

Part 1: Introduction to Potential to Emit

The Potential to Emit Workbook: A practical Guide to Calculating and Evaluating Your Potential to Emit Air Contaminants was developed by the Michigan Department of Environmental Quality (DEQ), Air Quality Division (AQD) in collaboration with the Office of Environmental Assistance.

This publication is intended for guidance purposes only. Alternative methods to calculate your potential to emit (PTE) may be acceptable. Additionally, methods for calculating PTE from every industrial process are not contained in this workbook. If after reviewing this workbook you find you have additional specific questions relating to calculating PTE for your facility, feel free to contact the Office of Environmental Assistance at 800-662-9278.

How can this document help you?

The applicability of some air quality requirements is based upon a facility's PTE air pollutants. In order to determine whether or not your facility is subject to Air Quality rules and regulations, each facility must determine their PTE of air contaminants. The greater the PTE for your facility, the more likely you are subject to various Air Quality rules and regulations. This document will help you understand what PTE is, how it is calculated, and what air regulations may apply to you based on your facility's calculated PTE.

What is PTE?

The entire definition for PTE is contained in R 336.1116(n) or Rule 116(n) of the Michigan Air Pollution Control Rules (see Appendix A).

To put it simply, PTE is the maximum amount of air contaminants that your facility could emit if all of the following is evaluated:

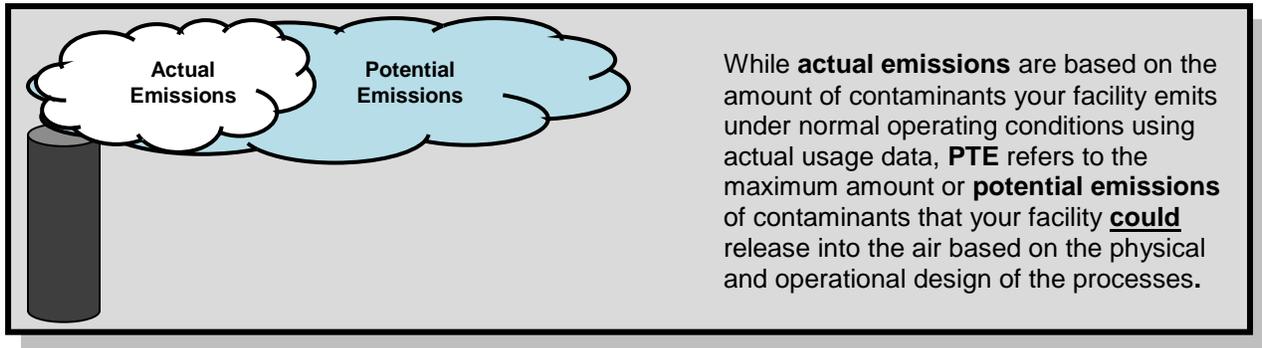
- each process is operated at 100% of its design capacity;
- each process is operated 24 hours/day, 365 days/year;
- the materials emitting the highest amount of air contaminants are used or processed; and
- air pollution control equipment either is not in use or is turned off.

The PTE Equation

PTE refers to the amounts of air contaminants that the facility could release into the air while operating at the maximum design capacity, with the highest polluting materials and operating 100% of the time. The standard equation used in calculating PTE for each air contaminant emitted from each process is:

$$\text{PTE} = (\text{maximum hourly emission rate of pollutant}) \times (8760 \text{ hours})$$

However, as you will see in Part 2 of this workbook, process bottlenecks, permit conditions, air quality rules, and compliance/enforcement documents may legally restrict the ability your facility has to emit air contaminants.



Why is a facility’s PTE used and not actual emissions when determining applicability?

Many state and federal rules governing air pollutants are based on a source’s PTE, not their actual emissions. PTE is an impartial way to categorize and regulate facilities by using consistent criteria that does not change unless new equipment is added or operational restrictions have changed. Actual emissions, on the other hand, can fluctuate from year-to-year due to changes in a facility’s production rates. Using PTE to determine applicability levels the playing field for all companies.

What pollutants?

The Clean Air Act (CAA) governs air pollutants based on whether the pollutants may have negative effects on human health and/or the environment. When calculating PTE, the focus is on three categories of pollutants (Table 1-1):

- *Regulated pollutants*
- *Hazardous air pollutants*
- *Other air pollutants*

Table 1-1: Air Pollutants

<u>Regulated Pollutants</u>
<ul style="list-style-type: none"> • Carbon Monoxide (CO) • Lead (Pb) • Ozone (O₃), including Volatile Organic Compounds (VOC) and Nitrogen Oxides (NO_x) - ozone precursors* • Nitrogen Oxides (NO_x) • Particulate Matter (PM) • Particulate Matter ≤ 10 microns in diameter (PM-10) • Particulate Matter ≤ 2.5 microns in diameter (PM 2.5) • Sulfur Dioxide (SO₂) • Green House Gases (GHGs)
<u>Hazardous Air Pollutants</u>
<p>Table 1-3 on page 1-5 contains the list of hazardous air pollutants (HAPs). Some HAPs are also considered VOCs and should be included in PTE calculations for both. HAPs that are in particulate form may also be counted as PM, PM10 and PM2.5.</p>

Table 1-1: Air Pollutants (continued)

<u>Other Air Pollutants</u>		
National Emission Standards for Hazardous Air Pollutants (NESHAP)		
<ul style="list-style-type: none"> • Arsenic • Asbestos • Beryllium • Benzene 	<ul style="list-style-type: none"> • Mercury • Radionuclides • Vinyl chloride 	
New Source Performance Standard (NSPS) Pollutants		
<ul style="list-style-type: none"> • Cadmium • Dioxin/furan • Fluorides** • Hydrogen chloride • Hydrogen sulfide** 	<ul style="list-style-type: none"> • Mercury • Nonmethane organic compounds • Reduced sulfur compounds • Sulfuric acid mist** 	<ul style="list-style-type: none"> • Total organic compounds • Total particulate matter • Total reduced sulfur**
Class I and Class II Pollutants		
<p>Title VI of the Clean Air Act Amendments of 1990 requires the phase-out of chlorofluorocarbons (CFCs) that deplete the ozone layer in the upper atmosphere (this is the “good” ozone that protects us from the sun’s harmful rays). These ozone depleting substances are divided into two classes, Class I and Class II air pollutants. Table 1-5 contains a list of these ozone depleting pollutants.</p>		

* Most facilities do not directly emit ozone. However, they may emit VOCs and NOx, which contribute to ground level ozone formation. A VOC is any compound of carbon or mixture of compounds of carbon that participates in photochemical reactions excluding the compounds listed in Table 1-5.

** Also considered to be a regulated pollutant under the Prevention of Significant Deterioration (PSD) Program. Questions about these four pollutants, contact the Office of Environmental Assistance at 800.662.9278.

What does it mean to be a major source of an air contaminant?

There are several programs that apply to specific categories of major sources, such as the Renewable Operