers Div. - Colton Facility	Colton	CA	NT	17	15	

ATTACHMENT 2:

MACT Floor Impacts for

- Vertical tanks associated with batch processes
- Vertical tanks associated with continuous processes
- Horizontal tanks associated with batch processes

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	4	T02	38,000	1.70	1,752	Scrubber	0	1,752	1,664	$13,414	$2,648	$3,182
2	4	T03	38,000	1.40	990	Scrubber	0	990	941	$13,414	$2,720	$5,783
3	4	T01	38,000	1.10	4,141	Scrubber	0	4,141	3,934	$13,414	$2,421	$1,231
4	6	6	15,000	1.08	1,641		0	1,641	1,559	$9,627	$1,864	$2,392
5	6	7	15,000	1.08	1,641		0	1,641	1,559	$9,627	$1,864	$2,392
6	10	Tank 18	38,000	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
7	10	Tank 29	14,000	1.11	551		0	551	523	$9,587	$1,959	$7,491
8	10	Tank 27	38,000	2.02	2,811	Scrubber	0	2,811	2,670	$13,414	$2,547	$1,908
9	10	Tank 26	38,000	2.02	1,694	Scrubber	0	1,694	1,609	$13,414	$2,653	$3,298
10	10	Tank 25	38,000	2.02	1,694	Scrubber	0	1,694	1,609	$13,414	$2,653	$3,298
11	10	Tank 24	38,000	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
12	10	Tank 19	38,000	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
13	10	Tank 32	12,000	2.49	1,109		0	1,109	1,053	$8,947	$1,772	$3,365
14	10	Tank 15	14,000	1.29	705		0	705	669	$9,587	$1,944	$5,808
15	10	Tank 13	14,000	1.06	616		0	616	585	$9,587	$1,953	$6,677
16	10	Tank 11	14,000	1.29	262		0	262	248	$9,587	$1,986	$15,988
17	10	Tank 09	23,000	1.29	1,146		0	1,146	1,089	$11,019	$2,203	$4,046
18	10	Tank 01	21,000	1.29	504		0	504	479	$10,953	$2,250	$9,401
19	10	Tank 20	14,000	2.02	1,082		0	1,082	1,028	$9,587	$1,908	$3,711
20	11	TK-0370	24,322	9.50	199		0	199	189	$11,061	$2,302	$24,296
21	11	TK-0930	12,770	1.30	151		0	151	143	$8,981	$1,870	$26,091
22	11	TK-0430	12,886	1.50	419		0	419	398	$8,986	$1,845	$9,264
23	11	TK-0380	24,322	1.00	44		0	44	42	$11,061	$2,316	$110,682
24	11	TK-0014	24,332	2.50	611		0	611	580	$11,061	$2,263	$7,800
25	11	TK-0010	24,583	1.59	1,755		0	1,755	1,667	$11,069	$2,156	$2,586
26	11	TK-0080	117,600	1.20	336		0	336	319	$19,001	$3,955	$24,770
27	11	TK-0011	24,332	2.50	92		0	92	87	$11,061	$2,312	$53,012
28	12	T-528	25,000	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
29	12	T-521	79,000	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
30	12	T-522	25,000	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
31	12	T-523	25,000	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
32	12	T-524	25,000	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
33	12	T-525	25,000	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
34	12	T-527	25,000	1.70	1,999	Scrubber	0	1,999	1,899	$11,391	$2,200	$2,317
35	12	T-529	25,000	1.70	736	Scrubber	0	736	699	$11,391	$2,320	$6,633
36	12	T-530	79,000	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
37	12	T-552	65,000	1.70	3,007	Scrubber	0	3,007	2,856	$15,667	$3,001	$2,101
38	12	T-507	12,000	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844
39	12	T-526	25,000	1.70	736	Scrubber	0	736	699	$11,391	$2,320	$6,633
40	12	T-382	100,000	3.15	10,350	Flare	99	104	0	$0	$0	$0
41	12	T-352	11,000	3.15	1,898	Flare	99	19	0	$0	$0	$0
42	12	T-353	30,000	3.15	3,737	Flare	99	37	0	$0	$0	$0
43	12	T-508	12,000	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
44	12	T-358	14,500	3.15	3,326	Flare	99	33	0	$0	$0	$0
45	12	T-501	37,000	1.70	472	Scrubber	0	472	449	$13,389	$2,764	$12,318
46	12	T-502	37,000	1.70	2,704	Scrubber	0	2,704	2,569	$13,389	$2,552	$1,987
47	12	T-503	37,000	1.70	2,704	Scrubber	0	2,704	2,569	$13,389	$2,552	$1,987
48	12	T-504	37,000	1.70	1,832	Scrubber	0	1,832	1,740	$13,389	$2,635	$3,029
49	12	T-505	37,000	1.70	1,832	Scrubber	0	1,832	1,740	$13,389	$2,635	$3,029
50	12	T-506	12,000	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844
51	12	T-520	79,000	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
52	12	T-354	30,000	3.15	3,737	Flare	99	37	0	$0	$0	$0
53	15	S-125	16,075	1.00	1,513		0	1,513	1,438	$9,669	$1,885	$2,622
54	15	S-126	19,000	7.70	2,263		0	2,263	2,150	$10,330	$1,952	$1,816
55	15	S-127	19,000	7.70	2,263		0	2,263	2,150	$10,330	$1,952	$1,816
56	15	S-303	20,000	7.70	18,745		0	18,745	17,808	$10,365	$394	$44
57	15	S-63	14,838	2.00	2,291		0	2,291	2,176	$9,620	$1,801	$1,655
58	25	206	12,000	1.87	1,024	Condenser	95	51	0	$0	$0	$0
59	27	methanol	15,000	1.95	598		0	598	568	$9,627	$1,963	$6,909
60	29	T-14	24,000	1.10	252		0	252	239	$11,051	$2,294	$19,184
61	29	T-19	45,800	1.88	429		0	429	408	$13,846	$2,864	$14,051
62	29	T-3	23,192	2.30	708		0	708	672	$11,025	$2,246	$6,682
63	29	T-4	23,192	1.88	429		0	429	408	$11,025	$2,272	$11,147
64	29	T-5	23,192	1.40	411		0	411	391	$11,025	$2,274	$11,646
65	29	T-8	45,800	1.88	429		0	429	408	$13,846	$2,864	$14,051
66	29	T-9	45,800	1.88	429		0	429	408	$13,846	$2,864	$14,051
67	29	T-13	24,000	1.10	252		0	252	239	$11,051	$2,294	$19,184
68	31	210/3025	10,000	1.80	804		0	804	764	$8,856	$1,782	$4,665
69	31	340/3011	12,700	1.50	1,154		0	1,154	1,096	$8,978	$1,774	$3,237
70	31	333/3001	42,800	1.92	1,863		0	1,863	1,770	$13,222	$2,597	$2,934
71	31	313/3004	307,000	1.92	10,995		0	10,995	10,445	$26,103	$4,432	$849
72	31	242/3001	12,700	1.50	989		0	989	940	$8,978	$1,790	$3,810
73	31	242/3002	12,700	1.50	989		0	989	940	$8,978	$1,790	$3,810
74	33	209	10,000	1.90	329		0	329	313	$8,856	$1,827	$11,690
75	33	646	20,000	1.30	44		0	44	41	$10,365	$2,170	$104,695
76	33	682	20,000	1.90	196		0	196	186	$10,365	$2,156	$23,197
77	34	3202F	15,000	1.02	1,512	Condenser	100	8	0	$0	$0	$0
78	36	RM14	30,500	2.40	5,143		0	5,143	4,885	$11,797	$1,987	$813
79	36	RTK34	15,000	1.93	320		0	320	304	$9,627	$1,989	$13,073
80	38	102	15,000	2.40	3,865		0	3,865	3,672	$9,627	$1,653	$900
81	41	115	12,400	1.40	290	Thermal	93	21	6	$9,274	$1,945	$609,402
82	41	149	10,600	2.20	2,295		0	2,295	2,180	$8,884	$1,646	$1,510
83	41	199	15,300	2.20	3,035		0	3,035	2,883	$9,639	$1,734	$1,203
84	41	CR-164	15,950	2.20	4,103		0	4,103	3,898	$9,664	$1,638	$840
85	41	CR-166	15,950	2.20	4,040		0	4,040	3,838	$9,664	$1,644	$857

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
86	42	160	13,000	1.22	656		0	656	623	$9,545	$1,940	$6,228
87	42	180	10,600	1.80	341		0	341	324	$8,884	$1,831	$11,289
88	43	5102	10,000	1.35	1,912		0	1,912	1,817	$8,856	$1,676	$1,845
89	43	5103	10,000	1.53	1,379		0	1,379	1,310	$8,856	$1,727	$2,637
90	43	5101	10,000	1.35	1,912		0	1,912	1,817	$8,856	$1,676	$1,845
91	43	1360	20,000	1.58	580		0	580	551	$10,365	$2,119	$7,688
92	43	1210	20,000	1.17	725		0	725	689	$10,365	$2,106	$6,112
93	43	1200	20,000	3.23	1,108		0	1,108	1,052	$10,365	$2,069	$3,932
94	43	1130	30,000	3.23	2,555		0	2,555	2,427	$11,783	$2,229	$1,837
95	43	1060	20,000	2.73	1,524		0	1,524	1,447	$10,365	$2,030	$2,805
96	43	1030	30,000	3.52	3,823		0	3,823	3,632	$11,783	$2,109	$1,161
97	43	1020	30,000	3.23	2,555		0	2,555	2,427	$11,783	$2,229	$1,837
98	43	1010	30,000	2.73	2,545		0	2,545	2,418	$11,783	$2,230	$1,844
99	43	1150	20,000	1.08	400		0	400	380	$10,365	$2,137	$11,260
100	44	1982-05	13,000	1.86	362	Thermal	99	4	0	$0	$0	$0
101	44	1982-06	15,000	1.86	990	Thermal	99	10	0	$0	$0	$0
102	44	1984-25	15,000	1.86	1,544	Thermal	99	15	0	$0	$0	$0
103	44	1987-35	13,000	1.86	567	Thermal	99	6	0	$0	$0	$0
104	44	1988-15	15,000	1.86	382	Thermal	99	4	0	$0	$0	$0
105	45	T-1534	30,000	1.28	656	Scrubber	0	656	623	$12,093	$2,475	$7,941
106	45	T-596	20,000	1.54	728		0	728	692	$10,365	$2,105	$6,083
107	45	T-1141	20,000	1.54	1,039		0	1,039	987	$10,365	$2,076	$4,207
108	45	T-833	12,000	4.84	1,805	Scrubber	0	1,805	1,714	$9,257	$1,771	$2,066
109	48	VS 2704	30,000	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
110	48	VS 703	30,000	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
111	48	VS 704	30,000	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
112	52	T-2431	25,400	1.00	2,564		0	2,564	2,436	$11,649	$2,200	$1,806
113	52	T-2457	16,632	3.25	3,721		0	3,721	3,535	$10,244	$1,796	$1,016
114	53	11-211	11,000	2.50	509		0	509	483	$8,903	$1,819	$7,529
115	53	11-235	11,000	2.38	349		0	349	331	$8,903	$1,835	$11,082
116	53	16-237	16,000	1.97	93		0	93	88	$9,666	$2,019	$45,814
117	56	91-1339	25,000	2.40	338		0	338	321	$11,082	$2,293	$14,266
118	57	ALA07	13,382	1.95	307		0	307	291	$9,561	$1,977	$13,572
119	57	ALA05/4E	14,015	1.20	2,407		0	2,407	2,287	$9,587	$1,783	$1,559
120	57	ALA01B	10,872	1.20	398	Carbon	99	4	0	$0	$0	$0
121	57	ALA01A	10,872	1.20	398	Carbon	99	4	0	$0	$0	$0
122	60	Tank 61	19,000	2.00	1,225		0	1,225	1,164	$10,330	$2,051	$3,525
123	60	Tank 64	19,000	3.00	1,603		0	1,603	1,523	$10,330	$2,015	$2,647
124	60	Tank 73	19,000	2.00	723		0	723	686	$10,330	$2,099	$6,116
125	63	V-4	15,000	1.05	3,148	Condenser	90	315	157	$9,936	$2,069	$26,287
126	63	V-54	15,000	2.85	3,546		0	3,546	3,369	$9,627	$1,683	$999
127	63	V-53	15,000	2.85	4,448		0	4,448	4,225	$9,627	$1,597	$756

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
128	63	V-52	15,000	13.63	4,649		0	4,649	4,416	$9,627	$1,578	$715
129	63	V-51	15,000	2.46	1,123		0	1,123	1,067	$9,627	$1,913	$3,586
130	63	V-50	15,000	13.63	2,935		0	2,935	2,788	$9,627	$1,741	$1,249
131	63	V-5	15,000	1.55	595		0	595	565	$9,627	$1,963	$6,947
132	63	V-48	15,000	3.01	3,555		0	3,555	3,378	$9,627	$1,682	$996
133	63	V-45	10,000	6.79	6,160	Combination	100	6	0	$0	$0	$0
134	63	V-35	15,000	2.83	401	Flare	98	8	0	$0	$0	$0
135	63	V-13	15,000	1.37	1,376	Flare	98	28	0	$0	$0	$0
136	63	V-32	15,000	2.61	2,023	Flare	98	40	0	$0	$0	$0
137	63	V-29	15,000	2.87	2,217	Flare	98	44	0	$0	$0	$0
138	63	V-28	13,500	1.48	2,424	Flare	98	48	0	$0	$0	$0
139	63	V-27	15,000	2.89	3,303	Flare	98	66	0	$0	$0	$0
140	63	V-26	15,000	2.89	3,303	Flare	98	66	0	$0	$0	$0
141	63	V-22	15,000	1.40	74	Flare	98	1	0	$0	$0	$0
142	63	V-18	25,000	1.86	1,963	Flare	98	39	0	$0	$0	$0
143	63	V-16	12,000	1.78	1,983	Flare	98	40	0	$0	$0	$0
144	63	V-15	12,000	1.86	1,270	Flare	98	25	0	$0	$0	$0
145	63	V-33	15,000	6.40	437		0	437	415	$9,627	$1,978	$9,526
146	63	V-47	15,000	3.01	1,557		0	1,557	1,479	$9,627	$1,872	$2,531
147	64	T027	49,073	1.86	693		0	693	658	$13,920	$2,855	$8,677
148	65	VT-1	25,300	3.66	2,416		0	2,416	2,295	$11,645	$2,214	$1,929
149	65	VT-201	25,300	3.66	2,416		0	2,416	2,295	$11,645	$2,214	$1,929
150	67	ST-900A	29,900	2.25	674	Scrubber	0	674	640	$12,090	$2,472	$7,720
151	67	ST-900B	19,570	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
152	67	ST-918	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
153	67	ST-919	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
154	67	ST-920	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
155	67	ST-921	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
156	67	ST-924	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
157	67	ST-981	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
158	67	ST-967	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
159	67	ST-968	16,875	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
160	67	ST-970	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
161	67	ST-971	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
162	67	ST-972	16,875	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
163	67	ST-973	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
164	67	ST-964	16,875	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
165	67	ST-975	16,875	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
166	67	ST-987	19,570	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
167	67	ST-982	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
168	67	ST-983	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
169	67	ST-984	21,000	2.25	545	Scrubber	0	545	518	$11,263	$2,311	$8,926

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
170	67	ST-985	21,000	2.25	545	Scrubber	0	545	518	$11,263	$2,311	$8,926
171	67	ST-986	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
172	67	ST-990	13,500	2.25	431	Scrubber	0	431	409	$9,876	$2,031	$9,928
173	67	ST-923	24,670	2.25	599	Scrubber	0	599	569	$11,381	$2,331	$8,193
174	67	ST-974	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
175	67	ST-929	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
176	67	ST-994	10,600	2.25	385	Scrubber	0	385	365	$9,194	$1,892	$10,359
177	67	ST-925	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
178	67	ST-922	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
179	67	ST-926	16,608	2.25	479	Scrubber	0	479	455	$10,553	$2,168	$9,532
180	67	ST-960	15,277	2.25	458	Scrubber	0	458	435	$9,947	$2,043	$9,384
181	67	ST-928	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
182	67	ST-934	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
183	67	ST-935	11,290	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
184	67	ST-950	19,570	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
185	67	ST-927	12,080	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
186	67	ST-951	19,570	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
187	67	ST-940	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
188	67	ST-949	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
189	67	ST-948	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
190	67	ST-947	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
191	67	ST-945	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
192	67	ST-941	16,800	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
193	68	ST6	16,000	1.80	291		0	291	277	$9,666	$2,000	$14,461
194	68	ST7	12,000	1.90	177		0	177	168	$8,947	$1,860	$22,148
195	68	ST1	500,000	1.70	42,893	IFR	95	2,145	0	$0	$0	$0
196	71	1	35,251	2.40	1,451	EFR	95	73	0	$0	$0	$0
197	73	N110	10,000	2.01	495		0	495	471	$8,856	$1,811	$7,696
198	73	T326	20,000	1.06	1,139	Scrubber	0	1,139	1,082	$10,674	$2,131	$3,939
199	74	Y-210	15,300	2.45	426		0	426	404	$9,639	$1,982	$9,803
200	75	D501	15,000	1.90	517		0	517	491	$9,627	$1,971	$8,029
201	78	SN-711	18,650	10.10	11,673		0	11,673	11,089	$10,318	$1,056	$190
202	82	AT-3	10,000	1.91	253		0	253	240	$8,856	$1,834	$15,276
203	82	AT-4	10,000	1.91	175		0	175	166	$8,856	$1,841	$22,154
204	82	AT-6	14,000	1.91	216		0	216	206	$9,587	$1,991	$19,361
205	83	597	10,500	1.90	635	Condenser	90	64	32	$9,189	$1,925	$121,220
206	83	606	25,000	1.90	1,719	Condenser	90	172	86	$11,391	$2,381	$55,408
207	86	T-18	16,500	1.93	593		0	593	563	$10,239	$2,092	$7,428
208	87	2T116 (# 781)	10,000	1.39	122		0	122	116	$8,856	$1,846	$31,888
209	87	4T013 (# 690)	10,000	1.93	194		0	194	185	$8,856	$1,839	$19,927
210	89	T-1121	10,053	2.40	290		0	290	275	$8,858	$1,831	$13,297
211	90	A-177	25,000	3.39	1,058	Incinerator	99	11	0	$0	$0	$0

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
212	90	C-133	49,000	2.27	5,942	Absorber	0	5,942	5,645	$14,228	$2,420	$857
213	90	B-172	10,100	2.03	704	Incinerator	99	7	0	$0	$0	$0
214	90	A-165	49,000	2.03	1,128	Incinerator	99	11	0	$0	$0	$0
215	90	C-132	49,000	2.27	5,942	Absorber	0	5,942	5,645	$14,228	$2,420	$857
216	91	T01	12,000	1.80	664		0	664	631	$8,947	$1,814	$5,750
217	92	304	15,150	1.51	337		0	337	321	$9,633	$1,989	$12,410
218	92	779	10,152	1.09	255		0	255	242	$8,863	$1,835	$15,153
219	92	778	10,152	1.09	248		0	248	235	$8,863	$1,836	$15,597
220	92	777	10,112	1.09	279		0	279	265	$8,861	$1,833	$13,847
221	92	727	10,038	1.09	166		0	166	158	$8,857	$1,842	$23,310
222	92	720	10,081	1.10	213		0	213	202	$8,860	$1,839	$18,205
223	92	701	10,362	1.09	230		0	230	218	$8,873	$1,840	$16,856
224	92	622	29,762	1.05	313		0	313	297	$11,777	$2,441	$16,417
225	92	620	29,762	1.11	375		0	375	357	$11,777	$2,435	$13,659
226	92	260	39,317	8.06	8,992		0	8,992	8,542	$13,137	$1,902	$445
227	92	254	19,725	1.35	913	IFR	95	46	0	$0	$0	$0
228	92	253	19,725	1.61	461		0	461	438	$10,355	$2,129	$9,715
229	92	252	19,725	1.61	423		0	423	402	$10,355	$2,132	$10,612
230	92	241	19,731	1.35	380		0	380	361	$10,356	$2,137	$11,854
231	92	216	19,691	1.35	599		0	599	569	$10,354	$2,115	$7,428
232	92	212	19,677	1.35	764		0	764	726	$10,354	$2,100	$5,784
233	92	211	19,677	1.35	516		0	516	491	$10,354	$2,123	$8,654
234	92	111	131,750	1.13	1,996		0	1,996	1,896	$19,755	$3,955	$4,172
235	92	792	14,867	1.09	258		0	258	245	$9,622	$1,994	$16,294
236	92	261	39,317	5.78	5,291		0	5,291	5,026	$13,137	$2,254	$897
237	93	TK-592	20,000	3.20	1,189	Flare	98	24	0	$0	$0	$0
238	105	2770595	13,000	5.11	5,336		0	5,336	5,069	$9,545	$1,496	$590
239	106	T-08	19,080	3.54	2,338		0	2,338	2,221	$10,333	$1,946	$1,752
240	106	T-753	19,080	4.04	715		0	715	679	$10,333	$2,100	$6,185
241	107	T-443	10,030	8.50	1,982	Scrubber	0	1,982	1,883	$9,167	$1,735	$1,843
242	109	V129B	11,000	1.90	351		0	351	333	$8,903	$1,834	$11,013
243	110	V-334	12,500	1.87	206		0	206	196	$8,969	$1,862	$18,988
244	110	V-372	12,500	1.87	206		0	206	196	$8,969	$1,862	$18,988
245	110	V-374	12,500	1.87	206		0	206	196	$8,969	$1,862	$18,988
246	110	V-376	12,500	1.87	206		0	206	196	$8,969	$1,862	$18,988
247	112	03TK305B	14,700	1.96	290		0	290	276	$9,615	$1,990	$14,429
248	112	04TK433	23,700	2.34	1,281		0	1,281	1,217	$11,041	$2,195	$3,606
249	112	03V381	16,000	1.12	319	Condenser		319	303	$9,975	$2,063	$13,630
250	112	02TK101	16,500	2.34	978		0	978	929	$10,239	$2,055	$4,424
251	112	03V310	18,000	2.16	229	Condenser		229	218	$10,604	$2,203	$20,231
252	112	03V309	16,000	1.21	139	Condenser		139	132	$9,975	$2,080	$31,605
253	112	03TK310	16,000	1.12	319	Condenser		319	303	$9,975	$2,063	$13,630

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
254	112	02TK254	18,700	1.96	355		0	355	338	$10,320	$2,131	$12,626
255	112	02TK150	15,000	1.68	435		0	435	413	$9,627	$1,978	$9,568
256	112	02TK104	19,200	2.11	2,723		0	2,723	2,587	$10,337	$1,910	$1,477
257	112	02TK102	19,400	2.29	1,381		0	1,381	1,312	$10,344	$2,039	$3,108
258	112	02TK103	48,000	1.96	904		0	904	858	$13,896	$2,830	$6,593
259	112	02TK255	18,700	2.16	245		0	245	233	$10,320	$2,142	$18,398
260	119	T-128	11,900	1.87	246		0	246	234	$8,943	$1,853	$15,871
261	119	T-114	12,700	2.35	880		0	880	836	$8,978	$1,800	$4,308
262	124	Tank 15	15,000	1.38	249		0	249	237	$9,627	$1,996	$16,857
263	124	Tank 30 CS2	15,000	6.27	8,366		0	8,366	7,947	$9,627	$1,225	$308
264	125	101	14,000	1.95	255	Condenser	71	74	61	$9,896	$2,070	$67,706
265	133	PT0019	12,900	7.11	1,914	Afterburner	99	19	0	$0	$0	$0
266	133	PT0020	291,000	1.63	3,443	Afterburner	99	34	0	$0	$0	$0
267	133	PT0083	12,900	4.65	1,314	Afterburner	99	13	0	$0	$0	$0
268	134	TF-42	50,000	4.60	3,194		0	3,194	3,034	$13,940	$2,621	$1,728
269	134	TF-49	50,000	3.23	1,676		0	1,676	1,592	$13,940	$2,765	$3,474
270	134	TF-32	50,000	2.26	3,053		0	3,053	2,901	$13,940	$2,635	$1,817
271	135	TF-13A	20,000	2.90	394		0	394	374	$10,365	$2,137	$11,414
272	135	TF-2	50,000	2.07	1,701		0	1,701	1,616	$13,940	$2,763	$3,419
273	136	101-A-03	50,000	3.53	1,116		0	1,116	1,060	$13,940	$2,819	$5,318
274	137	C-10	15,350	1.35	486		0	486	462	$9,641	$1,976	$8,558
275	137	C-11	15,350	1.36	489		0	489	465	$9,641	$1,976	$8,507
276	137	C-12	15,350	1.78	627		0	627	596	$9,641	$1,963	$6,587
277	141	CRU-#068	25,000	1.76	3,358		0	3,358	3,190	$11,082	$2,006	$1,258
278	141	CRU-#072	14,500	1.72	2,926		0	2,926	2,780	$9,607	$1,738	$1,250
279	147	3080	10,000	1.80	2,974	Boiler	99	30	0	$0	$0	$0
280	147	T-6240	17,000	2.30	35	Scrubber	0	35	33	$10,567	$2,214	$133,813
281	147	T-6250	17,000	2.30	35	Scrubber	0	35	33	$10,567	$2,214	$133,813
282	149	S404	20,000	2.35	1,210		0	1,210	1,149	$10,365	$2,060	$3,585
283	149	S405	20,000	1.66	435		0	435	414	$10,365	$2,133	$10,314
284	150	V-56	12,000	2.18	344	N2 Blkt		344	327	$9,257	$1,909	$11,683
285	150	V-57	12,000	2.18	286	N2 Blkt		286	272	$9,257	$1,915	$14,098
286	150	V-53	12,000	2.18	189	N2 Blkt		189	179	$9,257	$1,924	$21,468
287	153	TS-11 (Meth.Rec.)	30,250	3.87	4,321		0	4,321	4,105	$11,790	$2,063	$1,005
288	153	TS-11(Textile)	25,000	4.60	5,377		0	5,377	5,108	$11,082	$1,814	$710
289	153	TS-15 (Meth. Rec.)	30,250	3.87	4,321		0	4,321	4,105	$11,790	$2,063	$1,005
290	156	DT-09B	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
291	156	DT-23	11,655	1.77	104		0	104	99	$8,932	$1,864	$37,637
292	156	DT-02B	10,879	1.77	469		0	469	445	$8,897	$1,822	$8,184
293	156	DT-11	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743

Vertical Tanks =>10,000 gal. with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
294	156	DT-30A	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
295	156	DT-09C	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
296	156	DT-08C	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
297	156	DT-06	10,613	1.77	525		0	525	498	$8,885	$1,814	$7,280
298	156	DT-02A	10,879	1.77	562		0	562	534	$8,897	$1,813	$6,789
299	156	DT-08A	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
300	156	DT-09A	10,879	1.77	359		0	359	341	$8,897	$1,832	$10,743
301	158	441-031	12,000	1.11	231		0	231	219	$8,947	$1,855	$16,928
302	158	445-008	12,000	1.11	231		0	231	219	$8,947	$1,855	$16,928
303	158	441-281	15,200	6.00	1,976		0	1,976	1,878	$9,635	$1,834	$1,953
304	158	441-027	12,000	6.00	1,296		0	1,296	1,231	$8,947	$1,754	$2,850
305	158	441-015	20,700	1.11	198		0	198	188	$10,943	$2,277	$24,189
306	158	422-199	13,500	1.03	101	Insulated but		101	96	$9,876	$2,062	$42,790
307	158	441-452	30,500	1.11	243		0	243	231	$11,797	$2,452	$21,248
308	161	T-1	16,000	6.38	2,104	Condenser	22	1,641	1,536	$9,975	$1,939	$2,524
309	162	141-T-6 (5004)	17,625	1.76	985		0	985	936	$10,281	$2,063	$4,408
310	163	68C	12,000	8.60	2,431		0	2,431	2,310	$8,947	$1,646	$1,425
311	163	83C	15,000	5.03	1,554		0	1,554	1,476	$9,627	$1,872	$2,536
312	167	Tank 714	10,147	6.99	2,895	Condenser	86	414	269	$9,172	$1,897	$14,091
313	167	Tank 521	15,066	2.94	881	None	0	881	837	$9,939	$2,002	$4,786
				Total	483,720			362,829	341,268	$2,918,341	$578,142	$3,338

Horizontal Tanks with HAP Partial Pressure => 1.0 psia and Condenser Cost (MACT Floor)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	28	TLI-5	26,000	9.55	23,330	Carbon adsorber	81	4,433	3,266	$50,917	$44,238	$27,088
2	28	TLI-4	12,500	9.55	11,964	Carbon adsorber	81	2,273	1,675	$50,917	$44,366	$52,978
3	20	S-6402	10,000	8.90	3,361	Scrubber	0	3,361	3,193	$32,459	$41,345	$25,901
4	167	Tank 1141	63,676	3.40	3,974	Thermal oxidizer	99	40	0	$0	$0	$0
5	167	Tank 1142	192,528	3.40	8,233	Thermal oxidizer	99	82	0	$0	$0	$0
6	167	Tank 1143	63,676	3.40	3,974	Thermal oxidizer	99	40	0	$0	$0	$0
7	167	Tank 364	54,457	2.94	3,812	Thermal oxidizer	99	38	0	$0	$0	$0
8	167	Tank 376	52,209	2.94	1,806	Thermal oxidizer	99	18	0	$0	$0	$0
9	167	Tank 1215	10,153	2.94	2,062	Thermal oxidizer	99	21	0	$0	$0	$0
10	167	Tank 377	42,336	2.94	1,701	Thermal oxidizer	99	17	0	$0	$0	$0
11	134	23-6	30,000	2.79	812		0	812	771	$30,701	$40,872	$105,977
12	161	T-16	10,750	2.78	974		0	974	926	$25,509	$40,067	$86,562
13	166	TP930 HT13	12,000	2.10	335	None	0	335	318	$31,764	$41,025	$258,132
14	166	TP930 HT-1	12,000	2.10	335	None	0	335	318	$31,764	$41,025	$258,132
15	166	TP930 HT-6	12,000	2.10	335	None	0	335	318	$31,764	$41,025	$258,132
16	137	U-8	15,000	1.95	471		0	471	447	$32,029	$41,044	$183,525
17	137	U-9	15,000	1.95	541		0	541	514	$32,029	$41,038	$159,817
18	10	Tank 05	13,000	1.93	1,037	Scrubber	0	1,037	985	$27,125	$40,189	$81,614
19	44	1340-01	11,550	1.86	167	Thermal oxidizer	99	2	0	$0	$0	$0
20	156	G-65-1	29,151	1.77	359		0	359	341	$32,376	$41,095	$240,974
21	84	T014	30,000	1.70	5,031		0	5,031	4,779	$25,037	$39,514	$16,537
22	84	T013	30,000	1.70	5,031		0	5,031	4,779	$25,037	$39,514	$16,537
23	130	T-325A	10,000	1.70	1,437		0	1,437	1,365	$24,640	$39,821	$58,329
24	141	PO-#129	15,000	1.63	749		0	749	712	$30,100	$40,701	$114,351
25	28	TS-146	12,500	1.62	243		0	243	231	$32,091	$41,047	$355,436
26	167	Tank 1219	40,218	1.61	2,537	Thermal oxidizer	99	25	0	$0	$0	$0
27	167	Tank 1119	40,218	1.61	2,537	Thermal oxidizer	99	25	0	$0	$0	$0
28	70	TA-951	45,000	1.60	1,197	Carbon adsorber	95	60	0	$0	$0	$0
29	40	TF_ST104	10,000	1.49	483		0	483	459	$30,483	$40,773	$177,807
30	87	4T003 (# 672)	10,000	1.37	263		0	263	250	$30,851	$40,840	$326,358
31	57	ALA05	240,385	1.20	5,835		0	5,835	5,543	$14,185	$37,725	$13,611
32	2	T035	25,000	1.16	2,409		0	2,409	2,288	$29,726	$40,463	$35,367
33	2	T038	25,000	1.16	2,409		0	2,409	2,288	$29,726	$40,463	$35,367
34	2	T037	25,000	1.16	2,409		0	2,409	2,288	$29,726	$40,463	$35,367
35	2	T036	25,000	1.16	2,409		0	2,409	2,288	$29,726	$40,463	$35,367
36	34	3104F	10,000	1.02	603	Condenser	99	6	0	$0	$0	$0
			Total		105,161			44,344	40,342	$740,682	$979,116	$48,541

Continuous Vertical Tanks with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	M126	METHANOL TANK 41/MEOH	50,000	1.93	1,340	NONE	0	1,340	1,273	$13,940	$2,797	$4,394
2	M126	METHANOL TANK 41/MEOH	50,000	1.93	1,560	NONE	0	1,560	1,482	$13,940	$2,776	$3,746
3	M126	CRUDE DIBASIC ESTER	18,000	1.93	3,880	VAPOR RECOVERY	0	3,880	3,686	$10,604	$1,856	$1,007
4	M146	D-123 CHILLED WATER	32,000	1.93	0	NONE	0	0	0	$12,393	$2,600	$13,684,211
5	M257	FRESH METHANOL	59,000	1.93	4,640	IFR	95	232	0	$0	$0	$0
6	M257	MOTHER LIQUOR	220,000	1.93	12,000	IFR	95	600	0	$0	$0	$0
7	M257	MOTHER LIQUOR	220,000	1.93	12,000	IFR	95	600	0	$0	$0	$0
8	M257	RECOVERED METHANOL	220,000	1.93	9,560	IFR	95	478	0	$0	$0	$0
9	M257	SEAL FLUSH METHANOL	59,000	1.93	5,200	IFR	95	260	0	$0	$0	$0
10	M258	DRY METHANOL STORAGE	150,000	1.93	11,600	IFR	95	580	0	$0	$0	$0
11	M258	SPENT HEXANE STORAGE	500,000	2.93	27,200	IFR	95	1,360	0	$0	$0	$0
12	M262	HEXANE STORAGE TANKS D.	130,900	2.93	156,000	FLARE & CONDENSER	100	468	0	$0	$0	$0
13	M262	HEXANE STORAGE TANKS D.	40,500	2.93	9,067	FLARE & CONDENSER	100	27	0	$0	$0	$0
14	M270	TANK STORAGE/TK-401/29	10,000	2.93	2,440	NONE	0	2,440	2,318	$8,856	$1,626	$1,403
15	M270	TANK STORAGE/TK-902/03	12,000	2.93	723	NONE	0	723	687	$8,947	$1,808	$5,265
16	M270	HEXANE STORAGE	80,000	2.93	8,400	IFR	95	420	0	$0	$0	$0
17	M279	POLYMER TANK	57,000	1.93	2,782	VAPOR-CONDENSERS	89	306	18	$14,953	$3,120	$339,869
18	M279	WASHWATER	37,000	1.93	89	NONE	0	89	85	$13,079	$2,736	$64,719
19	M279	VINYL ACETATE (B	95,000	3.54	358	VAPOR-CONDENSERS	83	61	7	$17,857	$3,742	$1,025,768
20	M279	VINYL ACETATE (A	95,000	3.54	200	VAPOR-CONDENSERS	83	34	4	$17,857	$3,744	$1,835,294
21	M279	VINYL ACETATE "B" DAY	158,000	1.61	4,745	NONE	0	4,745	4,508	$20,653	$3,882	$1,722
22	M279	VINYL ACETATE "A" DAY	158,000	1.61	5,765	NONE	0	5,765	5,477	$20,653	$3,785	$1,382
23	M279	VINYL "C"	375,000	1.61	8,684	NONE	0	8,684	8,249	$27,800	$5,007	$1,214
24	M279	VINYL "C" DAY	158,000	1.61	944	NONE	0	944	897	$20,653	$4,243	$9,461
25	M279	VINYL "B"	375,000	1.61	6,919	NONE	0	6,919	6,573	$27,800	$5,175	$1,575
26	M279	POLYMER TANK	57,000	1.93	7,276	VAPOR-CONDENSERS	89	800	48	$14,953	$3,094	$128,852
27	M279	MILLION GAL VAM.	1,000,000	1.61	17,270	VAPOR-CONDENSERS	82	3,074	393	$40,364	$8,247	$41,919
28	M279	METHYL ACETATE	84,000	1.93	9	VAPOR-CONDENSERS	77	2	0	$17,121	$3,592	$17,844,014
29	M279	METHANOL STORAGE	210,000	1.93	883	NONE	0	883	839	$22,924	$4,726	$11,265
30	M279	INHIBITOR STORAGE	18,000	1.93	433	NONE	0	433	412	$10,295	$2,119	$10,293
31	M279	CENTRATE AND WASH	375,000	1.93	175	NONE	0	175	167	$27,800	$5,816	$69,807
32	M279	"B" PLANT CONVERTIBLE	110,000	1.93	2,386	VAPOR-CONDENSERS	79	492	77	$18,644	$3,874	$101,031
33	M279	VINYL "A"	375,000	1.61	8,784	NONE	0	8,784	8,345	$27,800	$4,998	$1,198
34	M279	SODIUM METHYLATE	11,000	1.93	0	NONE	0	0	0	$8,903	$1,868	$3,269,217,

Continuous Vertical Tanks with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
35	M280	B CRUDE RECEIVER	38,000	1.93	22	NONE	0	22	21	$13,105	$2,747	$267,739
36	M280	NO. 4 TWKA RECEIVER	50,000	1.93	15	NONE	0	15	14	$13,940	$2,923	$404,848
37	M280	NO. 3 TWKA STORAGE TANK	500,000	1.93	2	NONE	0	2	2	$30,975	$6,498	$8,550,000
38	M280	NO. 3 TWKA RECEIVER	50,000	1.93	15	NONE	0	15	14	$13,940	$2,923	$404,848
39	M280	NO. 2 RECYCLE VA	50,000	1.61	18,716	IFR	95	936	0	$0	$0	$0
40	M280	HMI STORAGE	19,000	1.93	5	NONE	0	5	5	$10,330	$2,167	$912,421
41	M280	F CRUDE DCH STORAGE	160,000	1.93	22	NONE	0	22	21	$20,678	$4,336	$407,519
42	M280	E REWORK	160,000	1.93	4	NONE	0	4	4	$20,678	$4,338	$2,403,324
43	M280	CRUDE KA TANK - OP	104,000	1.93	18	NONE	0	18	17	$18,244	$3,826	$457,656
44	M280	BIG A CRUDE	552,000	1.93	84	NONE	0	84	80	$31,893	$6,683	$167,096
45	M280	A CRUDE RECEIVER	38,000	1.93	3	NONE	0	3	3	$13,105	$2,749	$1,702,167
46	M280	WASTE COLLECTION	11,000	1.93	0	NONE	0	0	0	$8,903	$1,868	$19,663,158
47	M280	BIG B CRUDE	552,000	1.93	8	NONE	0	8	8	$31,893	$6,690	$1,676,692
48	M280	RECYCLE AQUA COLUMN	12,000	1.93	0	NONE	0	0	0	$8,947	$1,877	$19,757,895
49	M280	WASTE ORGANIC STORAGE	18,000	1.93	215	NONE	0	215	204	$10,295	$2,139	$20,964
50	M280	VINYL ACETATE	100,000	1.61	18,716	IFR	95	936	0	$0	$0	$0
51	M281	STORAGE	12,000	2.24	60		0	60	57	$9,257	$1,936	$67,930
52	M281	STORAGE	17,000	13.29	60		0	60	57	$10,567	$2,211	$77,579
53	M281	STORAGE TANK 43	33,000	13.29	420		0	420	399	$12,730	$2,631	$13,188
54	M281	STORAGE TANK	215,000	13.29	2,300		0	2,300	2,185	$23,288	$4,667	$4,272
55	M281	REJECT	50,000	1.93	10		0	10	10	$14,250	$2,989	$629,263
56	M281	MOLTEN STORAGE	93,280	2.93	562		0	562	534	$17,829	$3,687	$13,812
57	M281	MIX TANK/ EP008T34/008T34	14,000	1.93	38		0	38	36	$9,896	$2,073	$114,848
58	M281	FLUX OIL TANK	67,600	3.16	1,528		0	1,528	1,451	$15,717	$3,152	$4,343
59	M281	CRUDE NPG	40,000	1.93	460		0	460	437	$13,464	$2,781	$12,728
60	M281	MOLTEN STORAGE	93,280	2.93	562	VAPOR RECOVERY	0	562	534	$17,829	$3,687	$13,812
61	M281	TANK	25,600	13.29	240		0	240	228	$11,964	$2,487	$21,816
62	M283	HEXANE STORAGE TANK	53,000	2.93	18,000	IFR	95	900	0	$0	$0	$0
63	M283	HEXANE STORAGE TANK	160,000	2.93	22,000	IFR	95	1,100	0	$0	$0	$0
64	M289	TANK T-503/ 5T6040/5T6040	85,140	2.93	320	IFR	95	16	0	$0	$0	$0
65	M289	TANK T-502/ 5T6020/5T6020	85,140	2.93	120	IFR	95	6	0	$0	$0	$0
66	M289	TANK T-501/ 5T6010/5T6010	85,140	2.93	320	IFR	95	16	0	$0	$0	$0
67	M289	TANK 2T-502/ 5T6030/5T6030	85,140	2.93	320	IFR	95	16	0	$0	$0	$0
68	M289	TANK 2T-503/ 5T6050/5T6050	85,140	2.93	320	IFR	95	16	0	$0	$0	$0
69	M293	STORAGE	451,000	1.68	0	NONE	0	0	0	$30,061	$6,307	$33,194,737
70	M293	STORAGE	24,000	1.68	507	NONE	0	507	482	$11,051	$2,270	$9,422
71	M300	TANK	21,000	1.93	318	NONE	0	318	302	$10,953	$2,268	$15,015
72	M300	TANK	109,000	2.93	200	IFR	95	10	0	$0	$0	$0
73	M300	TANK	42,000	2.06	81	NONE	0	81	77	$13,203	$2,762	$71,787
74	M306	TANK/2A/2A	20,700	2.93	1,280	NONE	0	1,280	1,216	$10,943	$2,174	$3,576
75	M306	TANK/2B/2B	20,700	2.93	1,280	NONE	0	1,280	1,216	$10,943	$2,174	$3,576

Continuous Vertical Tanks with HAP Partial Pressure => 1.0 psia and IFR Control Cost (MACT Floor) (continued)

	Facil. #	Tank ID	Tank capacity	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
76	M330	POLY ETHYLENE PLANT	15,200	2.32	8,868	NONE	0	8,868	8,425	$9,635	$1,179	$280
77	M343	R-1372 SCRUBBER/TKR372	10,000	1.93	12	NONE	0	12	11	$8,856	$1,857	$325,789
78	M358	2-9,800 GALLON ROSIN	19,600	1.93	3,882	None	0	3,882	3,688	$10,351	$1,803	$978
79	M358	RESIN PRODUCT	30,000	1.93	3,882	None	0	3,882	3,688	$11,783	$2,103	$1,140
80	M358	3-150,000 GALLON POND	450,000	1.93	4,500	None	0	4,500	4,275	$30,053	$5,878	$2,750
81	M358	RXN. OIL, HEADS OR PITCH	20,000	1.93	4,500	None	0	4,500	4,275	$10,365	$1,747	$817
82	M358	2-16,900 GALLON RESIN	33,800	1.93	7,765	None	0	7,765	7,377	$12,442	$1,873	$508
83	M358	NEW ROSIN TANK, ST-25, PT	15,200	1.93	3,882	None	0	3,882	3,688	$9,635	$1,653	$896
84	M44	TANKS 360 AND	250,000	1.93	7,938	VAPOR-CONDENSERS	68	2,540	686	$24,761	$4,980	$14,523
85	M44	TANKS	25,000	1.68	5,040	SCRUBBER	0	50	48	$11,391	$1,911	$79,825
86	M44	TANKS	25,000	3.62	766	NONE	0	766	728	$11,082	$2,252	$6,189
87	M44	TANKS	25,000	1.68	1,450	NONE	0	1,450	1,378	$11,082	$2,187	$3,175
88	M44	TANKS	37,000	1.68	1,448	NONE	0	1,448	1,376	$13,079	$2,607	$3,790
89	M44	TANK	100,000	1.93	14,600	FLARE-WASTE	98	292	0	$0	$0	$0
90	M44	TANK	48,000	1.93	113	VAPOR-CONDENSERS	68	36	10	$14,205	$2,977	$612,551
91	M44	T-352,353,&354/ FB03T0354/EB	30,000	1.93	18	PROCESS CHANGE	0	18	17	$12,093	$2,535	$296,491
92	M44	T-352,353,&354/ FB03T0354/EB	30,000	1.93	130	NONE	0	130	124	$11,783	$2,460	$39,838
93	M44	1100 PROCESS	10,000	6.93	2,916	NONE	0	2,916	2,770	$8,856	$1,581	$1,141
94	M44	TANKS	20,000	2.06	218	NONE	0	218	207	$10,365	$2,154	$20,782
95	M44	1100 PROCESS	10,000	1.38	108	NONE	0	108	103	$8,856	$1,848	$36,023
				Total:	494,501			118,495	98,031	$1,170,333	$234,836	$4,791
				National Total:	989,001			236,990	196,062	$2,340,666	$469,672	

ATTACHMENT 3:

Regulatory Alternative Impacts for

- Vertical tanks associated with batch processes
- Vertical tanks associated with continuous processes
- Horizontal tanks associated with batch processes

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	4	T01	1.10	4,141	Scrubber	0	4,141	3,934	$13,414	$2,421	$1,231
2	4	T02	1.70	1,752	Scrubber	0	1,752	1,664	$13,414	$2,648	$3,182
3	4	T03	1.40	990	Scrubber	0	990	941	$13,414	$2,720	$5,783
4	6	6	1.08	1,641		0	1,641	1,559	$9,627	$1,864	$2,392
5	6	7	1.08	1,641		0	1,641	1,559	$9,627	$1,864	$2,392
6	10	Tank 01	1.29	504		0	504	479	$10,953	$2,250	$9,401
7	10	Tank 07	0.52	1,331		0	1,331	1,264	$11,019	$2,185	$3,456
8	10	Tank 09	1.29	1,146		0	1,146	1,089	$11,019	$2,203	$4,046
9	10	Tank 11	1.29	262		0	262	248	$9,587	$1,986	$15,988
10	10	Tank 13	1.06	616		0	616	585	$9,587	$1,953	$6,677
11	10	Tank 15	1.29	705		0	705	669	$9,587	$1,944	$5,808
12	10	Tank 16	0.54	433		0	433	412	$9,587	$1,970	$9,571
13	10	Tank 18	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
14	10	Tank 19	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
15	10	Tank 20	2.02	1,082		0	1,082	1,028	$9,587	$1,908	$3,711
16	10	Tank 21	0.76	615		0	615	584	$11,019	$2,253	$7,714
17	10	Tank 23	0.76	628		0	628	597	$11,019	$2,252	$7,544
18	10	Tank 24	2.02	1,837	Scrubber	0	1,837	1,745	$13,414	$2,640	$3,025
19	10	Tank 25	2.02	1,694	Scrubber	0	1,694	1,609	$13,414	$2,653	$3,298
20	10	Tank 26	2.02	1,694	Scrubber	0	1,694	1,609	$13,414	$2,653	$3,298
21	10	Tank 27	2.02	2,811	Scrubber	0	2,811	2,670	$13,414	$2,547	$1,908
22	10	Tank 28	0.91	344		0	344	327	$9,587	$1,979	$12,110
23	10	Tank 29	1.11	551		0	551	523	$9,587	$1,959	$7,491
24	10	Tank 30	0.60	998		0	998	948	$9,587	$1,916	$4,041
25	10	Tank 32	2.49	1,109		0	1,109	1,053	$8,947	$1,772	$3,365
26	11	TK-0010	1.59	1,755		0	1,755	1,667	$11,069	$2,156	$2,586
27	11	TK-0011	2.50	92		0	92	87	$11,061	$2,312	$53,012
28	11	TK-0014	2.50	611		0	611	580	$11,061	$2,263	$7,800
29	11	TK-0020	0.70	25		0	25	24	$11,069	$2,320	$192,751
30	11	TK-0080	1.20	336		0	336	319	$19,001	$3,955	$24,770
31	11	TK-0130	0.50	12		0	12	11	$8,947	$1,876	$336,535
32	11	TK-0370	9.50	199		0	199	189	$11,061	$2,302	$24,296
33	11	TK-0380	1.00	44		0	44	42	$11,061	$2,316	$110,682
34	11	TK-0430	1.50	419		0	419	398	$8,986	$1,845	$9,264
35	11	TK-0930	1.30	151		0	151	143	$8,981	$1,870	$26,091
36	12	T-352	3.15	1,898	Flare	99	19	0	$0	$0	$0
37	12	T-353	3.15	3,737	Flare	99	37	0	$0	$0	$0
38	12	T-354	3.15	3,737	Flare	99	37	0	$0	$0	$0
39	12	T-358	3.15	3,326	Flare	99	33	0	$0	$0	$0
40	12	T-382	3.15	10,350	Flare	99	104	0	$0	$0	$0
41	12	T-501	1.70	472	Scrubber	0	472	449	$13,389	$2,764	$12,318
42	12	T-502	1.70	2,704	Scrubber	0	2,704	2,569	$13,389	$2,552	$1,987
43	12	T-503	1.70	2,704	Scrubber	0	2,704	2,569	$13,389	$2,552	$1,987
44	12	T-504	1.70	1,832	Scrubber	0	1,832	1,740	$13,389	$2,635	$3,029

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
45	12	T-505	1.70	1,832	Scrubber	0	1,832	1,740	$13,389	$2,635	$3,029
46	12	T-506	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844
47	12	T-507	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844
48	12	T-508	1.70	240	Scrubber	0	240	228	$9,257	$1,919	$16,844
49	12	T-520	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
50	12	T-521	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
51	12	T-522	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
52	12	T-523	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
53	12	T-524	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
54	12	T-525	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
55	12	T-526	1.70	736	Scrubber	0	736	699	$11,391	$2,320	$6,633
56	12	T-527	1.70	1,999	Scrubber	0	1,999	1,899	$11,391	$2,200	$2,317
57	12	T-528	1.70	737	Scrubber	0	737	700	$11,391	$2,320	$6,627
58	12	T-529	1.70	736	Scrubber	0	736	699	$11,391	$2,320	$6,633
59	12	T-530	1.70	2,167	Scrubber	0	2,167	2,058	$16,479	$3,252	$3,160
60	12	T-552	1.70	3,007	Scrubber	0	3,007	2,856	$15,667	$3,001	$2,101
61	15	S-125	1.00	1,513		0	1,513	1,438	$9,669	$1,885	$2,622
62	15	S-126	7.70	2,263		0	2,263	2,150	$10,330	$1,952	$1,816
63	15	S-127	7.70	2,263		0	2,263	2,150	$10,330	$1,952	$1,816
64	15	S-303	7.70	18,745		0	18,745	17,808	$10,365	$394	$44
65	15	S-63	2.00	2,291		0	2,291	2,176	$9,620	$1,801	$1,655
66	22	70S0148	0.64	382		0	382	363	$8,856	$1,822	$10,036
67	24	S0124	0.64	243		0	243	231	$9,595	$1,990	$17,210
68	25	206	1.87	1,024	Condenser	95	51	0	$0	$0	$0
69	27	methanol	1.95	598		0	598	568	$9,627	$1,963	$6,909
70	29	T-13	1.10	252		0	252	239	$11,051	$2,294	$19,184
71	29	T-14	1.10	252		0	252	239	$11,051	$2,294	$19,184
72	29	T-19	1.88	429		0	429	408	$13,846	$2,864	$14,051
73	29	T-3	2.30	708		0	708	672	$11,025	$2,246	$6,682
74	29	T-4	1.88	429		0	429	408	$11,025	$2,272	$11,147
75	29	T-5	1.40	411		0	411	391	$11,025	$2,274	$11,646
76	29	T-8	1.88	429		0	429	408	$13,846	$2,864	$14,051
77	29	T-9	1.88	429		0	429	408	$13,846	$2,864	$14,051
78	31	210/3025	1.80	804		0	804	764	$8,856	$1,782	$4,665
79	31	242/3001	1.50	989		0	989	940	$8,978	$1,790	$3,810
80	31	242/3002	1.50	989		0	989	940	$8,978	$1,790	$3,810
81	31	313/3004	1.92	10,995		0	10,995	10,445	$26,103	$4,432	$849
82	31	333/3001	1.92	1,863		0	1,863	1,770	$13,222	$2,597	$2,934
83	31	340/3011	1.50	1,154		0	1,154	1,096	$8,978	$1,774	$3,237
84	32	71T6	0.56	1,607		0	1,607	1,527	$13,154	$2,607	$3,414
85	33	209	1.90	329		0	329	313	$8,856	$1,827	$11,690
86	33	508	0.66	71		0	71	67	$8,978	$1,877	$55,663

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
87	33	645	0.77	10		0	10	9	$10,368	$2,174	$458,335
88	33	646	1.30	44		0	44	41	$10,365	$2,170	$104,695
89	33	682	1.90	196		0	196	186	$10,365	$2,156	$23,197
90	33	953	0.85	201		0	201	191	$8,879	$1,844	$19,294
91	34	3202F	1.02	1,512	Condenser	100	8	0	$0	$0	$0
92	36	RM14	2.40	5,143		0	5,143	4,885	$11,797	$1,987	$813
93	36	RTK34	1.93	320		0	320	304	$9,627	$1,989	$13,073
94	38	102	2.40	3,865		0	3,865	3,672	$9,627	$1,653	$900
95	40	RP_ST199	0.77	288		0	288	273	$8,969	$1,854	$13,574
96	41	115	1.40	290	Thermal	93	21	6	$9,274	$1,945	$609,402
97	41	138	0.60	743	Thermal	93	54	16	$11,974	$2,510	$306,910
98	41	139	0.60	320	Thermal	93	23	7	$11,974	$2,511	$712,252
99	41	149	2.20	2,295		0	2,295	2,180	$8,884	$1,646	$1,510
100	41	199	2.20	3,035		0	3,035	2,883	$9,639	$1,734	$1,203
101	41	CR-164	2.20	4,103		0	4,103	3,898	$9,664	$1,638	$840
102	41	CR-166	2.20	4,040		0	4,040	3,838	$9,664	$1,644	$857
103	41	CR-186	0.73	45		0	45	43	$8,947	$1,873	$87,983
104	42	160	1.22	656		0	656	623	$9,545	$1,940	$6,228
105	42	180	1.80	341		0	341	324	$8,884	$1,831	$11,289
106	42	185	0.50	854		0	854	811	$11,009	$2,229	$5,497
107	43	1010	2.73	2,545		0	2,545	2,418	$11,783	$2,230	$1,844
108	43	1012	0.57	110		0	110	105	$8,856	$1,847	$35,207
109	43	1020	3.23	2,555		0	2,555	2,427	$11,783	$2,229	$1,837
110	43	1030	3.52	3,823		0	3,823	3,632	$11,783	$2,109	$1,161
111	43	1060	2.73	1,524		0	1,524	1,447	$10,365	$2,030	$2,805
112	43	1070	0.79	570		0	570	542	$10,365	$2,120	$7,830
113	43	1080	0.79	271		0	271	258	$10,365	$2,149	$16,684
114	43	1130	3.23	2,555		0	2,555	2,427	$11,783	$2,229	$1,837
115	43	1150	1.08	400		0	400	380	$10,365	$2,137	$11,260
116	43	1180	0.79	589		0	589	559	$10,365	$2,119	$7,580
117	43	1200	3.23	1,108		0	1,108	1,052	$10,365	$2,069	$3,932
118	43	1210	1.17	725		0	725	689	$10,365	$2,106	$6,112
119	43	1240	0.79	289		0	289	275	$10,365	$2,147	$15,634
120	43	1360	1.58	580		0	580	551	$10,365	$2,119	$7,688
121	43	1370	0.79	213		0	213	202	$10,365	$2,154	$21,325
122	43	3073	0.56	623		0	623	592	$11,783	$2,413	$8,152
123	43	5101	1.35	1,912		0	1,912	1,817	$8,856	$1,676	$1,845
124	43	5102	1.35	1,912		0	1,912	1,817	$8,856	$1,676	$1,845
125	43	5103	1.53	1,379		0	1,379	1,310	$8,856	$1,727	$2,637
126	44	1982-05	1.86	362	Thermal	99	4	0	$0	$0	$0
127	44	1982-06	1.86	990	Thermal	99	10	0	$0	$0	$0
128	44	1984-25	1.86	1,544	Thermal	99	15	0	$0	$0	$0

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
129	44	1987-35	1.86	567	Thermal	99	6	0	$0	$0	$0
130	44	1988-15	1.86	382	Thermal	99	4	0	$0	$0	$0
131	45	T-1141	1.54	1,039		0	1,039	987	$10,365	$2,076	$4,207
132	45	T-1534	1.28	656	Scrubber	0	656	623	$12,093	$2,475	$7,941
133	45	T-596	1.54	728		0	728	692	$10,365	$2,105	$6,083
134	45	T-833	4.84	1,805	Scrubber	0	1,805	1,714	$9,257	$1,771	$2,066
135	48	VS 2704	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
136	48	VS 703	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
137	48	VS 704	2.50	2,442		0	2,442	2,320	$11,783	$2,240	$1,931
138	52	T-1409	0.76	1,122	Condenser	99	11	0	$0	$0	$0
139	52	T-2421	0.58	281		0	281	267	$11,044	$2,290	$17,143
140	52	T-2431	1.00	2,564		0	2,564	2,436	$11,649	$2,200	$1,806
141	52	T-2457	3.25	3,721		0	3,721	3,535	$10,244	$1,796	$1,016
142	52	T-9962	0.65	94	Carbon	99	1	0	$0	$0	$0
143	52	T-9964	0.65	94	Carbon	99	1	0	$0	$0	$0
144	53	11-211	2.50	509		0	509	483	$8,903	$1,819	$7,529
145	53	11-213	0.54	19		0	19	18	$8,903	$1,866	$207,278
146	53	11-231	0.76	96		0	96	91	$8,903	$1,859	$40,881
147	53	11-233	0.57	133		0	133	126	$8,903	$1,855	$29,466
148	53	11-235	2.38	349		0	349	331	$8,903	$1,835	$11,082
149	53	11-241	0.57	45		0	45	43	$8,903	$1,863	$87,134
150	53	11-245	0.95	138		0	138	131	$8,903	$1,855	$28,295
151	53	16-217	0.55	22		0	22	21	$9,666	$2,026	$196,408
152	53	16-237	1.97	93		0	93	88	$9,666	$2,019	$45,814
153	56	48-515	0.51	127	Condenser	92	10	4	$9,936	$2,084	$1,094,242
154	56	91-1339	2.40	338		0	338	321	$11,082	$2,293	$14,266
155	57	ALA01A	1.20	398	Carbon	99	4	0	$0	$0	$0
156	57	ALA01B	1.20	398	Carbon	99	4	0	$0	$0	$0
157	57	ALA05/4E	1.20	2,407		0	2,407	2,287	$9,587	$1,783	$1,559
158	57	ALA07	1.95	307		0	307	291	$9,561	$1,977	$13,572
159	59	A-17	0.66	157	Carbon	95	8	0	$0	$0	$0
160	59	A86	0.66	157	Carbon	95	8	0	$0	$0	$0
161	59	A87	0.66	214	Carbon	95	11	0	$0	$0	$0
162	60	Tank 61	2.00	1,225		0	1,225	1,164	$10,330	$2,051	$3,525
163	60	Tank 64	3.00	1,603		0	1,603	1,523	$10,330	$2,015	$2,647
164	60	Tank 73	2.00	723		0	723	686	$10,330	$2,099	$6,116
165	63	V-1	0.50	128		0	128	122	$9,627	$2,008	$33,004
166	63	V-13	1.37	1,376	Flare	98	28	0	$0	$0	$0
167	63	V-15	1.86	1,270	Flare	98	25	0	$0	$0	$0
168	63	V-16	1.78	1,983	Flare	98	40	0	$0	$0	$0
169	63	V-18	1.86	1,963	Flare	98	39	0	$0	$0	$0
170	63	V-2	0.50	123		0	123	117	$9,627	$2,008	$34,321

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
171	63	V-22	1.40	74	Flare	98	1	0	$0	$0	$0
172	63	V-23	0.61	67	Flare	98	1	0	$0	$0	$0
173	63	V-26	2.89	3,303	Flare	98	66	0	$0	$0	$0
174	63	V-27	2.89	3,303	Flare	98	66	0	$0	$0	$0
175	63	V-28	1.48	2,424	Flare	98	48	0	$0	$0	$0
176	63	V-29	2.87	2,217	Flare	98	44	0	$0	$0	$0
177	63	V-32	2.61	2,023	Flare	98	40	0	$0	$0	$0
178	63	V-33	6.40	437		0	437	415	$9,627	$1,978	$9,526
179	63	V-34	0.74	2,072	Flare	98	41	0	$0	$0	$0
180	63	V-35	2.83	401	Flare	98	8	0	$0	$0	$0
181	63	V-39	0.74	2,072	Flare	98	41	0	$0	$0	$0
182	63	V-4	1.05	3,148	Condenser	90	315	157	$9,936	$2,069	$26,287
183	63	V-43	0.96	323	Combination	100	0	0	$0	$0	$0
184	63	V-44	0.79	515	Combination	100	1	0	$0	$0	$0
185	63	V-45	6.79	6,160	Combination	100	6	0	$0	$0	$0
186	63	V-47	3.01	1,557		0	1,557	1,479	$9,627	$1,872	$2,531
187	63	V-48	3.01	3,555		0	3,555	3,378	$9,627	$1,682	$996
188	63	V-5	1.55	595		0	595	565	$9,627	$1,963	$6,947
189	63	V-50	13.63	2,935		0	2,935	2,788	$9,627	$1,741	$1,249
190	63	V-51	2.46	1,123		0	1,123	1,067	$9,627	$1,913	$3,586
191	63	V-52	13.63	4,649		0	4,649	4,416	$9,627	$1,578	$715
192	63	V-53	2.85	4,448		0	4,448	4,225	$9,627	$1,597	$756
193	63	V-54	2.85	3,546		0	3,546	3,369	$9,627	$1,683	$999
194	64	T027	1.86	693		0	693	658	$13,920	$2,855	$8,677
195	64	T191	0.87	392		0	392	373	$11,078	$2,287	$12,270
196	65	VT-1	3.66	2,416		0	2,416	2,295	$11,645	$2,214	$1,929
197	65	VT-201	3.66	2,416		0	2,416	2,295	$11,645	$2,214	$1,929
198	67	ST-900A	2.25	674	Scrubber	0	674	640	$12,090	$2,472	$7,720
199	67	ST-900B	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
200	67	ST-918	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
201	67	ST-919	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
202	67	ST-920	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
203	67	ST-921	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
204	67	ST-922	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
205	67	ST-923	2.25	599	Scrubber	0	599	569	$11,381	$2,331	$8,193
206	67	ST-924	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
207	67	ST-925	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
208	67	ST-926	2.25	479	Scrubber	0	479	455	$10,553	$2,168	$9,532
209	67	ST-927	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
210	67	ST-928	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
211	67	ST-929	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
212	67	ST-934	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
213	67	ST-935	2.25	396	Scrubber	0	396	376	$9,225	$1,898	$10,100
214	67	ST-940	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
215	67	ST-941	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
216	67	ST-945	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
217	67	ST-947	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
218	67	ST-948	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
219	67	ST-949	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
220	67	ST-950	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
221	67	ST-951	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
222	67	ST-960	2.25	458	Scrubber	0	458	435	$9,947	$2,043	$9,384
223	67	ST-964	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
224	67	ST-967	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
225	67	ST-968	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
226	67	ST-970	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
227	67	ST-971	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
228	67	ST-972	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
229	67	ST-973	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
230	67	ST-974	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
231	67	ST-975	2.25	483	Scrubber	0	483	459	$10,563	$2,170	$9,460
232	67	ST-981	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
233	67	ST-982	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
234	67	ST-983	2.25	482	Scrubber	0	482	458	$10,560	$2,170	$9,482
235	67	ST-984	2.25	545	Scrubber	0	545	518	$11,263	$2,311	$8,926
236	67	ST-985	2.25	545	Scrubber	0	545	518	$11,263	$2,311	$8,926
237	67	ST-986	2.25	408	Scrubber	0	408	388	$9,260	$1,904	$9,819
238	67	ST-987	2.25	524	Scrubber	0	524	498	$10,660	$2,187	$8,792
239	67	ST-990	2.25	431	Scrubber	0	431	409	$9,876	$2,031	$9,928
240	67	ST-994	2.25	385	Scrubber	0	385	365	$9,194	$1,892	$10,359
241	68	ST1	1.70	42,893	IFR	95	2,145	0	$0	$0	$0
242	68	ST12	0.70	717		0	717	681	$8,947	$1,809	$5,309
243	68	ST2	0.60	631		0	631	600	$11,783	$2,412	$8,045
244	68	ST6	1.80	291		0	291	277	$9,666	$2,000	$14,461
245	68	ST7	1.90	177		0	177	168	$8,947	$1,860	$22,148
246	71	1	2.40	1,451	EFR	95	73	0	$0	$0	$0
247	73	N110	2.01	495		0	495	471	$8,856	$1,811	$7,696
248	73	T312	0.52	155		0	155	147	$8,856	$1,843	$25,027
249	73	T326	1.06	1,139	Scrubber	0	1,139	1,082	$10,674	$2,131	$3,939
250	74	Y-210	2.45	426		0	426	404	$9,639	$1,982	$9,803
251	75	D501	1.90	517		0	517	491	$9,627	$1,971	$8,029
252	78	SN-711	10.10	11,673		0	11,673	11,089	$10,318	$1,056	$190
253	80	RS-48	0.76	687		0	687	652	$8,856	$1,793	$5,496
254	82	AT-3	1.91	253		0	253	240	$8,856	$1,834	$15,276

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
255	82	AT-4	1.91	175		0	175	166	$8,856	$1,841	$22,154
256	82	AT-6	1.91	216		0	216	206	$9,587	$1,991	$19,361
257	83	597	1.90	635	Condenser	90	64	32	$9,189	$1,925	$121,220
258	83	606	1.90	1,719	Condenser	90	172	86	$11,391	$2,381	$55,408
259	86	T-18	1.93	593		0	593	563	$10,239	$2,092	$7,428
260	87	2T116 (# 781)	1.39	122		0	122	116	$8,856	$1,846	$31,888
261	87	4T013 (# 690)	1.93	194		0	194	185	$8,856	$1,839	$19,927
262	89	T-1121	2.40	290		0	290	275	$8,858	$1,831	$13,297
263	90	A-165	2.03	1,128	Incinerator	99	11	0	$0	$0	$0
264	90	A-177	3.39	1,058	Incinerator	99	11	0	$0	$0	$0
265	90	A-208	0.74	285	Incinerator	99	3	0	$0	$0	$0
266	90	A-217	0.86	551		0	551	523	$11,082	$2,273	$8,685
267	90	A-402	0.76	807	Flare	98	16	0	$0	$0	$0
268	90	B-172	2.03	704	Incinerator	99	7	0	$0	$0	$0
269	90	B-242	0.74	787	Incinerator	99	8	0	$0	$0	$0
270	90	B-257	0.74	1,103	Incinerator	99	11	0	$0	$0	$0
271	90	B-271	0.74	2,408	Incinerator	99	24	0	$0	$0	$0
272	90	B-404	0.74	821	Flare	98	16	0	$0	$0	$0
273	90	B-431	0.74	821	Flare	98	16	0	$0	$0	$0
274	90	C-132	2.27	5,942	Absorber	0	5,942	5,645	$14,228	$2,420	$857
275	90	C-133	2.27	5,942	Absorber	0	5,942	5,645	$14,228	$2,420	$857
276	90	C-216	0.74	1,858	Incinerator	99	19	0	$0	$0	$0
277	90	C-451	0.74	2,053	Flare	98	41	0	$0	$0	$0
278	91	T01	1.80	664		0	664	631	$8,947	$1,814	$5,750
279	91	T12	0.60	892		0	892	847	$9,627	$1,935	$4,567
280	91	T15	0.50	586	Scrubber	0	586	557	$12,093	$2,481	$8,910
281	91	T23	0.50	3,903		0	3,903	3,708	$24,451	$4,759	$2,567
282	92	11	0.68	193		0	193	184	$9,633	$2,003	$21,811
283	92	111	1.13	1,996		0	1,996	1,896	$19,755	$3,955	$4,172
284	92	12	0.68	186		0	186	177	$9,633	$2,003	$22,656
285	92	13	0.68	181		0	181	172	$9,632	$2,004	$23,306
286	92	14	0.68	172		0	172	164	$9,632	$2,004	$24,461
287	92	211	1.35	516		0	516	491	$10,354	$2,123	$8,654
288	92	212	1.35	764		0	764	726	$10,354	$2,100	$5,784
289	92	216	1.35	599		0	599	569	$10,354	$2,115	$7,428
290	92	236	0.68	376		0	376	357	$12,393	$2,564	$14,373
291	92	241	1.35	380		0	380	361	$10,356	$2,137	$11,854
292	92	252	1.61	423		0	423	402	$10,355	$2,132	$10,612
293	92	253	1.61	461		0	461	438	$10,355	$2,129	$9,715
294	92	254	1.35	913	IFR	95	46	0	$0	$0	$0
295	92	260	8.06	8,992		0	8,992	8,542	$13,137	$1,902	$445
296	92	261	5.78	5,291		0	5,291	5,026	$13,137	$2,254	$897

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
297	92	304	1.51	337		0	337	321	$9,633	$1,989	$12,410
298	92	331	0.87	367		0	367	349	$10,981	$2,269	$13,008
299	92	535	0.57	418		0	418	397	$8,932	$1,834	$9,231
300	92	536	0.57	453		0	453	431	$8,932	$1,831	$8,501
301	92	542	0.66	349		0	349	331	$8,932	$1,841	$11,121
302	92	546	0.66	510		0	510	485	$8,932	$1,825	$7,531
303	92	620	1.11	375		0	375	357	$11,777	$2,435	$13,659
304	92	622	1.05	313		0	313	297	$11,777	$2,441	$16,417
305	92	632	0.52	176		0	176	167	$11,776	$2,454	$29,311
306	92	701	1.09	230		0	230	218	$8,873	$1,840	$16,856
307	92	710	0.77	2,454		0	2,454	2,332	$24,536	$4,914	$4,215
308	92	719	0.58	109		0	109	103	$8,860	$1,848	$35,752
309	92	720	1.10	213		0	213	202	$8,860	$1,839	$18,205
310	92	721	0.86	179		0	179	170	$8,860	$1,842	$21,682
311	92	726	0.67	105		0	105	100	$8,857	$1,848	$36,957
312	92	727	1.09	166		0	166	158	$8,857	$1,842	$23,310
313	92	777	1.09	279		0	279	265	$8,861	$1,833	$13,847
314	92	778	1.09	248		0	248	235	$8,863	$1,836	$15,597
315	92	779	1.09	255		0	255	242	$8,863	$1,835	$15,153
316	92	792	1.09	258		0	258	245	$9,622	$1,994	$16,294
317	93	TK-592	3.20	1,189	Flare	98	24	0	$0	$0	$0
318	94	505#1	0.55	1,377		0	1,377	1,308	$13,940	$2,794	$4,272
319	94	505#3	0.55	633		0	633	602	$10,365	$2,114	$7,029
320	105	2770171	0.59	1,095		0	1,095	1,040	$9,545	$1,899	$3,651
321	105	2770595	5.11	5,336		0	5,336	5,069	$9,545	$1,496	$590
322	106	T-08	3.54	2,338		0	2,338	2,221	$10,333	$1,946	$1,752
323	106	T-753	4.04	715		0	715	679	$10,333	$2,100	$6,185
324	107	T-443	8.50	1,982	Scrubber	0	1,982	1,883	$9,167	$1,735	$1,843
325	109	V129B	1.90	351		0	351	333	$8,903	$1,834	$11,013
326	110	V-334	1.87	206		0	206	196	$8,969	$1,862	$18,988
327	110	V-372	1.87	206		0	206	196	$8,969	$1,862	$18,988
328	110	V-374	1.87	206		0	206	196	$8,969	$1,862	$18,988
329	110	V-376	1.87	206		0	206	196	$8,969	$1,862	$18,988
330	112	02TK101	2.34	978		0	978	929	$10,239	$2,055	$4,424
331	112	02TK102	2.29	1,381		0	1,381	1,312	$10,344	$2,039	$3,108
332	112	02TK103	1.96	904		0	904	858	$13,896	$2,830	$6,593
333	112	02TK104	2.11	2,723		0	2,723	2,587	$10,337	$1,910	$1,477
334	112	02TK150	1.68	435		0	435	413	$9,627	$1,978	$9,568
335	112	02TK254	1.96	355		0	355	338	$10,320	$2,131	$12,626
336	112	02TK255	2.16	245		0	245	233	$10,320	$2,142	$18,398
337	112	03TK305B	1.96	290		0	290	276	$9,615	$1,990	$14,429
338	112	03TK310	1.12	319	Condenser	319	303	$9,975	$2,063	$13,630	$0

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
339	112	03V309	1.21	139	Condenser	139	132	$9,975	$2,080	$31,605	$0
340	112	03V310	2.16	229	Condenser	229	218	$10,604	$2,203	$20,231	$0
341	112	03V369	0.76	126	Condenser	126	119	$9,975	$2,081	$34,837	$0
342	112	03V374	0.62	79	Condenser	79	75	$9,975	$2,085	$55,396	$0
343	112	03V381	1.12	319	Condenser	319	303	$9,975	$2,063	$13,630	$0
344	112	04TK433	2.34	1,281		0	1,281	1,217	$11,041	$2,195	$3,606
345	118	T-141	0.51	815		0	815	774	$9,623	$1,942	$5,019
346	118	T-224	0.55	271	Afterburner	95	14	0	$0	$0	$0
347	119	T-114	2.35	880		0	880	836	$8,978	$1,800	$4,308
348	119	T-128	1.87	246		0	246	234	$8,943	$1,853	$15,871
349	124	Tank 15	1.38	249		0	249	237	$9,627	$1,996	$16,857
350	124	Tank 30 CS2	6.27	8,366		0	8,366	7,947	$9,627	$1,225	$308
351	125	101	1.95	255	Condenser	71	74	61	$9,896	$2,070	$67,706
352	131	1155-01	0.66	3,294	IFR	95	165	0	$0	$0	$0
353	131	1250-01	0.90	2,865	IFR	95	143	0	$0	$0	$0
354	131	1250-02	0.66	3,294	IFR	95	165	0	$0	$0	$0
355	131	1650-01	0.66	8,548	IFR	95	427	0	$0	$0	$0
356	133	PT0019	7.11	1,914	Afterburner	99	19	0	$0	$0	$0
357	133	PT0020	1.63	3,443	Afterburner	99	34	0	$0	$0	$0
358	133	PT0083	4.65	1,314	Afterburner	99	13	0	$0	$0	$0
359	134	TF-32	2.26	3,053		0	3,053	2,901	$13,940	$2,635	$1,817
360	134	TF-33	0.74	1,432		0	1,432	1,360	$13,940	$2,789	$4,101
361	134	TF-42	4.60	3,194		0	3,194	3,034	$13,940	$2,621	$1,728
362	134	TF-49	3.23	1,676		0	1,676	1,592	$13,940	$2,765	$3,474
363	135	TF-13A	2.90	394		0	394	374	$10,365	$2,137	$11,414
364	135	TF-14	0.87	379		0	379	360	$10,365	$2,139	$11,872
365	135	TF-17	0.95	430		0	430	409	$10,365	$2,134	$10,447
366	135	TF-2	2.07	1,701		0	1,701	1,616	$13,940	$2,763	$3,419
367	135	TF-3B	0.53	460		0	460	437	$13,940	$2,881	$13,177
368	135	TF-6	0.66	1,016		0	1,016	965	$13,940	$2,828	$5,859
369	136	101-A-01	0.80	743		0	743	706	$13,940	$2,854	$8,084
370	136	101-A-03	3.53	1,116		0	1,116	1,060	$13,940	$2,819	$5,318
371	136	398-A-32	0.55	282		0	282	268	$10,365	$2,148	$16,054
372	136	398-A-34	0.65	190		0	190	180	$10,365	$2,157	$23,931
373	137	C-10	1.35	486		0	486	462	$9,641	$1,976	$8,558
374	137	C-11	1.36	489		0	489	465	$9,641	$1,976	$8,507
375	137	C-12	1.78	627		0	627	596	$9,641	$1,963	$6,587
376	137	C-9	0.75	282		0	282	268	$9,641	$1,996	$14,915
377	141	CRU-#068	1.76	3,358		0	3,358	3,190	$11,082	$2,006	$1,258
378	141	CRU-#072	1.72	2,926		0	2,926	2,780	$9,607	$1,738	$1,250
379	143	T1201	0.54	450		0	450	428	$9,643	$1,980	$9,255
380	143	T1202	0.54	450		0	450	428	$9,643	$1,980	$9,255

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
381	143	T1215	0.54	776		0	776	738	$9,667	$1,954	$5,298
382	143	T1216	0.54	811		0	811	771	$10,955	$2,221	$5,763
383	143	T203	0.54	1,231		0	1,231	1,170	$8,879	$1,746	$2,986
384	147	3056	0.60	177		0	177	168	$8,856	$1,841	$21,934
385	147	3080	1.80	2,974	Boiler	99	30	0	$0	$0	$0
386	147	T-6240	2.30	35	Scrubber	0	35	33	$10,567	$2,214	$133,813
387	147	T-6250	2.30	35	Scrubber	0	35	33	$10,567	$2,214	$133,813
388	149	S262	0.55	337	Thermal	99	3	0	$0	$0	$0
389	149	S404	2.35	1,210		0	1,210	1,149	$10,365	$2,060	$3,585
390	149	S405	1.66	435		0	435	414	$10,365	$2,133	$10,314
391	149	S410	0.55	187	Thermal	99	2	0	$0	$0	$0
392	150	V-53	2.18	189	N2 Blkt	189	179	$9,257	$1,924	$21,468	$0
393	150	V-56	2.18	344	N2 Blkt	344	327	$9,257	$1,909	$11,683	$0
394	150	V-57	2.18	286	N2 Blkt	286	272	$9,257	$1,915	$14,098	$0
395	150	V-61	0.51	88	N2 Blkt	88	83	$9,257	$1,934	$46,452	$0
396	150	V-63	0.54	137	N2 Blkt	137	130	$9,257	$1,929	$29,666	$0
397	150	V-64	0.55	84	N2 Blkt	84	80	$9,257	$1,934	$48,306	$0
398	150	V-69	0.66	63	N2 Blkt	63	60	$9,257	$1,936	$65,066	$0
399	153	TS-11	3.87	4,321		0	4,321	4,105	$11,790	$2,063	$1,005
400	153	TS-11(Textile)	4.60	5,377		0	5,377	5,108	$11,082	$1,814	$710
401	153	TS-15 (Meth.	3.87	4,321		0	4,321	4,105	$11,790	$2,063	$1,005
402	156	DT-02A	1.77	562		0	562	534	$8,897	$1,813	$6,789
403	156	DT-02B	1.77	469		0	469	445	$8,897	$1,822	$8,184
404	156	DT-06	1.77	525		0	525	498	$8,885	$1,814	$7,280
405	156	DT-08A	1.77	359		0	359	341	$8,897	$1,832	$10,743
406	156	DT-08C	1.77	359		0	359	341	$8,897	$1,832	$10,743
407	156	DT-09A	1.77	359		0	359	341	$8,897	$1,832	$10,743
408	156	DT-09B	1.77	359		0	359	341	$8,897	$1,832	$10,743
409	156	DT-09C	1.77	359		0	359	341	$8,897	$1,832	$10,743
410	156	DT-11	1.77	359		0	359	341	$8,897	$1,832	$10,743
411	156	DT-22	0.66	2,117		0	2,117	2,011	$8,897	$1,666	$1,657
412	156	DT-23	1.77	104		0	104	99	$8,932	$1,864	$37,637
413	156	DT-30A	1.77	359		0	359	341	$8,897	$1,832	$10,743
414	156	XT-04A	0.66	1,932		0	1,932	1,835	$11,089	$2,143	$2,335
415	157	TK 5731	0.57	298		0	298	283	$8,903	$1,839	$13,007
416	158	422-199	1.03	101	Insulated but	101	96	$9,876	$2,062	$42,790	$0
417	158	441-015	1.11	198		0	198	188	$10,943	$2,277	$24,189
418	158	441-025	0.74	245		0	245	233	$8,947	$1,854	$15,921
419	158	441-027	6.00	1,296		0	1,296	1,231	$8,947	$1,754	$2,850
420	158	441-028	0.74	75		0	75	71	$8,947	$1,870	$52,566
421	158	441-031	1.11	231		0	231	219	$8,947	$1,855	$16,928
422	158	441-281	6.00	1,976		0	1,976	1,878	$9,635	$1,834	$1,953

Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
423	158	441-421	0.72	186		0	186	177	$11,797	$2,457	$27,830
424	158	441-422	0.72	167		0	167	158	$11,797	$2,459	$31,066
425	158	441-452	1.11	243		0	243	231	$11,797	$2,452	$21,248
426	158	445-008	1.11	231		0	231	219	$8,947	$1,855	$16,928
427	161	T-1	6.38	2,104	Condenser	22	1,641	1,536	$9,975	$1,939	$2,524
428	162	141-T-6 (5004)	1.76	985		0	985	936	$10,281	$2,063	$4,408
429	163	29C	0.95	476		0	476	452	$8,947	$1,832	$8,107
430	163	68C	8.60	2,431		0	2,431	2,310	$8,947	$1,646	$1,425
431	163	83C	5.03	1,554		0	1,554	1,476	$9,627	$1,872	$2,536
432	167	Tank 521	2.94	881	None	0	881	837	$9,939	$2,002	$4,786
433	167	Tank 714	6.99	2,895	Condenser	86	414	269	$9,172	$1,897	$14,091
			Total	567,122				384,600	$3,891,330	$777,939	$4,045

Horizontal Tanks with HAP Partial Pressure =>0.5 psia and Condenser Cost (Above Floor)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	28	TLI-4	9.55	11,964	Carbon adsorber	81	2,273	1,675	$50,917	$44,861	$53,569
2	28	TLI-5	9.55	23,330	Carbon adsorber	81	4,433	3,266	$50,917	$45,290	$27,732
3	20	S-6402	8.90	3,361	Scrubber	0	3,361	3,193	$32,459	$41,477	$25,984
4	167	Tank 1141	3.40	3,974	Thermal oxidizer	99	40	0	$0	$0	$0
5	167	Tank 1142	3.40	8,233	Thermal oxidizer	99	82	0	$0	$0	$0
6	167	Tank 1143	3.40	3,974	Thermal oxidizer	99	40	0	$0	$0	$0
7	167	Tank 364	2.94	3,812	Thermal oxidizer	99	38	0	$0	$0	$0
8	167	Tank 376	2.94	1,806	Thermal oxidizer	99	18	0	$0	$0	$0
9	167	Tank 1215	2.94	2,062	Thermal oxidizer	99	21	0	$0	$0	$0
10	167	Tank 377	2.94	1,701	Thermal oxidizer	99	17	0	$0	$0	$0
11	134	23-6	2.79	812		0	812	771	$30,701	$40,965	$106,218
12	161	T-16	2.78	974		0	974	926	$25,509	$40,112	$86,659
13	166	TP930 HT13	2.10	335	None	0	335	318	$31,764	$41,069	$258,409
14	166	TP930 HT-6	2.10	335	None	0	335	318	$31,764	$41,069	$258,409
15	166	TP930 HT-1	2.10	335	None	0	335	318	$31,764	$41,069	$258,409
16	137	U-9	1.95	541		0	541	514	$32,029	$41,130	$160,175
17	137	U-8	1.95	471		0	471	447	$32,029	$41,117	$183,852
18	10	Tank 05	1.93	1,037	Scrubber	0	1,037	985	$27,125	$40,472	$82,188
19	44	1340-01	1.86	167	Thermal oxidizer	99	2	0	$0	$0	$0
20	156	G-65-1	1.77	359		0	359	341	$32,376	$41,193	$241,549
21	84	T013	1.70	5,031		0	5,031	4,779	$25,037	$39,988	$16,735
22	84	T014	1.70	5,031		0	5,031	4,779	$25,037	$39,988	$16,735
23	130	T-325A	1.70	1,437		0	1,437	1,365	$24,640	$39,973	$58,552
24	141	PO-#129	1.63	749		0	749	712	$30,100	$40,754	$114,500
25	28	TS-146	1.62	243		0	243	231	$32,091	$41,051	$355,471
26	167	Tank 1219	1.61	2,537	Thermal oxidizer	99	25	0	$0	$0	$0
27	167	Tank 1119	1.61	2,537	Thermal oxidizer	99	25	0	$0	$0	$0
28	70	TA-951	1.60	1,197	Carbon adsorber	95	60	0	$0	$0	$0
29	40	TF_ST104	1.49	483		0	483	459	$30,483	$40,808	$177,960
30	87	4T003 (# 672)	1.37	263		0	263	250	$30,851	$40,849	$326,430
31	57	ALA05	1.20	5,835		0	5,835	5,543	$14,185	$37,934	$13,687
32	2	T035	1.16	2,409		0	2,409	2,288	$29,726	$40,679	$35,556
33	2	T036	1.16	2,409		0	2,409	2,288	$29,726	$40,679	$35,556
34	2	T037	1.16	2,409		0	2,409	2,288	$29,726	$40,679	$35,556
35	2	T038	1.16	2,409		0	2,409	2,288	$29,726	$40,679	$35,556
36	34	3104F	1.02	603	Condenser	99	6	0	$0	$0	$0
37	167	Tank 368	0.96	1,055	Thermal oxidizer	99	11	0	$0	$0	$0
38	167	Tank 369	0.96	1,107	Thermal oxidizer	99	11	0	$0	$0	$0
39	40	TF_ST144	0.60	293		0	293	279	$18,617	$38,972	$279,763
40	70	TA-960	0.59	258	Carbon adsorber	95	13	0	$0	$0	$0
41	54	C-749	0.58	786		0	786	746	$39,251	$42,412	$113,646
42	54	C-751	0.58	1,039		0	1,039	987	$39,251	$42,460	$86,062
43	70	TA-950	0.55	3,416	Carbon adsorber	95	171	0	$0	$0	$0
44	70	TA-952	0.55	1,386	Carbon adsorber	95	69	0	$0	$0	$0
45	40	TF_ST118	0.54	858		0	858	815	$16,524	$38,642	$94,847
46	134	23-4	0.50	343		0	343	326	$22,656	$39,550	$242,529
			Total	115,702			47,937	43,495	$876,981	$1,185,92	$54,532

Continuous Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
1	M126	CRUDE DIBASIC	1.93	3,880	VAPOR RECOVERY	0	3,880	3,686.00	$11,578	$2,451	$1,330
2	M126	METHANOL TANK	1.93	1,340	NONE	0	1,340	1,273.00	$15,221	$3,648	$5,731
3	M126	METHANOL TANK	1.93	1,560	NONE	0	1,560	1,482.00	$15,221	$3,623	$4,889
4	M146	D-123 CHILLED	1.93	0	NONE	0	0	0.38	$13,532	$3,377	$17,773,684
5	M257	FRESH METHANOL	1.93	4,640	IFR	95	232	0.00	$0	$0	$0
6	M257	MOTHER LIQUOR	1.93	12,000	IFR	95	600	0.00	$0	$0	$0
7	M257	MOTHER LIQUOR	1.93	12,000	IFR	95	600	0.00	$0	$0	$0
8	M257	RECOVERED	1.93	9,560	IFR	95	478	0.00	$0	$0	$0
9	M257	SEAL FLUSH	1.93	5,200	IFR	95	260	0.00	$0	$0	$0
10	M258	DRY METHANOL	1.93	11,600	IFR	95	580	0.00	$0	$0	$0
11	M258	SPENT HEXANE	2.93	27,200	IFR	95	1,360	0.00	$0	$0	$0
12	M262	HEXANE STORAGE	2.93	156,000	FLARE & CONDENSER	100	468	0.00	$0	$0	$0
13	M262	HEXANE STORAGE	2.93	9,067	FLARE & CONDENSER	100	27	0.00	$0	$0	$0
14	M270	HEXANE STORAGE	2.93	8,400	IFR	95	420	0.00	$0	$0	$0
15	M270	TANK	2.93	2,440	NONE	0	2,440	2,318.00	$9,669	$2,138	$1,845
16	M270	TANK	2.93	723	NONE	0	723	686.85	$9,769	$2,357	$6,863
17	M279	"B" PLANT	1.93	2,386	VAPOR-CONDENSERS	79	492	76.69	$20,357	$5,037	$131,361
18	M279	CENTRATE AND	1.93	175	NONE	0	175	166.63	$30,354	$7,556	$90,692
19	M279	INHIBITOR	1.93	433	NONE	0	433	411.73	$11,240	$2,757	$13,392
20	M279	METHANOL	1.93	883	NONE	0	883	839.04	$25,030	$6,148	$14,655
21	M279	METHYL ACETATE	1.93	9	VAPOR-CONDENSERS	77	2	0.40	$18,693	$4,666	$23,179,334
22	M279	MILLION GAL VAM.	1.61	17,270	VAPOR-CONDENSERS	82	3,074	393.47	$44,072	$10,737	$54,576
23	M279	POLYMER TANK	1.93	2,782	VAPOR-CONDENSERS	89	306	18.36	$16,327	$4,055	$441,721
24	M279	POLYMER TANK	1.93	7,276	VAPOR-CONDENSERS	89	800	48.02	$16,327	$4,023	$167,541
25	M279	SODIUM	1.93	0	NONE	0	0	0.00	$9,720	$2,426	$4,245,782,
26	M279	VINYL "A"	1.61	8,784	NONE	0	8,784	8,345.18	$30,354	$6,583	$1,578
27	M279	VINYL "B"	1.61	6,919	NONE	0	6,919	6,572.86	$30,354	$6,794	$2,067
28	M279	VINYL "C" DAY	1.61	944	NONE	0	944	896.99	$22,551	$5,522	$12,312
29	M279	VINYL "C"	1.61	8,684	NONE	0	8,684	8,249.42	$30,354	$6,595	$1,599
30	M279	VINYL ACETATE "A"	1.61	5,765	NONE	0	5,765	5,476.56	$22,551	$4,977	$1,818
31	M279	VINYL ACETATE "B"	1.61	4,745	NONE	0	4,745	4,507.94	$22,551	$5,092	$2,259
32	M279	VINYL ACETATE (A	3.54	200	VAPOR-CONDENSERS	83	34	4.08	$19,498	$4,864	$2,384,314
33	M279	VINYL ACETATE (B	3.54	358	VAPOR-CONDENSERS	83	61	7.30	$19,498	$4,862	$1,332,785
34	M279	WASHWATER	1.93	89	NONE	0	89	84.55	$14,281	$3,554	$84,069
35	M280	A CRUDE	1.93	3	NONE	0	3	3.23	$14,309	$3,571	$2,211,146

Continuous Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
36	M280	B CRUDE	1.93	22	NONE	0	22	20.52	$14,309	$3,569	$347,856
37	M280	BIG A CRUDE	1.93	84	NONE	0	84	79.99	$34,823	$8,682	$217,077
38	M280	BIG B CRUDE	1.93	8	NONE	0	8	7.98	$34,823	$8,691	$2,178,195
39	M280	CRUDE KA TANK -	1.93	18	NONE	0	18	16.72	$19,920	$4,970	$594,498
40	M280	E REWORK	1.93	4	NONE	0	4	3.61	$22,578	$5,635	$3,121,884
41	M280	F CRUDE DCH	1.93	22	NONE	0	22	21.28	$22,578	$5,633	$529,417
42	M280	HMI STORAGE	1.93	5	NONE	0	5	4.75	$11,279	$2,815	$1,185,263
43	M280	NO. 2 RECYCLE VA	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
44	M280	NO. 3 TWKA	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
45	M280	NO. 3 TWKA	1.93	2	NONE	0	2	1.52	$33,821	$8,441	$11,106,579
46	M280	NO. 4 TWKA	1.93	15	NONE	0	15	14.44	$15,221	$3,797	$525,900
47	M280	RECYCLE AQUA	1.93	0	NONE	0	0	0.19	$9,769	$2,438	$25,663,158
48	M280	VINYL ACETATE	1.61	18,716	IFR	95	936	0.00	$0	$0	$0
49	M280	WASTE	1.93	0	NONE	0	0	0.19	$9,720	$2,426	$25,536,842
50	M280	WASTE ORGANIC	1.93	215	NONE	0	215	204.06	$11,240	$2,781	$27,257
51	M281	CRUDE NPG	1.93	460		0	460	437.00	$14,701	$3,617	$16,554
52	M281	FLUX OIL TANK	3.16	1,528		0	1,528	1,451.41	$17,161	$4,111	$5,665
53	M281	MIX	1.93	38		0	38	36.10	$10,805	$2,693	$149,197
54	M281	MOLTEN STORAGE	2.93	562		0	562	533.90	$19,467	$4,796	$17,966
55	M281	MOLTEN STORAGE	2.93	562	VAPOR RECOVERY	0	562	533.90	$19,467	$4,796	$17,966
56	M281	REJECT	1.93	10		0	10	9.50	$15,559	$3,882	$817,263
57	M281	STORAGE TANK	13.29	2,300		0	2,300	2,185.00	$25,427	$6,087	$5,572
58	M281	STORAGE TANK 43	13.29	420		0	420	399.00	$13,899	$3,422	$17,153
59	M281	STORAGE	2.24	60		0	60	57.00	$10,107	$2,516	$88,281
60	M281	STORAGE	13.29	60		0	60	57.00	$11,538	$2,873	$100,807
61	M281	TANK	13.29	240		0	240	228.00	$13,063	$3,233	$28,360
62	M283	HEXANE STORAGE	2.93	22,000	IFR	95	1,100	0.00	$0	$0	$0
63	M283	HEXANE STORAGE	2.93	18,000	IFR	95	900	0.00	$0	$0	$0
64	M289	TANK	2.93	320	IFR	95	16	0.00	$0	$0	$0
65	M289	TANK	2.93	320	IFR	95	16	0.00	$0	$0	$0
66	M289	TANK	2.93	320	IFR	95	16	0.00	$0	$0	$0
67	M289	TANK	2.93	120	IFR	95	6	0.00	$0	$0	$0
68	M289	TANK	2.93	320	IFR	95	16	0.00	$0	$0	$0
69	M293	STORAGE	1.68	0	NONE	0	0	0.38	$32,823	$8,192	$43,115,789
70	M293	STORAGE	1.68	507	NONE	0	507	481.84	$12,066	$2,954	$12,261
71	M300	TANK	1.93	318	NONE	0	318	302.10	$11,960	$2,949	$19,523
72	M300	TANK	2.06	81	NONE	0	81	76.95	$14,416	$3,589	$93,281
73	M300	TANK	2.93	200	IFR	95	10	0.00	$0	$0	$0
74	M306	TANK/2A/2A	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
75	M306	TANK/2B/2B	2.93	1,280	NONE	0	1,280	1,216.00	$11,949	$2,838	$4,668
76	M306	TANK/3/3	0.71	260	NONE	0	260	247.00	$9,695	$2,391	$19,360
77	M330	POLY ETHYLENE	2.32	8,868	NONE	0	8,868	8,424.60	$10,520	$1,623	$385

Continuous Vertical Tanks with HAP Partial Pressure => 0.5 psia and IFR Control Cost (Above Floor) (continued)

	Facil. #	Tank ID	HAP partial pressure (psia)	Uncontrolled HAP emissions (lb/yr)	Control device	Control efficiency	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	TCI ($)	TAC ($/yr)	CE ($/ton)
78	M343	R-1372	1.93	12	NONE	0	12	11.40	$9,669	$2,412	$423,158
79	M358	2-16,900 GALLON	1.93	7,765	None	0	7,765	7,376.75	$13,585	$2,513	$681
80	M358	2-9,800 GALLON	1.93	3,882	None	0	3,882	3,687.90	$11,302	$2,382	$1,292
81	M358	3-150,000 GALLON	1.93	4,500	None	0	4,500	4,275.00	$32,814	$7,682	$3,594
82	M358	NEW ROSIN TANK,	1.93	3,882	None	0	3,882	3,687.90	$10,520	$2,187	$1,186
83	M358	RESIN PRODUCT	1.93	3,882	None	0	3,882	3,687.90	$12,866	$2,773	$1,504
84	M358	RESINATE TANKS,	0.71	6,666	None	0	6,666	6,332.70	$12,045	$2,253	$712
85	M358	RXN. OIL, HEADS	1.93	4,500	None	0	4,500	4,275.00	$11,317	$2,316	$1,084
86	M358	ST-26 RESINATE	0.71	2,244	None	0	2,244	2,131.80	$12,739	$2,926	$2,745
87	M358	TOLUENE TANK	0.71	1,498	None	0	1,498	1,423.10	$12,049	$2,838	$3,988
88	M44	1100 PROCESS	6.93	2,916	NONE	0	2,916	2,770.20	$9,669	$2,084	$1,505
89	M44	1100 PROCESS	1.38	108	NONE	0	108	102.60	$9,669	$2,401	$46,803
90	M44	T-352,353,&354/FB03	1.93	130	NONE	0	130	123.50	$12,866	$3,197	$51,773
91	M44	T-352,353,&354/FB03	1.93	18	PROCESS CHANGE	0	18	17.10	$13,204	$3,294	$385,263
92	M44	TANK	1.93	113	VAPOR-CONDENSERS	68	36	9.72	$15,510	$3,868	$795,885
93	M44	TANK	1.93	14,600	FLARE-WASTE	98	292	0.00	$0	$0	$0
94	M44	TANKS 360 AND	1.93	7,938	VAPOR-CONDENSERS	68	2,540	685.80	$27,035	$6,493	$18,936
95	M44	TANKS	1.68	1,448	NONE	0	1,448	1,375.60	$14,281	$3,401	$4,945
96	M44	TANKS	1.68	1,450	NONE	0	1,450	1,377.50	$12,100	$2,856	$4,147
97	M44	TANKS	1.68	5,040	SCRUBBER	0	50	47.88	$12,438	$2,535	$105,890
98	M44	TANKS	3.62	766	NONE	0	766	727.70	$12,100	$2,934	$8,064
99	M44	TANKS	2.06	218	NONE	0	218	207.29	$11,317	$2,800	$27,015
						Total	129,163	108,165	$1,324,380	$316,633	$5,855
						National Total	509,121	216,331	$2,648,760	$633,266	

ATTACHMENT 4:

Internal Floating Roof Cost Module

```
Option Compare Database
Option Explicit

Public Sub IFRCost()
 Dim dbs As Database
 Dim rst As Recordset
 Dim TankSize As Double                                    'tank capacity, gal
 Dim TankDia As Double                                     'tank diameter, ft
 Dim Degas As Double                                       'cleaning and degassing of tank, $
 Dim FlRoof As Double                                      'new NSPS floating roof, $
 'Dim SecSeal As Double                                    'addition of secondary seal, $
 'Dim CtrlDeck As Double                                   'addition of control deck fittings, $
 Dim CtrlDev As Variant                                    'control device
 Dim CtrlEff As Variant                                    'control device efficiency (percent)
 Dim BaseEmiss As Double                                   'calculated emissions (lb/yr)
 Dim EmissRed As Double                                    'reduction in emissions, lb/yr
 Const Price As Double = 0.1                               'price for recovered voc, $
 Dim RemovCond As Double                                   'removing existing condenser, $
 Dim TAC As Double                                         'total annualized cost, $
 Dim CapCost As Double                                     'capitalized cost, $
 Dim PEC As Double                                         'purchased equipment cost, $
 Dim TCI As Double                                         'total capital investment, $
 Dim RC As Double                                          'recovery credit, $
 Dim DAC As Double                                         'direct annual cost, $
 Dim OandM As Double                                       'operating and maintenance cost
Const Mirror As Single = 0                                 'monitoring, recordkeeping and
                                                             'reporting cost
Dim CAR As Double                                          'annualized capital cost
Const RecvCrdt As Single = 0                               'recovery credit is 0 because no recovery
Dim PP As Double                                           'HAP PP

 Set dbs = CurrentDb
 Set rst = dbs.OpenRecordset("Vertical Tanks w/pp 0,1 psia and Control Cost")

 rst.MoveFirst
 Do While Not rst.EOF
    TankSize = rst![Tank Capacity]
    CtrlDev = rst![Control Device]
    CtrlEff = rst![Tank Control Device Efficiency (percent)]
    BaseEmiss = rst![Baseline HAP Emissions (lb/yr)]
    EmissRed = rst![HAP Reduction (lb/yr)]
    PP = rst![HAP Partial Pressure (psia)]

    Degas = 7.61 * (TankSize) ^ (0.5132)

    TankDia = Int((TankSize / 7.481) ^ (1 / 3)) + 1   'assumes cylindrical vol= pi (D^2)h/4
                                                          'and D=(cylindrical vol)^(1/3) and
                                                          '1 cuft = 7.481 gal
    FlRoof = 509 * (TankDia) + 1160
    RemovCond = 284                                     'per tank

If Not IsNull(CtrlDev) Then
    CapCost = (Degas + FlRoof + RemovCond) * (387.9 / 356)
                                                        'escalate using cost indices from Feb 99
                                                          'and July 1989
Else
    CapCost = (Degas + FlRoof) * (387.9 / 356)
End If                                                   'escalate using cost indices from Feb 99
                                                          'and July 1989

    TAC = ((CapCost * 0.2098) - (EmissRed * 0.1))


    OandM = 0.1 * CapCost
    CAR = CapCost * 0.1098                             'assuming 15 yr life and 7% interest
    RC = EmissRed * 0.1

    rst.Edit

     If CtrlEff >= 95 Then
        rst![HAP Reduction (lb/yr)] = 0
```

```
       rst!IFR_TCC = 0
       rst!IFR_TAC = 0
       rst![O&M ($)] = 0
       rst![ACR ($)] = 0
       rst![MRR ($)] = Mirror
       rst![RC ($)] = 0
   Else
        rst!IFR_TCC = CapCost
        rst!IFR_TAC = TAC
        rst![O&M ($)] = OandM
        rst![ACR ($)] = CAR
        rst![MRR ($)] = Mirror
        rst![RC ($)] = RC
   End If

   rst.Update

   rst.MoveNext
Loop

End Sub
```

ATTACHMENT 5:

Condenser Cost Module

```
Attribute VB_Name = "CondenserCostCalc"
Option Compare Database
Option Explicit

Public Sub CondenserCostCalc()
Dim dbs As Database
Dim rst As Recordset
Dim PPpsia As Double                        'partial pressure of 5% HAP
Dim PPmmHg As Double                        'partial pressure converted from psia to mmHg
Dim HAPpsia As Double                       'HAP partial pressure from table 5 of ICR
Dim Tcon As Double                          'temperature of condensation, degF
Dim VOCin As Double                         'VOC flow rate in the inlet, lb-mole/hr
Const Qtot As Double = 20                   'Flow (scfm)
Dim Cvoc As Variant                         'concentration of VOC, ppmv
Dim antA As Double                          'a is antoine constant
Dim antB As Double                          'b is antoine constant
Dim antC As Double                          'c is antoin constant
Dim VOCout As Double                        'voc flow rate in the outlet, lb-mole/hr
Const RE As Double = 95                     'recovery efficiency is 95%
Dim VOCcon As Double                        'flow rate of condensed VOC, lb-mole/hr
Dim dHcon As Double                         'enthalpy change of the condensed VOC, Btu/lbmol
Const dHvoc As Double = 15000               'heat of condensation of the voc, Btu/hr
Const Cpvoc As Double = 20                  'heat capacity of voc, btu/lb-mole-degF
Const CPair As Double = 6.95                'heat capacity of air, Btu/lb-mole-degF
Const Tin As Single = 68                    'inlet stream temperature, degF
Dim dHuncon As Double                       'enthalpy change of uncondensed voc, Btu/hr
Dim dHnoncon As Double                      'enthalpy change of noncondensibleair, Btu/hr
Dim Hload As Double                         'condenser heat load, Btu/hr
Dim Tcooli As Double                        'coolant inlet temperature, degF
Dim Tcoolo As Double                        'coolant outlet temperature, degF
Dim dTlm As Double                          'log mean temperature difference, degF
Dim Acon As Double                          'condenser surface area, sqft
Const U As Single = 20                      'overall heat transfer coefficient, Btu/hr-ft2-degF
Dim Qcoolant As Double                      'coolant flow rate, lb/hr
Const Cpcool As Double = 0.65               'heat capacity of coolant, Btu/hr
Dim Ref As Double                           'required refrigeration capacity, tons
Dim Qrec As Double                          'quantity of recovered voc, lb/yr
Dim MW As Double                            'molecular weight of voc, lb/lb-mole
Dim ECr As Double                           'refrigeration unit cost, $
Dim ECcon As Double                         'voc condenser cost in third quart, 1990 $
Dim ECtank As Double                        'recovery tank cost,  $
Dim Density As Variant                      'density of HAP, lb/lb-mole
Dim Qtank As Double                         'recovery tank capacity requirement, gal
Const ECpre As Single = 0                   'precooler equipment cost
Const ECaux As Single = 0                   'auxiliary equipment cost
Dim ECc As Double                           'total equipment cost, $
Dim PEC As Double                           'purchased equipment cost, $
Dim TCC As Double                           'total capital investment, $
Const n As Single = 8760                    'operating hours for refrigeration unit are
                                                 '24 hr/day and 7 days/week
Const e As Double = 0.059                   'electricity cost, $/kWh
Const s As Double = 0.1                     'salvage value of recovered voc (see Handbook -
                                                 'pg 4-63)
Dim LaborCost As Double                     'operating labor cost, $
Dim SupervCost As Double                    'supervisory labor, $
Dim MaintCost As Double                     'maintenance labor, $
Dim MaintMat As Double                      'maintenance material, $
Dim DC As Double                            'direct annual cost
Dim Ce As Double                            'electrical cost intermediate, $/yr
Dim Overhead As Double
Dim PropTax As Double
Dim Admin As Double
Dim CapRecov As Double
Dim Insur As Double                         'insurance
Dim RC As Double                            'recovery credit
Dim IC As Double                            'total indirect cost
Dim TAC As Double                           'total annual cost
Dim Electric As Double                      'electricity required, kWh/yr
Dim ElectricCost As Double                  'electrical cost, total $,yr
Dim OandM As Double                         'operating and maintenance cost
Const M As Double = 780                     'monitoring, recordkeeping and reporting cost
Dim CAR As Double                           'annualized capital cost
Dim EmisRed As Double                       'hap reduction, lb/yr
Dim Thruput As Double                       '1995 tank throughput, gal/yr
```

```
Dim Filltime As Double                      'Time required to fill tank
Dim Nonfill As Double                       'Time not filling tank
Dim UNChap As Double                        'Working losses, lb/yr
Dim CtrlEff As Double                       'Control efficiency

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("Horizontal Tanks w/pp 0,1 psia and Control Cost")

rst.MoveFirst
Do While Not rst.EOF
    HAPpsia = rst![HAP Partial Pressure (psia)]
    UNChap = rst![WORKING LOSS,    LBS]
    MW = rst![HAP MW]
    Density = rst![HAP Density]
    antA = rst!a
    antB = rst!b
    antC = rst!c
    EmisRed = rst![HAP Reduction (lb/yr)]
    Thruput = rst![1995 Tank Throughput]
    CtrlEff = rst![Tank Control Device Efficiency (percent)]

                                            ' ********Condenser Sizing*******
Filltime = (Thruput * 0.13368 / Qtot) / 60                 'calculate required fill time/yr
Nonfill = n - Filltime                                     'non-fill is balance of year

PPmmHg = 760 * ((HAPpsia / 14.7 * (1 - RE / 100)) / (1 - (HAPpsia / 14.7) * (RE / 100)))
'PPmmHg = PPpsia * 760 / 14.69               'to convert from psia to mmHg
Tcon = (antB / (antA - (Log(PPmmHg) / Log(10))) - antC) * 1.8 + 32
VOCin = UNChap / Filltime / MW                         '385 scf/lb-mole at 68 degF and 1atm
VOCout = VOCin * (1 - (RE / 100))
VOCcon = VOCin - VOCout                                      'flow rate of condensed voc
dHcon = VOCcon * (dHvoc + Cpvoc * (Tin - Tcon))              'enthalpy change of condensed
                                                                  'voc
dHuncon = VOCout * Cpvoc * (Tin - Tcon)                      'enthalpy change due to
                                                                  'uncondensed voc
dHnoncon = ((Qtot * 60 / 385) - VOCin) * CPair * (Tin - Tcon)  'enthalpy change of
                                                                  'noncondensible air
Hload = dHcon + dHuncon + dHnoncon                           'condenser heat load
Tcooli = Tcon - 15
Tcoolo = Tcooli + 25
dTlm = ((Tin - Tcoolo) - (Tcon - Tcooli)) / Log((Tin - Tcoolo) / (Tcon - Tcooli))
                                                              'log mean temperature diff
Acon = Hload / (U * dTlm)                                     'condenser surface area
Qcoolant = Hload / (Cpcool * (Tcoolo - Tcooli))               'coolant flow rate
Ref = Hload / 12000                                           'refrigeration capacity
Qrec = Int(VOCcon * MW) + 1                                   'quantity recovered/hr

                                                '********Cost Calculation********

If Tcon > -20 And Ref < 10 Then
    ECr = Exp(9.83 - 0.014 * Tcon + 0.34 * Log(Ref))          'refrigeration unit cost for
                                                                  'single stage
ElseIf Tcon > -20 And Ref >= 10 Then
    ECr = Exp(9.26 - 0.007 * Tcon + 0.627 * Log(Ref))         'refrigeration cost for
                                                                  'single stage
ElseIf Tcon < -20 Then
    ECr = Exp(9.73 - 0.012 * Tcon + 0.584 * Log(Ref))         'refrigeration cost for
                                                                  'multistage
End If

'ECcon = 34 * Acon + 3775                                      'voc condenser cost 3rd quart,
                                                                  '1990 $
'Qtank = Qrec / Density * 24                                   'assuming 24-hr daily
                                                                  'operation
'If Qtank >= 50 Then
'    ECtank = 2.72 * Qtank + 1960                              'recovery tank cost, 1990$
'Else
'    ECtank = 2.72 * 50 + 1960
'End If
'ECc = ECr + ECcon + ECtank + ECpre + ECaux                    'equipment cost
```

```
ECc = 1.25 * ECr + ECaux                                      'Equipment cost

PEC = 1.08 * ECc                                              'PEC including instrumentation,
                                                                 'controls,taxes and freight
'**Filling cost**

If Tcon >= 40 Then                                            'these estimates were
                                                                  'developed from
    Ce = (Ref * 1.3 / 0.85) * Filltime * e                        'product literature from
                                                                  'one vendor
ElseIf Tcon >= 20 And Tcon < 40 Then                          'using equation
                                                                  'Ce=(Ref*E/0.85)*n*e
    Ce = (Ref * 2.2 / 0.85) * Filltime * e                        'where E=electricity
                                                                  'requirement, kW/ton
ElseIf Tcon >= -20 And Tcon < 20 Then
    Ce = (Ref * 4.7 / 0.85) * Filltime * e
ElseIf Tcon >= -50 And Tcon < -20 Then
    Ce = (Ref * 5 / 0.85) * Filltime * e
ElseIf Tcon < -50 Then
    Ce = (Ref * 11.7 / 0.85) * Filltime * e
End If


ElectricCost = Ce + Ce / Filltime * Nonfill * 0.1             'Total electricity cost
                                                                  'non filling is assumed to be
                                                                  '10% of filling usage, $/yr.
Electric = ElectricCost / e                                   'Electricity use kWhr/yr

'RC = Qrec * Filltime * s                                     'recovery credit
RC = 0.1 * EmisRed
If Ref < 7 Then
    LaborCost = 0
Else: LaborCost = 0.5 / 8 * n * 15.64                         'labor cost is $15.64 /hr
End If

SupervCost = 0.15 * LaborCost                                 '15% of labor cost
MaintCost = 0.5 / 8 * n * 17.21                               'maintenance labor is
                                                                  '$17.21/hr
MaintMat = MaintCost
DC = ElectricCost + LaborCost + MaintCost + MaintMat + SupervCost             'DC
Overhead = 0.6 * (LaborCost + SupervCost + MaintCost + MaintMat)    '60% of labor and
                                                                        'maintenance
TCC = (1.15 * PEC) * (106.1 / 100) * (99.3 / 103.3) + M             'multiplying by Vatavuk
                                                                        'cost indexes for
                                                                        '1st quarter 99$
                                                                        'relative to 3rd
                                                                        'quarter 90$
Admin = 0.02 * TCC
PropTax = 0.01 * TCC
Insur = 0.01 * TCC
CAR = 0.1098 * TCC                                            'capital recovery for a 15
                                                                        'year lifetime and 7%
                                                                        'interest rate
IC = Overhead + Admin + PropTax + Insur + CAR
TAC = (DC + IC - RC) + 5940                                   'add $5940 for monitoring costs
OandM = TAC - CAR + RC

rst.Edit
```

```
If CtrlEff >= 95 Then
        rst!CondenserTCC = 0
        rst!CondenserTAC = 0
        rst![Electricity (kWh/yr)] = 0
        rst![O&M ($)] = 0
        rst![MRR ($)] = 0
        rst![ACR ($)] = 0
        rst![RC ($)] = 0
        rst![Recovery] = Qrec
        rst![T cond] = Tcon

    Else
        rst![Conc] = Cvoc
        'rst![VOCin] = VOCin
        'rst![VOCout] = VOCout
        'rst![VOC] = VOCcon
        'rst![Hload] = Hload
        'rst![Tlogmean] = dTlm
        'rst![Condarea] = Acon
        'rst![Qcool] = Qcoolant
        'rst![ECr] = ECr
        'rst![ECc] = ECc
        'rst![PEC] = PEC
        'rst![LaborCost] = LaborCost
        'rst![SupervCost] = SupervCost
        'rst![MaintCost] = MaintCost
        'rst![DC] = DC
        'rst![Overhead] = Overhead
        'rst![IC] = IC
        rst!CondenserTCC = TCC
        rst!CondenserTAC = TAC
        rst![Electricity (kWh/yr)] = Electric
        rst![O&M ($)] = OandM
        rst![MRR ($)] = M
        rst![ACR ($)] = CAR
        rst![RC ($)] = RC
        rst![Recovery] = Qrec
        rst![T cond] = Tcon
    End If

    rst.Update

    rst.MoveNext
Loop

End Sub
```

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: July 31, 2000

Subject: MACT Floor, Regulatory Alternatives, and Nationwide Impacts for Equipment Leaks at Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Brenda Shine
David Randall

To: MON Project File

I. Introduction

This memorandum describes existing and new source MACT floors for equipment leaks and the resulting emission reductions and costs for implementing the 40 CFR Part 63 Subpart H LDAR program at chemical manufacturing facilities.

II. MACT Floor and Regulatory Alternatives

The MACT floor for both existing and new sources is a leak detection and repair (LDAR) program equivalent to that in the hazardous organic NESHAP (HON).[1,2] No regulatory alternatives above these floors were selected because the Subpart H LDAR program is already the most stringent Federal program available.

III. Impacts

The HAP emission reductions and cost impacts associated with the MACT floor were estimated using two model processes, a MON continuous process and a MON batch process. The component counts for the continuous process was developed from the screening surveys conducted to support the development of the new source performance standards (NSPS) for Subpart VV of Part 60 (the SOCMI 24-Unit Study). The component count for the batch model was derived from data from the amino-phenolic resin manufacturing industry.[3] These component counts are presented in Table 1.

TABLE 1. MODEL UNIT EQUIPMENT COUNTS

Equipment	Continuous MON unit	Batch MON unit
Valves/gas-vapor	44	0
Valves/ light liquid	526	61
Valves/ heavy liquid	133	68
Pumps/light liquid	12	5
Pumps/heavy liquid	8	5
Compressors	0	0
Agitators[a]	0	3
Pressure relief devices/gas-vapor	1	0
Open-ended lines	156	11
Flanges/connectors	1,067	325
Sampling connections	39	10
Total	1,986	488

[a] Agitators were treated like pumps in heavy liquid service in the cost impacts analysis.

The procedures used to estimate the emissions, emission reductions, and cost impacts are described in the following sections of this memorandum. The impacts of the analyses for each existing facility to meet the MACT floor are presented in Attachment 1, and the nationwide impacts are summarized in Table 2.

TABLE 2. MACT FLOOR IMPACTS FOR EXISTING SOURCES

Emission reduction, Mg/yr	Total capital investment, $	Total annual cost, $/yr	Cost effectiveness relative to baseline, $/Mg
13,800	14,100,000	9,320,000	675

A. Emissions Estimates

Equipment leak HAP emissions were estimated using the emission factors that are based on data from two of the three types of processes that were used to develop the average SOCMI emission factors. The three processes are cumene, vinyl acetate, and ethylene. The MON factors were developed as the average of the factors for cumene and vinyl acetate. Ethylene data were excluded because ethylene units have many components in gas-phase and high pressure liquid phase service, which differ from the characteristics of MON chemical processes. The average uncontrolled emissions for the MON continuous and batch model process were calculated by taking the average emissions calculated for the model process in vinyl acetate service and the model process in cumene service. For the continuous MON model process, the uncontrolled emission estimate is 105,000 lb/yr; for the MON batch model process, the resulting uncontrolled emission estimate is 31,300 lbs/yr.[3] For each existing facility, total uncontrolled emissions were estimated by multiplying the emissions per process by the actual number of reported processes at the facility.

In order to calculate the baseline level of emissions for facilities in the MON database, a reduction from the above uncontrolled estimates was applied based on the reported LDAR program. The reduction is based on what type of program was reported and whether the processes are batch or continuous. The estimated percentage reductions for different LDAR programs are presented in Table 3.[3]

TABLE 3. EMISSION REDUCTIONS FOR VARIOUS LDAR PROGRAMS

	Reduction from uncontrolled, percent	
Program	Batch	Continuous
HON	72	69
LA non-HON	42	66
Subpart VV	21	NA[a]
TX28VHP	39	60
TXReg5	38	NA
TX28RCT	NA	60
TX28MID	39	NA
TX28M	NA	24
Subpart V	20	NA
AVO	0	0

[a] NA= No processes in the MON database.

Emission reductions for the MACT floor were estimated by subtracting emissions calculated by applying the HON program reductions from the baseline emissions for each facility. As noted in previous analyses, the facilities in the database with continuous processes were assumed to represent half of the nationwide number of continuous processes in the source category.[4] Thus, we estimated the nationwide equipment leak emissions from continuous processes by doubling the estimated emissions from the processes for which data were available.

The nationwide uncontrolled emissions were estimated to be 23,350 Mg/yr (25,740 tons/yr), and the nationwide baseline emissions were estimated to be 20,580 Mg/yr (22,680 tons/yr). Estimated emission reductions under the MACT floor for each facility are shown in Attachment 1; nationwide emission reductions are estimated to be 13,800 Mg/yr (15,200 tons/yr).

B. Cost Impacts

The cost impacts consist of both initial costs and annual costs. All of the following initial costs were treated as part of the total capital investment (TCI):

- initial control equipment (open-ended lines, closed purge system for sampling connections, disk and disk holders for pressure relief devices, replacement pump seals for initially leaking pumps)
- initial LDAR for pumps, valves, and connectors
- monitoring instrument and data collection system (1 system for each 7,000 components)
- initial planning and training

The total annual cost (TAC) consists of all of the following:

- annual monitoring costs
- annual maintenance cost
- annual online repair costs (for all leaking pumps and some leaking valves and connectors)
- annual offline repair costs (for the remainder of the valves and connectors)
- annual miscellaneous costs
- annual administrative and reporting costs
- annualized capital costs
- a product recovery credit

When a facility reported a program other than the HON, costs were calculated by first costing out an LDAR program equivalent to the requirements of NSPS VV and then subtracting these costs from the costs for a HON-equivalent program. The TCI and TAC were estimated using procedures nearly identical to those used to estimate costs for the Amino and Phenolic Resins NESHAP (and the HON before that).[5] The spreadsheets used to estimate the costs for the two model facilities are presented in Attachment 2. A summary of the capital and annual costs per process is presented in Table 4. Costs for a monitoring instrument and data collection equipment were estimated for each 7,000 components; the capital cost was estimated to be \$7,700, and annual maintenance and miscellaneous costs were estimated to be \$4,588/yr. Because this equipment collects the leak concentration data automatically, no costs were estimated for manual data entry. Planning and training costs were estimated to \$7,390 for a HON LDAR program, and \$6,762 for other programs. Cost elements used in the spreadsheets are described in detail in Attachment 3.

TABLE 4. COSTS FOR MODEL PROCESSES

Parameter	Model process costs	
	Batch	Continuous
HON program costs		
Fixed capital cost, $	6,291	39,773
Annualized capital costs, $/yr	1,956	6,726
Annual expenses, $/yr	6,782	14,495
Subpart VV program costs		
Fixed capital costs, $	5,993	38,444
Annualized capital costs, $/yr	1,822	6,436
Annual expenses, $/yr	4,235	10,246

IV. References

1. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. May 20, 1999. Existing Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

2. Memorandum from C. Zukor and R. Howle, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. June 7, 1999. New Source MACT Floors for Batch and Continuous Chemical Manufacturing Processes Covered by the MON.

3. Ranking of Equipment Leak Programs for the Miscellaneous Organic NESHAP. Alpha-Gamma Technologies, Inc. Draft. April 1999.

4. Memorandum from C. Zukor, Alpha-Gamma Technologies, Inc., to Miscellaneous Organic NESHAP Project File. July 27, 1999. National Impacts Associated with Regulatory Options for MON Chemical Manufacturing Processes.

5. Memorandum from K. Meardon, Pacific Environmental Services, Inc., to J. Schaefer, EPA:ESD. May 4, 1998. Equipment Leak Analysis for Amino and Phenolic Resins NESHAP.

6. U. S. Environmental Protection Agency. Office of Air Quality Planning and Standards. Protocol for Equipment Leak Emission Estimates. EPA Document No. EPA-453/R-95-017. November 1995.

ATTACHMENT 1

Emissions and Cost Impacts

Equipment Leak Control Cost – MACT Floor

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
1	M1	6	0	187800	None	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
2	M10	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
3	M100	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
4	M101	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
5	M102	6	0	187800	None	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
6	M103	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
7	M104	1	0	31300	LA non-HON	0.42	2	18,154	9,390	Batch	$926	$3,056	$651
8	M105	7	0	219100	None	0	0	219,100	157,752	Batch	$59,127	$51,072	$647
9	M106	8	0	250400	HON	0.72	1	70,112	0	Batch	$0	$0	$0
10	M107	0	1	105000	HON	0.69	1	32,550	0	Continuous	$0	$0	$0
11	M107	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
12	M107	7	0	219100	TX28VHP	0.39	2	133,651	72,303	Batch	$2,714	$20,082	$555
13	M108	11	0	344300	None	0	0	344,300	247,896	Batch	$84,291	$77,010	$621
14	M109	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
15	M11	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
16	M110	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
17	M111	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
18	M112	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
19	M113	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
20	M113	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
21	M114	1	0	31300	HON	0.72	1	8,764	0	Batch	$0	$0	$0
22	M114	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
23	M115	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
24	M116	4	0	125200	AVO	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
25	M116	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
26	M117	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
27	M118	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
28	M119	6	0	187800	AVO	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
29	M12	5	0	156500	Subpart VV	0.21	2	123,635	79,815	Batch	$2,118	$8,710	$218
30	M120	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
31	M121	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
32	M122	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
33	M123	1	0	31300	Subpart V	0.2	2	25,040	16,276	Batch	$926	$1,680	$206
34	M124	2	0	62600	AVO	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
35	M125	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
36	M125	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
37	M126	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
38	M126	1	0	31300	TXReg5	0.38	0	19,406	10,642	Batch	$21,381	$12,166	$2,286
39	M127	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
40	M128	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
41	M129	127	0	3975100	None	0	0	3,975,100	2,862,072	Batch	$875,689	$874,657	$611
42	M13	3	0	93900	AVO	0	0	93,900	67,608	Batch	$33,964	$25,135	$744

Equipment Leak Control Cost – MACT Floor (continued)

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
43	M130	163	0	5101900	None	0	0	5,101,900	3,673,368	Batch	$1,125,24	$1,125,137	$613
44	M131	39	0	1220700	None	0	0	1,220,700	878,904	Batch	$275,827	$269,934	$614
45	M132	2	0	62600	AVO	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
46	M133	4	0	125200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
47	M134	26	0	813800	None	0	0	813,800	585,936	Batch	$186,348	$179,956	$614
48	M135	0	0	0	HON	0.72	1	0	0	Batch	$0	$0	$0
49	M136	6	0	187800	AVO	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
50	M137	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
51	M138	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
52	M141	1	0	31300	Subpart V	0.2	2	25,040	16,276	Batch	$926	$1,680	$206
53	M142	8	0	250400	None	0	0	250,400	180,288	Batch	$65,422	$57,557	$639
54	M142	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
55	M144	7	0	219100	Subpart VV	0.21	2	173,089	111,741	Batch	$2,714	$12,194	$218
56	M145	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
57	M146	3	0	93900	TX28MID	0.39	2	57,279	30,987	Batch	$1,522	$8,607	$556
58	M146	0	4	420000	TX28MID	0.6	2	168,000	37,800	Continuous	$5,944	$39,576	$2,094
59	M147	3	0	93900	Subpart VV	0.21	2	74,181	47,889	Batch	$1,522	$5,226	$218
60	M148	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
61	M149	11	0	344300	None	0	0	344,300	247,896	Batch	$84,291	$77,010	$621
62	M15	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
63	M15	1	0	31300	Subpart V	0.2	2	25,040	16,276	Batch	$926	$1,680	$206
64	M15	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
65	M150	3	0	93900	LA non-HON	0.42	2	54,462	28,170	Batch	$1,522	$9,170	$651
66	M150	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
67	M151	2	0	62600	TX28M	0.02	0	61,348	43,820	Batch	$27,672	$18,650	$851
68	M152	6	0	187800	Subpart VV	0.21	2	148,362	95,778	Batch	$2,416	$10,452	$218
69	M153	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
70	M154	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
71	M155	6	0	187800	None	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
72	M156	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
73	M157	13	0	406900	Subpart VV	0.21	2	321,451	207,519	Batch	$4,502	$22,646	$218
74	M158	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
75	M16	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
76	M160	2	0	62600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
77	M17	52	0	1627600	None	0	0	1,627,600	1,171,872	Batch	$365,306	$359,912	$614
78	M18	6	0	187800	Subpart VV	0.21	2	148,362	95,778	Batch	$2,416	$10,452	$218
79	M19	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
80	M2	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
81	M20	8	0	250400	None	0	0	250,400	180,288	Batch	$65,414	$57,556	$638
82	M21	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
83	M22	3	0	93900	HON	0.72	1	26,292	0	Batch	$0	$0	$0
84	M22	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080

Equipment Leak Control Cost – MACT Floor
(continued)

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
85	M23	0	1	105000	LA 2122	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
86	M23	2	0	62600	LA non-HON	0.42	2	36,308	18,780	Batch	$1,224	$6,113	$651
87	M23	0	2	210000	LA non-HON	0.66	2	71,400	6,300	Continuous	$3,286	$22,308	$7,082
88	M23	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
89	M24	3	0	93900	AVO	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
90	M25	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
91	M25	43	0	1345900	Subpart VV	0.21	2	1,063,261	686,409	Batch	$13,442	$74,906	$218
92	M254	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
93	M255	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
94	M256	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
95	M258	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
96	M259	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
97	M26	19	0	594700	None	0	0	594,700	428,184	Batch	$142,328	$134,568	$629
98	M260	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
99	M261	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
100	M262	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
101	M265	0	2	210000	TX28MID	0.6	2	84,000	18,900	Continuous	$3,286	$19,788	$2,094
102	M269	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
103	M27	7	0	219100	None	0	0	219,100	157,752	Batch	$59,127	$51,072	$647
104	M27	2	0	62600	Subpart VV	0.21	2	49,454	31,926	Batch	$1,224	$3,484	$218
105	M270	0	1	105000	TX28RCT	0.6	2	42,000	9,450	Continuous	$1,957	$9,894	$2,094
106	M271	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
107	M277	0	4	420000	None	0	0	420,000	289,800	Continuous	$181,882	$67,267	$464
108	M279	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
109	M28	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
110	M280	0	3	315000	28M	0.24	0	239,400	141,750	Continuous	$134,410	$47,610	$672
111	M281	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
112	M283	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
113	M284	0	1	105000	28M	0.24	0	79,800	47,250	Continuous	$54,863	$19,657	$832
114	M285	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
115	M287	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
116	M289	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
117	M29	4	0	125200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
118	M293	0	2	210000	TX28MID	0.6	2	84,000	18,900	Continuous	$3,286	$19,788	$2,094
119	M297	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
120	M299	0	3	315000	None	0	0	315,000	217,350	Continuous	$134,410	$47,610	$438
121	M3	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
122	M30	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
123	M300	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
124	M301	0	1	105000	TX28VHP	0.6	2	42,000	9,450	Continuous	$1,957	$9,894	$2,094
125	M303	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
126	M306	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543

Equipment Leak Control Cost – MACT Floor
(continued)

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
127	M307	0	1	105000	TX28VHP	0.6	2	42,000	9,450	Continuous	$1,957	$9,894	$2,094
128	M308	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
129	M311	0	1	105000	TX28RCT	0.6	2	42,000	9,450	Continuous	$1,957	$9,894	$2,094
130	M314	0	4	420000	None	0	0	420,000	289,800	Continuous	$181,882	$67,267	$464
131	M315	0	2	210000	TX28MID	0.6	2	84,000	18,900	Continuous	$3,286	$19,788	$2,094
132	M318	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
133	M32	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
134	M320	0	2	210000	TX28MID	0.6	2	84,000	18,900	Continuous	$3,286	$19,788	$2,094
135	M322	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
136	M325	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
137	M326	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
138	M328	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
139	M33	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
140	M330	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
141	M334	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
142	M337	0	1	105000	29MID	0.6	0	42,000	9,450	Continuous	$54,863	$19,657	$4,160
143	M34	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
144	M342	0	1	105000	TX28MID	0.6	2	42,000	9,450	Continuous	$1,957	$9,894	$2,094
145	M343	0	1	105000	28M	0.24	0	79,800	47,250	Continuous	$54,863	$19,657	$832
146	M347	0	1	105000	LA non-HON	0.66	2	35,700	3,150	Continuous	$1,957	$11,154	$7,082
147	M35	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
148	M350	0	1	105000	28M	0.24	0	79,800	47,250	Continuous	$54,863	$19,657	$832
149	M351	0	3	315000	None	0	0	315,000	217,350	Continuous	$134,410	$47,610	$438
150	M352	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
151	M358	0	2	210000	None	0	0	210,000	144,900	Continuous	$94,636	$33,633	$464
152	M359	0	1	105000	None	0	0	105,000	72,450	Continuous	$54,863	$19,657	$543
153	M36	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
154	M37	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
155	M38	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
156	M380	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
157	M39	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
158	M4	4	0	125200	Subpart VV	0.21	2	98,908	63,852	Batch	$1,820	$6,968	$218
159	M40	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
160	M41	1	0	31300	AVO	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
161	M42	36	0	1126800	None	0	0	1,126,800	811,296	Batch	$256,978	$250,484	$617
162	M43	12	0	375600	HON	0.72	1	105,168	0	Batch	$0	$0	$0
163	M44	0	2	210000	28M	0.24	0	159,600	94,500	Continuous	$94,636	$33,633	$712
164	M44	6	0	187800	HON	0.72	1	52,584	0	Batch	$0	$0	$0
165	M45	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
166	M45	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
167	M46	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
168	M47	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080

Equipment Leak Control Cost – MACT Floor
(continued)

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
169	M48	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
170	M49	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
171	M49	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
172	M5	10	0	313000	None	0	0	313,000	225,360	Batch	$78,000	$70,525	$626
173	M50	2	0	62600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
174	M51	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
175	M52	4	0	125200	HON	0.72	1	35,056	0	Batch	$0	$0	$0
176	M53	1	0	31300	TX28M	0.02	0	30,674	21,910	Batch	$21,381	$12,166	$1,111
177	M54	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
178	M55	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
179	M56	2	0	62600	Subpart VV	0.21	2	49,454	31,926	Batch	$1,224	$3,484	$218
180	M58	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
181	M59	1	0	31300	HON	0.72	1	8,764	0	Batch	$0	$0	$0
182	M6	0	0	0	None	0	0	0	0	Batch	$0	$0	$0
183	M60	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
184	M61	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
185	M62	11	0	344300	None	0	0	344,300	247,896	Batch	$84,291	$77,010	$621
186	M62	2	0	62600	Subpart V	0.2	2	50,080	32,552	Batch	$1,224	$3,359	$206
187	M63	4	0	125200	AVO	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
188	M64	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
189	M65	2	0	62600	LA non-HON	0.42	2	36,308	18,780	Batch	$1,224	$6,113	$651
190	M66	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
191	M67	6	0	187800	None	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
192	M68	2	0	62600	HON	0.72	1	17,528	0	Batch	$0	$0	$0
193	M69	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
194	M7	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
195	M70	2	0	62600	None	0	0	62,600	45,072	Batch	$27,672	$18,650	$828
196	M71	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
197	M72	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
198	M73	8	0	250400	None	0	0	250,400	180,288	Batch	$65,414	$57,556	$638
199	M74	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
200	M75	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
201	M76	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
202	M77	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
203	M78	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
204	M79	2	0	62600	Subpart VV	0.21	2	49,454	31,926	Batch	$1,224	$3,484	$218
205	M8	1	0	31300	Subpart VV	0.21	2	24,727	15,963	Batch	$926	$1,742	$218
206	M80	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
207	M81	4	0	125200	AVO	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
208	M82	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
209	M83	13	0	406900	None	0	0	406,900	292,968	Batch	$96,869	$89,978	$614
210	M84	5	0	156500	HON	0.72	1	43,820	0	Batch	$0	$0	$0

Equipment Leak Control Cost – MACT Floor
(continued)

Count	MFID	Batch PP	Continuous PP	Uncontrolled HAP emissions (lb/yr)	LDAR program	Reduction	MACT	Baseline HAP emissions (lb/yr)	HAP reduction (lb/yr)	Type	TCI	TAC	CE ($/ton)
211	M84	3	0	93900	None	0	0	93,900	67,608	Batch	$33,964	$25,135	$744
212	M85	13	0	406900	HON	0.72	1	113,932	0	Batch	$0	$0	$0
213	M86	6	0	187800	HON	0.72	1	52,584	0	Batch	$0	$0	$0
214	M87	11	0	344300	None	0	0	344,300	247,896	Batch	$84,291	$77,010	$621
215	M88	6	0	187800	None	0	0	187,800	135,216	Batch	$52,834	$44,588	$660
216	M89	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
217	M9	11	0	344300	HON	0.72	1	96,404	0	Batch	$0	$0	$0
218	M90	22	0	688600	None	0	0	688,600	495,792	Batch	$161,192	$154,020	$621
219	M91	5	0	156500	None	0	0	156,500	112,680	Batch	$46,545	$38,103	$676
220	M92	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
221	M93	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
222	M94	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
223	M95	10	0	313000	None	0	0	313,000	225,360	Batch	$78,000	$70,525	$626
224	M96	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
225	M97	4	0	125200	None	0	0	125,200	90,144	Batch	$40,254	$31,619	$702
226	M98	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
227	M99	1	0	31300	None	0	0	31,300	22,536	Batch	$21,381	$12,166	$1,080
Total				42,230,200				37,739,032	25,637,376		$10,691,846	$7,913,287	$617
Batch Total				32,990,200				30,114,982	20,877,726		$7,298,486	$6,508,223	$623
Continuous Total				9,240,000				7,624,050	4,759,650		$3,393,360	$1,405,064	$590
Overall Continuous Total				18,480,000				15,248,100	9,519,300		$6,786,720	$2,810,128	$590
National Total				51,470,200				45,363,082	30,397,026		$14,085,206	$9,318,351	$613

ATTACHMENT 2

Spreadsheets Used to Estimate Costs for HON and Other LDAR Programs
for the Model Batch and Continuous Processes

HON Program Model Process – Batch

Type of Component	Number of Components	Initial Monitoring Fee or Unit Cost ($/comp)	Initial LDAR Costs ($/yr) (Capital)	Initial LDAR Admin. Costs	Frequency of Monitoring (times/yr)	Subsequent Monitoring Fee ($/comp) or Charge (%)	Annual Monitoring Costs ($/yr)	Annual Maintenance Costs ($/yr)
Pump Seals								
* Light-liquid service	8	3.75	299.86		12	6.75	726.00	754.77
* Heavy-liquid service	5							
Valves								
* Gas/vapor service	0	0.75	0.00		4	0.75	0.00	0.00
* Light-liquid service	61	0.75	189.99		4	0.75	183.00	3.66
* Heavy-liquid service	68							
Connectors								
* Flanges - gas/vapor		0.75	0.00		1	0.75	0.00	0.00
* Flanges - light liquid	325	0.75	453.75		1	0.75	243.75	1.22
* Flanges -heavy liquid								
Pressure Relief Devices								
* Disks	0	78.00	0.00		1	2.00	0.00	0.00
* Disk holders, valves,etc.	0	3852.00	0.00		1	5.00		0.00
Open-ended Valves	11	102.00	1122.00			5.00		56.10
Sampling Connections	10	409.00	4090.00			5.00		204.50
Compressor Vent		6242.00	0.00			5.00		0.00
Replacement Pump Seals	8	180.00	134.93					
Monitoring Device	0	6500.00	0.00					0.00
Monitoring Device - Rent	0						0.00	
Data Collection System	0	1200.00	0.00					
Number of Subcategories: 1								
Administrative and Reports	60	36.95						
Planning and Training	200	36.95		7390.00				
Data Entry - Initial	0	1.88	0.00					
Data Entry - Subsequent	0	0.75					0.00	
TOTALS			6290.52	7390.00			1152.75	1020.25

Capital Costs w/o OVA and Train	6,291
Annualized Capital Costs	1,956
Annual Expenses	6,782
Annual Fixed Costs ($/yr)	4,964
Annual Variable Costs ($/yr)	3,774

Att. 2-1

HON Program Model Process – Batch
(continued)

Type of Component	Initial Leak Frequency (%)	Initial Number of Leaks	Subsequent Leak Frequency (%)	Annual Number of Leaks	Percent Repaired OnLine	Repair Time (hours)	Labor Charge ($/hr)	Annual OnLine Leak Repair Cost ($/yr)	Percent Requiring Further Repair	Repair Time (hours)	Labor Charge ($/hr)	Annual Offline Leak Repair Cost ($/yr)	Annual Admin. Cost ($/yr)	Annual Misc. Charges ($/yr)
Pump Seals														
* Light-liquid service	9.37	0.75	4.21	4.04	100	16.00	22.50	1454.98	0	80.00	22.50	0.00		581.99
* Heavy-liquid service														
Valves														
* Gas/vapor service	13.60	0.00	2.00	0.00	75	0.17	22.50	0.00	25	4.00	22.50	0.00		
* Light-liquid service	8.50	5.19	2.00	4.88	75	0.17	22.50	13.75	25	4.00	22.50	109.80		
* Heavy-liquid service														
Connectors														
* Flanges - gas/vapor	3.90	0.00	0.50	0.00	75	0.17	22.50	0.00	25	2.00	22.50	0.00		
* Flanges - light liquid	3.90	12.68	0.50	1.63	75	0.17	22.50	4.58	25	2.00	22.50	18.28		
* Flanges -heavy liquid														
Pressure Relief Devices														
* Disks		0.00		0.00										0.00
* Disk holders, valves,etc.		0.00		0.00										0.00
Open-ended Valves		0.00		0.00										44.88
Sampling Connections		0.00		0.00										163.60
Compressor Vent		0.00		0.00										0.00
Replacement Pump Seals														
Monitoring Device														0.00
Monitoring Device - Rent														
Data Collection System														0.00
Administrative and Reports													2217.00	
Planning and Training														
Data Entry - Initial														
Data Entry - Subsequent														
TOTALS								1473.31				128.08	2217.00	790.47

Batch SOCMI Program

Type of Component	Number of Components	Initial Monitoring Fee or Unit Cost ($/comp)	Initial LDAR Costs ($/yr) (Capital)	Initial LDAR Admin. Costs	Frequency of Monitoring (times/yr)	Subsequent Monitoring Fee ($/comp) or Charge (%)	Annual Monitoring Costs ($/yr)	Annual Maintenance Costs ($/yr)
Pump Seals								
* Light-liquid service	8	3.75	245.42		12	3.75	438.00	305.86
* Heavy-liquid service	5							
Valves								
* Gas/vapor service		0.75	0.00		4	0.75	0.00	
* Light-liquid service	61	0.75	112.78		4	0.75	183.00	
* Heavy-liquid service	68							
Connectors								
* Flanges - gas/vapor		0.75	0.00		1	0.75	0.00	
* Flanges - light liquid	325	0.75	314.62		1	0.75	243.75	
* Flanges -heavy liquid								
Pressure Relief Devices								
* Disks		78.00	0.00		1	2.00	0.00	0.00
* Disk holders, valves,etc.	0	3852.00	0.00		1	5.00		0.00
Open-ended Valves	11	102.00	1122.00			5.00		56.10
Sampling Connections	10	409.00	4090.00			5.00		204.50
Compressor Vent		6242.00	0.00			5.00		0.00
Replacement Pump Seals	8	180.00	107.71					
Monitoring Device - Buy		6500.00	0.00					0.00
Monitoring Device - Rent	0							
Data Collection System	0	1200.00	0.00					
Number of Monitoring Systems: 12 **Number of Subcategories: 1**								
Administrative and Reports	46	36.95						
Planning and Training	183	36.95		6761.85				
Data Entry - Initial	0	1.88	0.00					
Data Entry - Subsequent	0	0.75					0.00	
TOTALS			5992.53	6761.85			864.75	566.46

Capital Costs	5,993
Annualized Capital Costs	1,822
Annual Expenses	4,235
Annual Fixed Costs ($/yr)	3,975
Annual Variable Costs ($/yr)	2,083

Att. 2-3

Batch SOCMI Program
(continued)

Type of Component	Initial Monitoring Fee or Unit Cost ($/comp)	Initial Leak Frequency (%)	Initial Number of Leaks	Subsequent Leak Frequency (%)	Annual Number of Leaks	Percent Repaired OnLine	Repair Time (hours)	Labor Charge ($/hr)	Annual OnLine Leak Repair Cost ($/yr)	Percent Requiring Further Repair	Repair Time (hours)	Labor Charge ($/hr)	Annual Offline Leak Repair Cost ($/yr)	Annual Admin. Cost ($/yr)	Annual Misc. Charges ($/yr)
Pump Seals															
* Light-liquid service		7.48	0.60	1.77	1.70	100	16.00	22.50	611.71	0	80.00	22.50	0.00		244.68
* Heavy-liquid service															
Valves															
* Gas/vapor service		7.48	0.00	2.33	0.00	75	0.17	22.50	0.00	25	4.00	22.50	0.00		
* Light-liquid service		4.34	2.65	0.54	1.32	75	0.17	22.50	3.71	25	4.00	22.50	29.65		
* Heavy-liquid service															
Connectors															
* Flanges - gas/vapor		1.55	0.00	0.138	0.00	75	0.17	22.50	0.00	25	2.00	22.50	0.00		
* Flanges - light liquid		1.55	5.04	0.138	0.45	75	0.17	22.50	1.26	25	2.00	22.50	5.05		
* Flanges -heavy liquid															
Pressure Relief Devices															
* Disks			0.00												0.00
* Disk holders, valves, etc.			0.00												0.00
Open-ended Valves			0.00												44.88
Sampling Connections			0.00												163.60
Compressor Vent			0.00												0.00
Replacement Pump Seals															
Monitoring Device - Buy															0.00
Monitoring Device - Rent															
Data Collection System															0.00
Administrative and Reports														1699.70	
Planning and Training															
Data Entry - Initial															
Data Entry - Subsequent															
TOTALS									616.69				34.69	1699.70	453.16

Continuous SOCMI Program

Type of Component	Number of Components	Initial Monitoring Fee or Unit Cost ($/comp)	Initial LDAR Costs ($/yr) (Capital)	Initial LDAR Admin. Costs	Frequency of Monitoring (times/yr)	Subsequent Monitoring Fee ($/comp) or Charge (%)	Annual Monitoring Costs ($/yr)	Annual Maintenance Costs ($/yr)
Pump Seals								
* Light-liquid service	12	3.75	368.14		12	3.75	657.00	458.78
* Heavy-liquid service	8							
Valves								
* Gas/vapor service	44	0.75	116.33		4	0.75	132.00	
* Light-liquid service	526	0.75	972.47		4	0.75	1578.00	
* Heavy-liquid service	133							
Connectors								
* Flanges - gas/vapor		0.75	0.00		1	0.75	0.00	
* Flanges - light liquid	1,067	0.75	1032.92		1	0.75	800.25	
* Flanges -heavy liquid								
Pressure Relief Devices								
* Disks	1	78.00	78.00		1	2.00	2.00	3.90
* Disk holders, valves, etc.	1	3852.00	3852.00		1	5.00		192.60
Open-ended Valves	156	102.00	15912.00			5.00		795.60
Sampling Connections	39	409.00	15951.00			5.00		797.55
Compressor Vent		6242.00	0.00			5.00		0.00
Replacement Pump Seals	12	180.00	161.57					
Monitoring Device - Buy		6500.00	0.00					0.00
Monitoring Device - Rent	0							
Data Collection System	0	1200.00	0.00					
Number of Monitoring Days: 12								
Number of Subcategories: 1								
Administrative and Reports	46	36.95						
Planning and Training	183	36.95		6761.85				
Data Entry - Initial	0	1.88	0.00					
Data Entry - Subsequent	0	0.75					0.00	
TOTALS			38444.42	6761.85			3169.25	2248.43

Capital Costs	38,444	
Annualized Capital Costs	6,436	
Annual Expenses	10,246	
Annual Fixed Costs ($/yr)		9,934
Annual Variable Costs ($/yr)		6,747

Att. 2-5

Continuous SOCMI Program
(continued)

Type of Component	Initial Leak Frequency (%)	Initial Number of Leaks	Subsequent Leak Frequency (%)	Annual Number of Leaks	Percent Repaired OnLine	Repair Time (hours)	Labor Charge ($/hr)	Annual OnLine Leak Repair Cost ($/yr)	Percent Requiring Further Repair	Repair Time (hours)	Labor Charge ($/hr)	Annual Offline Leak Repair Cost ($/yr)	Annual Admin. Cost ($/yr)	Annual Misc. Charges ($/yr)
Pump Seals														
* Light-liquid service	7.48	0.90	1.77	2.55	100	16.00	22.50	917.57	0	80.00	22.50	0.00		367.03
* Heavy-liquid service														
Valves														
* Gas/vapor service	7.48	3.29	2.33	4.10	75	0.17	22.50	11.56	25	4.00	22.50	92.27		
* Light-liquid service	4.34	22.83	0.54	11.36	75	0.17	22.50	32.02	25	4.00	22.50	255.64		
* Heavy-liquid service														
Connectors														
* Flanges - gas/vapor	1.55	0.00	0.138	0.00	75	0.17	22.50	0.00	25	2.00	22.50	0.00		
* Flanges - light liquid	1.55	16.54	0.138	1.47	75	0.17	22.50	4.15	25	2.00	22.50	16.57		
* Flanges -heavy liquid														
Pressure Relief Devices														
* Disks		0.00												3.12
* Disk holders, valves, etc.		0.00												154.08
Open-ended Valves		0.00												636.48
Sampling Connections		0.00												638.04
Compressor Vent		0.00												0.00
Replacement Pump Seals														
Monitoring Device - Buy														0.00
Monitoring Device - Rent														
Data Collection System														0.00
Administrative and Reports													1699.70	
Planning and Training														
Data Entry - Initial														
Data Entry - Subsequent														
TOTALS								965.29				364.47	1699.70	1798.75

HON Program Model Process – Continuous

Type of Component	Number of Components	Initial Monitoring Fee or Unit Cost ($/comp)	Initial LDAR Costs ($/yr) (Capital)	Initial LDAR Admin. Costs	Frequency of Monitoring (times/yr)	Subsequent Monitoring Fee ($/comp) or Charge (%)	Annual Monitoring Costs ($/yr)	Annual Maintenance Costs ($/yr)
Pump Seals								
* Light-liquid service	12	3.75	449.78		12	6.75	1089.00	1132.15
* Heavy-liquid service	8							
Valves								
* Gas/vapor service	44	0.75	199.46		4	0.75	132.00	2.64
* Light-liquid service	526	0.75	1638.25		4	0.75	1578.00	31.56
* Heavy-liquid service	133							
Connectors								
* Flanges - gas/vapor		0.75	0.00		1	0.75	0.00	0.00
* Flanges - light liquid	1,067	0.75	1489.70		1	0.75	800.25	4.00
* Flanges -heavy liquid								
Pressure Relief Devices								
* Disks	1	78.00	78.00		1	2.00	2.00	3.90
* Disk holders, valves, etc.	1	3852.00	3852.00		1	5.00		192.60
Open-ended Valves	156	102.00	15912.00			5.00		795.60
Sampling Connections	39	409.00	15951.00			5.00		797.55
Compressor Vent		6242.00	0.00			5.00		0.00
Replacement Pump Seals	12	180.00	202.39					
Monitoring Device	0	6500.00	0.00					0.00
Monitoring Device - Rent	0						0.00	
Data Collection System	0	1200.00	0.00					
Number of Subcategories: 1								
Administrative and Reports	60	36.95						
Planning and Training	200	36.95		7390.00				
Data Entry - Initial	0	1.88	0.00					
Data Entry - Subsequent	0	0.75					0.00	
TOTALS			39772.59	7390.00			3601.25	2960.00

Capital Costs w/o OVA and Train	39,773	
Annualized Capital Costs	6,726	
Annual Expenses	14,495	
Annual Fixed Costs ($/yr)		11,247
Annual Variable Costs ($/yr)		9,973

Att. 2-7

HON Program Model Process – Continuous
(continued)

Type of Component	Initial Leak Frequency (%)	Initial Number of Leaks	Subsequent Leak Frequency (%)	Annual Number of Leaks	Percent Repaired OnLine	Repair Time (hours)	Labor Charge ($/hr)	Annual OnLine Leak Repair Cost ($/yr)	Percent Requiring Further Repair	Repair Time (hours)	Labor Charge ($/hr)	Annual Offline Leak Repair Cost ($/yr)	Annual Admin. Cost ($/yr)	Annual Misc. Charges ($/yr)
Pump Seals														
* Light-liquid service	9.37	1.12	4.21	6.06	100	16.00	22.50	2182.46	0	80.00	22.50	0.00		872.99
* Heavy-liquid service														
Valves														
* Gas/vapor service	13.60	5.98	2.00	3.52	75	0.17	22.50	9.92	25	4.00	22.50	79.20		
* Light-liquid service	8.50	44.71	2.00	42.08	75	0.17	22.50	118.59	25	4.00	22.50	946.80		
* Heavy-liquid service														
Connectors														
* Flanges - gas/vapor	3.90	0.00	0.50	0.00	75	0.17	22.50	0.00	25	2.00	22.50	0.00		
* Flanges - light liquid	3.90	41.61	0.50	5.34	75	0.17	22.50	15.03	25	2.00	22.50	60.02		
* Flanges -heavy liquid														
Pressure Relief Devices														
* Disks		0.00		0.00										3.12
* Disk holders, valves, etc.		0.00		0.00										154.08
Open-ended Valves		0.00		0.00										636.48
Sampling Connections		0.00		0.00										638.04
Compressor Vent		0.00		0.00										0.00
Replacement Pump Seals														
Monitoring Device														0.00
Monitoring Device - Rent														
Data Collection System														0.00
Administrative and Reports													2217.00	
Planning and Training														
Data Entry - Initial														
Data Entry - Subsequent														
TOTALS								2326.01				1086.02	2217.00	2304.71

ATTACHMENT 3

Data and Equations Used to Estimate Costs

TABLE 1. DATA FOR PUMPS, VALVES, AND CONNECTORS

Parameter	Monitoring Factor		
	Pumps	Valves	Connectors
Monitoring frequency	Monthly	Quarterly	Annually
Initial monitoring time, min/component	10	2	2
Subsequent monitoring time, min/component	10	2	2
Components repaired online, percent	100	75	75
Components repaired offline, percent		25	25
Repair time online, hr	16	0.17	0.17
Repair time offline, hr		4.0	2.0
HON Initial leak frequency, percent[a]	9.37	8.50	3.90
HON Subsequent leak frequency, percent[b]	4.21	2.00	0.50
VV Initial leak frequency, percent[a]	7.48	4.34	1.55
VV Subsequent leak frequency, percent[b]	1.77	0.54	0.138

[a] Calculated using SOCMI average emission factors in ALR equations (Table 5 in Reference 6) for appropriate leak definitions.

[b] Procedures used to develop the subsequent leak frequencies are described in the footnote to Table 1 in reference 5.

TABLE 2. MISCELLANEOUS COSTS AND COST FACTORS[a]

Parameter	Cost or cost factor	Comments
Initial equipment cost		
Control for open-ended lines	$102	Gate valve
Control for sampling connections	$409	Closed purge system
Pump seal replacement cost	$180	
Monitoring instrument cost		
OVA	$6,500	Per 7,000 components
Data Logger	$1,200	Per 7,000 components
Administrative and reporting		
HON	60 hr	
VV	46 hr	
Initial planning and training		
HON	200 hr	
VV	183 hr	
Labor costs		
Monitoring and repair	$22.50/hr	
Administrative, reporting, and training	$36.95/hr	Weighted average of technical ($33x1), secretarial ($15x0.1), and management ($49x0.05) burden
Capital recovery factor		
Pump replacement seals	0.244	5 years and 7% interest
All other initial costs	0.142	10 years and 7% interest

[a] All costs are in 1989 dollars.

TABLE 3. EQUATIONS USED IN COST ANALYSIS

Parameter	Equation
Initial number of leaks (all components)	(No. of components in model)x(initial leak frequency)
Annual monitoring cost	
Valves and connectors	(No. of components in model)x(monitoring time)x(monitoring frequency)x($22.50/hr)
Pumps[a]	(No. of components in model)x(monitoring time x monitoring frequency +0.5x60x52)x($22.50/hr)
Annual number of leaks (all components)	(No. of components in model)x(subsequent leak frequency)x(frequency of monitoring)
Annual online repair cost	(Annual number of leaks)x(percent repaired online)x(online repair time)x(repair labor rate)
Annual offline repair cost	(Annual number of leaks)x(percent repaired offline)x(offline repair time)x(repair labor rate)
Annual maintenance cost	
Pumps	(Annual number of leaks)x(pump seal replacement cost)
Open-ended lines and sampling connections	(Initial control equipment cost)x(0.05)
Annual miscellaneous charges	
Pumps	(Annual maintenance cost)x(0.8)
Open-ended lines and sampling connections	(Initial control equipment cost)x(0.04)
Data collection system	(Initial equipment cost)x(0.04)
Data entry costs	
Initial records	($1.88/component)x(Number of components in model)
Subsequent records (annual)	($0.75/component)x(Number of components in model)
Recovery credit	($200/ton)x(emission reduction, ton/yr)

[a] Includes weekly visual monitoring of 0.5 minute per pump.

ATTACHMENT 4

Access Module Used to Calculate Costs

```
Option Compare Database
Option Explicit

Public Sub LDARCost()
Dim dbs As Database
Dim rst As Recordset
Dim Batch_PP As Double              'Count of batch product process
Dim Cont_PP As Double               'count of continuous product process
Dim Component As Double             'number of components installed in each facility
Dim OVA As Long                     'number of OVA required for each facility
Dim OVACost As Long                 'cost for OVA required
Const HONContFC As Double = 39773   'continuous fixed cost for HON
Const HONBatchFC As Long = 6291     'batch fixed cost for HON
Const HONTrain As Long = 7390       'planing and training for HON
Const HONContCC As Long = 6726            'continuous annualized capital cost for HON
Const HONBatchCC As Long = 1956     'batch annualized capital cost for HON
Const HONContAnnExp As Long = 14495 'continuous annual expense for HON
Const HONBatchAnnExp As Long = 6782 'batch annual expense for HON
Dim HONTCI As Double                'total capital investment for HON
Dim HONTAC As Long                  'total annual cost for HON
Dim HONRC As Double                 'recovery credit for HON
Const VVContFC As Long = 38444      'continuous fixed cost for SubpartVV
Const VVBatchFC As Long = 5993      'batch fixed cost for SubpartVV
Const VVTrain As Double = 6761.85   'planing and training for SubpartVV
Const VVContCC As Long = 6436       'continuous annualized capital cost for SubpartVV
Const VVBatchCC As Long = 1822      'batch annualized capital cost for SubpartVV
Const VVContAnnExp As Long = 10246  'continuous annual expense for SubpartVV
Const VVBatchAnnExp As Long = 4235  'batch anual expense for SubpartVV
Dim VVTCI As Long                   'total capital investment for SubpartVV
Dim VVTAC As Long                   'total annual cost for SubpartVV
Dim VVRC As Double                  'recovery credit for SubpartVV
Dim ProType As String               'process type
Dim UnctrlEmis As Long              'HAP Uncontrolled emissions
Dim CtrlEmis As Long                'HAP controlled emissions
Dim TTCI As Long                    'total capital investment
Dim TTAC As Long                    'total annual cost
Dim RC As Long                      'total recovery credit
Dim Recovery As Double              'reduction in emission after applying LDAR
Dim LDAR As String                  'LDAR program
Dim MAC As Integer                  'MACT
Dim HAPRed As Double                'total hap reduction, lb/yr
Dim HONOandM As Double              'hon operating and maintenance cost
Const Mirror As Single = 0          'hon monitoring, reporting and recordkeeping
Dim HONCAR As Double                'hon annualized capital recovery
Dim RCHON As Double                 'hon recovery credit
Dim OandM As Double                 'operating and maintenance cost
'Const Mirror As Single = 0         'monitoring, recordkeeping and reporting cost
Dim CAR As Double                   'annualized capital cost
Dim VVOandM As Double               'VV operating and maintenance cost
'Const VVMirror As Single = 0       'VV monitoring, recordkeeping and reporting cost
Dim VVCAR As Double                 'VV annualized capital cost
Dim RCVV As Double                  'vv recovery credit
Dim MFID As String                  'master facility id
Dim OVAANN As Double                'Annualized OVA costs

Set dbs = CurrentDb
Set rst = dbs.OpenRecordset("LDAR for Batch & Continuous PP")

rst.MoveFirst

Do While Not rst.EOF

ProType = rst![ProcType]
UnctrlEmis = rst![LDAR Uncontrolled Emissions]
CtrlEmis = rst![LDAR Controlled Emissions]
Recovery = rst![Reduction]
```

```
LDAR = rst![LDAR Program]
MAC = rst![MACT]
Batch_PP = rst![BatchPP]
Cont_PP = rst![ContPP]
HAPRed = rst![Total HAP Reduction (lb/yr)]
MFID = rst![Master Facility ID]

Component = Batch_PP * (488) + Cont_PP * (1986)
OVA = Int(Component / 7000) + 1

If Batch_PP = 0 And Cont_PP = 0 Then
    OVACost = 0
    OVAANN = 0
Else
    OVACost = OVA * 7700 / (Batch_PP + Cont_PP)
    OVAANN = OVACost * 0.142 + (4588 * OVA) / (Batch_PP + Cont_PP)
                                                     '4588 is annual maintenance cost per
                                                     OVA
End If                                               '0.142 is the capital recovery
                                                     factor for
                                                     'the OVA assuming equipment life
                                                     'of 10 years

If MAC = 2 And ProType = "Batch" Then                '0.10 $/lb is salvage value
    HONRC = (0.72 - Recovery) * UnctrlEmis * 0.1
ElseIf MAC = 2 And ProType = "Continuous" Then
    HONRC = (0.69 - Recovery) * UnctrlEmis * 0.1
ElseIf MAC = 0 And ProType = "Batch" Then
    HONRC = 0.72 * UnctrlEmis * 0.1
ElseIf MAC = 0 And ProType = "Continuous" Then
    HONRC = 0.69 * UnctrlEmis * 0.1
End If

If (MAC = 2 Or MAC = 0) And ProType = "Continuous" Then
    HONTCI = HONTrain + (OVACost + HONContFC) * Cont_PP
    HONTAC = ((HONContCC + HONContAnnExp + OVAANN)) * Cont_PP - HONRC
    RCHON = HONRC
ElseIf (MAC = 2 Or MAC = 0) And ProType = "Batch" Then
    HONTCI = HONTrain + (OVACost + HONBatchFC) * Batch_PP
    HONTAC = ((HONBatchCC + HONBatchAnnExp + OVAANN) * Batch_PP) - HONRC
    RCHON = HONRC
ElseIf MAC = 1 Then
    HONTCI = 0
    HONTAC = 0
    RCHON = 0
End If

If MAC = 2 Then
    VVRC = Recovery * UnctrlEmis * 0.1          '0.10 $/lb is salvage value
Else
    VVRC = 0
End If

If MAC = 2 And ProType = "Continuous" Then
    VVTCI = VVTrain + (VVContFC + OVACost) * Cont_PP
    VVTAC = (VVContCC + VVContAnnExp + OVAANN) * Cont_PP - VVRC
    RCVV = VVRC
ElseIf MAC = 2 And ProType = "Batch" Then
    VVTCI = VVTrain + (VVBatchFC + OVACost) * Batch_PP
    VVTAC = (VVBatchCC + VVBatchAnnExp + OVAANN) * Batch_PP - VVRC
    RCVV = VVRC
Else
    VVTCI = 0
    VVTAC = 0
```

```
    RCVV = 0
End If

If MAC = 0 Then
    TTCI = HONTCI
    TTAC = HONTAC

ElseIf MAC = 2 Then
    TTCI = HONTCI - VVTCI
    TTAC = HONTAC - VVTAC
    RC = RCHON
 End If

rst.Edit

If HAPRed = 0 Then
    rst![HON_TCI] = 0
    rst![HON_TAC] = 0
    rst![VV_TCI] = 0
    rst![VV_TAC] = 0
    rst![TCI] = 0
    rst![TAC] = 0
    rst![O&M ($)] = 0
    rst![MRR ($)] = 0
    rst![ACR ($)] = 0
    rst![RC ($)] = 0

Else
    rst![HON_TCI] = HONTCI
    rst![HON_TAC] = HONTAC
    rst![VV_TCI] = VVTCI
    rst![VV_TAC] = VVTAC
    rst![TCI] = TTCI
    rst![TAC] = TTAC
    rst![O&M ($)] = TTAC - Mirror - (0.1098 * TTCI) + RC
    rst![MRR ($)] = Mirror
    rst![ACR ($)] = 0.1098 * TTCI
    rst![RC ($)] = RC

End If
rst.Update
rst.MoveNext
Loop
End Sub
```

MRI

MIDWEST RESEARCH INSTITUTE
Crossroads Corporate Park
5520 Dillard Road
Suite 100
Cary, North Carolina 27511-9232
Telephone (919) 851-8181
FAX (919) 851-3232

Date: July 31, 2000

Subject: Environmental and Energy Impacts for Chemical Manufacturing Facilities
Miscellaneous Organic NESHAP
EPA Project No. 95/08; MRI Project No. 104803.1.049

From: Jennifer Fields
David Randall

To: MON Project File

I. Introduction

The purpose of this memorandum is to present the environmental and energy impacts and the approach used to estimate the impacts for proposed regulatory alternatives that were developed for the national emissions standards for hazardous air pollutants (NESHAP) for the miscellaneous organic chemical manufacturing source category. The impacts that were estimated include: (1) primary air impacts; (2) secondary impacts, including air, water, and solid waste; and (3) fuel and electricity impacts. The impacts are presented for five types of emission points in the source category (process vents, equipment leaks, storage tanks, wastewater, and transfer operations).

II. Basis for Impacts Analysis

Regulatory alternatives (including the maximum achievable control technology [MACT] floor) for existing sources are described in detail in the MACT floor and regulatory alternatives memoranda.[1-5] In summary, components of the MACT floor were developed for each of the five emission points in the source category, and regulatory alternatives also were developed as appropriate. The control devices or other techniques assumed to be used to comply with the MACT floor or regulatory alternatives are summarized in Table 1.

III. Primary Impacts

Primary air impacts consist of the reduction in HAP emissions from the baseline level that is directly attributable to the regulatory alternative. The primary impacts for the miscellaneous organic chemical manufacturing source category are presented in Table 2. The uncontrolled emissions and baseline emissions are also shown in Table 2. The procedures used to estimate these emissions and emissions reductions are presented in previous memoranda.[1-6]

TABLE 1. ASSUMED CONTROL DEVICE OR APPROACH TO COMPLY WITH THE MACT FLOOR OR REGULATORY ALTERNATIVE

Emission source type	Control device or approach
Equipment leaks	LDAR program
Horizontal storage tanks	Condenser
Process vents	Thermal incinerator or flare, whichever has the lowest cost
Transfer operations	None[a]
Vertical storage tanks	Internal floating roof
Wastewater systems	Steam stripper

[a] Emissions are already controlled to level of MACT floor, and no regulatory alternative was developed.

TABLE 2. SUMMARY OF PRIMARY IMPACTS FOR CHEMICAL MANUFACTURING

Emission point	Uncontrolled emissions, Mg/yr	Baseline emissions, Mg/yr	Emission reductions from baseline, Mg/yr		
			MACT floor	Regulatory alternative	Proposed MACT
Process vents					
• Continuous vents	164,000	4,169	3,310	3,359	3,310
• Batch vents	29,980	7,088	6,290	6,435	6,290
Equipment leaks	23,347	20,576	13,788	N/A	13,788
Storage tanks	846	390	262	292	262
Wastewater	22,100	12,400	4,380	4,780	4,380
Transfer operations	N/A	N/A	0	N/A	0
TOTALS					28,000

IV. Secondary Environmental Impacts

Secondary environmental impacts consist of any adverse or beneficial environmental impacts other than the primary impacts described in Section III of this memorandum. The secondary impacts are indirect or induced air, water, or solid waste impacts that result from the operation of the control system that controls HAP emissions. Use of most control systems described in Section II of this memorandum will cause secondary air impacts; secondary water and solid waste impacts, however, are expected to be minimal. The secondary air, water, and solid waste impacts are discussed in the sections below.

A. Secondary Air Impacts

Secondary air impacts consist of: (1) generation of emissions as the byproducts of fuel combustion needed to operate the control devices and (2) reductions in emissions of VOC compounds. These secondary air impacts are discussed below.

Fuel combustion is necessary to maintain operating temperatures in incinerators, to produce steam for steam strippers, and to generate electricity for operating fans, pumps, and refrigeration units. Byproducts of fuel combustion include emissions of carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), and particulate matter less than 10 microns in diameter (PM_{10}).

Steam was assumed to be generated in small, natural gas-fired industrial boilers. Combustion control devices (incinerators and flares) also use natural gas as the auxiliary fuel. The estimated natural gas consumption rates are described in Section V of this memorandum. Emissions from combustion in both the boilers and the incinerators were estimated using AP-42 emission factors for small industrial boilers.[7]

Electricity was assumed to be generated at coal-fired utility plants built since 1978. The estimated electricity requirements, and the fuel energy needed to generate this electricity, are described in Section V of this memorandum. Utility plants built since 1978 are subject to the new source performance standards (NSPS) in subpart Da of 40 CFR Part 60.[8] These NSPS were used to estimate the PM_{10} and SO_2 emissions from coal combustion. The NO_X emissions were estimated using the AP-42 emission factor because the emission factor is lower than the level required by the NSPS.[9] The CO emissions were estimated using the AP-42 emission factor because the NSPS does not cover CO emissions.[9]

A summary of the estimated secondary air impacts that are generated for each of the five types of emission points in each source category is presented in Table 3. Secondary air impacts are generated from operation of thermal incinerators and flares for process vents, condensers for storage tanks, and steam strippers for wastewater streams. No secondary air impacts are associated with the use of floating roofs to control emissions from storage tanks or with the implementation of an LDAR program to control equipment leaks. Sample calculations are provided in Attachment 1.

In addition to the generation of emissions from fuel combustion for the operation of control devices, secondary air impacts also include the reduction of VOC emissions. The VOC compounds, which are precursors to ozone, include: (1) non-HAP VOC emissions and (2) HAP compounds that also are VOC compounds. The reduction of VOC achieved by the MACT floor and regulatory alternatives can not be quantified.

TABLE 3. SUMMARY OF SECONDARY AIR IMPACTS

Emission source type	Secondary air impacts, Mg/yr							
	MACT floor				Regulatory Alternative			
	CO^{a}	$NO_X{}^{b}$	$SO_2{}^{c}$	$PM_{10}{}^{d}$	CO^{a}	$NO_X{}^{b}$	$SO_2{}^{c}$	$PM_{10}{}^{d}$
Chemical manufacturing								
Equipment leaks	0	0	0	0	0	0	0	0
Process vents								
• Continuous vents	118.5	422.6	276.2	20.6	128.7	459.7	294.9	22.4
• Batch vents	48.7	173.5	113.6	8.5	57.4	203.3	140.9	10.0
Storage tanks	0.09	0.22	0.54	0.01	0.09	0.25	0.62	0.02
Transfer operations	0	0	0	0	0	0	0	0
Waste water	14.08	53.48	15.36	2.47	19.65	74.65	21.44	3.45

[a] The CO emissions were estimated using AP-42 emission factors of 5 lb/ton of coal and 35 lb/$10^6 ft^3$ of natural gas.
[b] The NO_X emissions were estimated using AP-42 emission factors of 13.7 lb NO_X/ton of coal and 140 lb $NO_X/10^6$ ft^3 of natural gas.
[c] The SO_2 emissions were estimated using the NSPS for coal-fired utility boilers of 1.2 lb $SO_2/10^6$BTU and the AP-42 emission factor of 0.6 lb $SO_2/10^6$ ft^3 of natural gas.
[d] The PM_{10} emissions were estimated using the NSPS for coal-fired utility boilers of 0.03 lb $PM_{10}/10^6$ BTU and the AP-42 emission factor of 6.2 lb $PM_{10}/10^6$ ft^3 of natural gas.

B. Secondary Water Impacts

Secondary water impacts are expected to be minimal. Scrubbers may be used to control process vents with a high halide content. However, because of the ease with which these emissions are controlled, this analysis assumes such emissions are already well controlled and that additional control will rarely be needed.

C. Secondary Solid Waste Impacts

Secondary solid waste impacts are expected to be minimal. At some plants, the overheads from a steam stripper (i.e., the mixture of steam and volatilized organic compounds may be a waste that needs to be disposed of). Other facilities, however, may be able to condense the overheads and return the condensed material to the process as either raw material or fuel. This analysis assumes the waste costs at some plants are balanced by the savings at other plants.

V. Energy Impacts

Energy impacts consist of the fuel usage and electricity needed to operate control devices that are used to comply with the regulatory alternatives. The estimated electricity and fuel impacts for each of the five types of emission points in each source category are presented in Table 4. In each case, the impacts are based on the total amount of electricity or fuel needed to operate the control devices; this approach overestimates the impacts because electricity and fuel needed for any existing, less efficient control devices are assumed to be negligible. The electricity and fuel impacts are discussed in detail in the subsections below.

TABLE 4. SUMMARY OF ENERGY IMPACTS

Emission source type	MACT floor						Regulatory Alternative					
	Increase in electricity use, kWh/yr	Increase in steam use, lb/yr	Increase in fuel energy, BTU/yr				Increase in electricity use, kWh/yr	Increase in steam use, lb/yr	Increase in fuel energy, BTU/yr			
			To generate electricity	Auxiliary fuel for incineration	To produce steam	Total			To generate electricity	Auxiliary fuel for incineration	To produce steam	Total
Chemicals manufacturing												
Equipment leaks	0	0	0	0	0	0	0	0	0	0	0	0
Process vents												
• Continuous	5.17e+07	3.66e+08	5.05e+11	4.35e+12	5.40e+11	5.39e+12	5.52e+07	4.11e+08	5.39e+11	4.75e+12	6.07e+11	5.89e+12
• Batch	2.13e+07	1.75e+08	2.08e+11	1.75e+12	2.59e+11	2.21e+12	2.64e+07	1.81e+08	2.58e+11	2.03e+12	2.68e+11	2.56e+12
Storage tanks	1.01e+05	0	9.91e+08	0	0	9.91e+08	1.16e+05	0	1.14e+09	0	0	1.14e+09
Transfer operations	0	0	0	0	0	0	0	0	0	0	0	0
Waste water	2.85e+06	5.04e+08	2.78e+10	0	7.45e+11	7.73e+11	3.98e+06	7.05e+08	3.89e+10	0	1.04e+12	1.08e+12
TOTAL	7.60e+07	1.05e+09	7.41e+11	6.09e+12	1.54e+12	8.37e+12	8.57e+07	1.30e+09	8.36e+11	6.78e+12	1.91e+12	9.53e+12

A. Electricity

Electricity would be needed to operate the control devices used to control emissions from process vents, storage tanks, and wastewater systems. As noted above, electricity was assumed to be generated in coal-fired boilers at utility plants. The amount of fuel required to generate the electricity was estimated using a heating value of 14,000 BTU/lb of coal and a power plant efficiency of 35 percent.

Specifically, electricity would be needed to operate the fans for the incinerators, and condensers; the refrigeration unit for condensers; and pumps for condensers and steam strippers. The power requirements for these devices were estimated using procedures outlined in the OAQPS Control Cost Manual and described in the MACT memoranda for each type of emission point.[1-6] No additional electricity would be needed to operate floating roofs for storage tanks or to implement an LDAR program for equipment leaks.

B. Fuel

Fuel would be needed to operate combustion control devices and to generate steam for steam strippers. In both cases, natural gas was assumed to be the fuel of choice. No additional fuel would be needed to operate condensers for process vents, to operate condensers or floating roofs for storage tanks, or to implement an LDAR program for equipment leaks. The fuel requirements for each control device are included in the control device cost algorithms, which can be found in the MACT memoranda for the emission point of interest.[1-6]

The amount of natural gas needed in incinerators was estimated using mass and energy balances around the incinerators. The operating temperature was assumed to be 871EC (1600EF). Energy losses were assumed to be equal to 10 percent of the total energy input. Additional details on the procedure are described in the OAQPS Control Cost Manual.[10]

The steam used in steam-assist flares that control process vent emissions, and the steam used in steam strippers that are used to treat wastewater streams, was assumed to be at 177EC (350EF) and 6.8 atm (100 psia). The enthalpy change was estimated to be 1,180 BTU/lb steam, assuming the feed water to the boiler is at 10EC (50EF). The energy required to generate the steam was estimated assuming a boiler efficiency of 80 percent. The quantity of natural gas needed to supply the energy was estimated assuming the heating value of natural gas is 1,000 BTU/standard cubic foot.

VI. References

1. Memorandum from J. Fields, B. Shine, and D. Randall, MRI, to MON Project File. June 2, 2000. Determination of TRE, MACT Floor, and Control Costs for Continuous Process Vents at Chemical Manufacturing Facilities.

2. Memorandum from D. Randall and J. Fields, MRI, to Miscellaneous Organic NESHAP Project File. December 10, 1999 (revised May 17, 2000). MACT Floor, Regulatory Alternative, and Impacts for Wastewater at Chemical Manufacturing Facilities.

3. Memorandum from D. Randall and J. Fields, MRI, to MON Project File. July 31, 2000. MACT Floor, Regulatory Alternatives, and Nationwide Impacts for Storage Tanks at Chemical Manufacturing Facilities.

4. Memorandum from B. Shine, North State Engineering, to MON Project File. July 31, 2000. MACT Floor, Regulatory Alternative, and Impacts for Equipment Leaks at Chemical Manufacturing Facilities.

5. Memorandum from B. Shine, North State Engineering and J. Fields, MRI, to MON Project File. July 31, 2000. MACT Floor, Regulatory Alternative, and Impacts for Batch Process Vents at Chemical Manufacturing Facilities.

6. Memorandum from B. Shine, North State Engineering, to MON Project File. March 28, 2000. MACT Floor, Regulatory Alternatives, and Nationwide Impacts for Transfer Operations at Chemical Manufacturing Facilities.

7. AP-42. 1995 Edition. pp. 1.4-3 and 1.4-4.

8. 40 CFR Part 60. Subpart Da..

9. AP-42. 1995 Edition. p. 1.1-3.

10. OAQPS Control Cost Manual. Fourth Edition. EPA 450/3-90-006. January 1990. p. 3-31 and 3-32.

ATTACHMENT 1

SAMPLE CALCULATIONS FOR PROCESS VENTS AT CHEMICAL MANUFACTURING FACILITIES

SAMPLE CALCULATIONS FOR PROCESS VENTS AT
CHEMICAL MANUFACTURING FACILITIES

A. Electricity used to run fans for process vent control devices (calculated using the cost algorithms in references 1 and 5):

- 2.127×10^7 kwh/yr for batch process vents
- 5.175×10^7 kwh/yr for continuous process vents

B. Fuel energy required to generate electricity (assuming electricity is generated in a coal-fired power plant that has an efficiency of 35 percent):

$$\text{Energy, Btu/yr} = \left(7.302 \times 10^7 \text{ kwh/yr}\right)\left(3{,}415 \text{ Btu/kwh}\right)\left(\frac{1}{0.35}\right)$$

$$= 7.12 \times 10^{11} \text{ Btu/yr}$$

C. Coal required to generate electricity:

$$\text{Coal, tons/yr} = \left(7.12 \times 10^{11} \text{ Btu/yr}\right)\left(\frac{1 \text{ lb coal}}{14{,}000 \text{ Btu}}\right)\left(\frac{1 \text{ ton}}{2{,}000 \text{ lb}}\right)$$

$$= 25{,}446 \text{ tons coal/yr}$$

D. Steam used in steam-assist flares (calculated using the cost algorithms in references 1 and 5):

- 1.754×10^8 lb steam/yr for batch process vents
- 3.664×10^8 lb steam/yr for continuous process vents

E. Fuel energy required to generate steam (assuming steam at 350EF and 100 psia is generated from water at 50EF in a boiler with an efficiency of 80 percent):

$$\text{Energy, Btu/yr} = \left(5.418 \times 10^8 \frac{\text{lb steam}}{\text{yr}}\right)\left(1{,}180 \frac{\text{Btu}}{\text{lb}}\right)\left(\frac{1}{0.8}\right)$$

$$= 7.99 \times 10^{11} \text{ Btu/yr}$$

F. Natural gas used to generate the steam:

$$\text{NG, scf/yr} = \left(7.99 \times 10^{11} \text{ Btu/yr}\right)\left(\frac{1 \text{ scf NG}}{1{,}000 \text{ Btu}}\right)$$

$$= 7.99 \times 10^8 \text{ scf NG/yr}$$

G. Auxiliary fuel (natural gas) used in combustion control devices (calculated using the cost algorithms in references 1 and 5):

- 1.747×10^9 scf/yr for batch process vents
- 4.348×10^9 scf/yr for continuous process vents

H. CO emissions (a similar calculation is used for NO_x emissions):

$$\text{CO, Mg/yr} = \left(\left(25{,}446\,\frac{\text{tons coal}}{\text{yr}}\right)\left(\frac{5\text{ lb CO}}{\text{ton coal}}\right) + \left(\frac{6.89\times10^{9}\text{ scf NG}}{\text{yr}}\right)\left(\frac{35\text{ lb CO}}{10^{6}\text{ scf NG}}\right)\right)\left(\frac{1\text{ Mg}}{2{,}204\text{ lb}}\right)$$

$$= 167.2\text{ Mg CO/yr}$$

I. SO_2 emissions (a similar calculation is used for PM_{10} emissions):

$$\text{SO}_2\text{, Mg/yr} = \left(\left(7.12\times10^{11}\,\frac{\text{Btu}}{\text{yr}}\right)\left(\frac{1.2\text{ lb SO}_2}{10^{6}\text{ Btu}}\right) + \left(\frac{6.89\times10^{9}\text{ scf NG}}{\text{yr}}\right)\left(\frac{0.6\text{ lb SO}_2}{10^{6}\text{ scf NG}}\right)\right)\left(\frac{1\text{ Mg}}{2{,}204\text{ lb}}\right)$$

$$= 390\text{ Mg SO}_2\text{/yr}$$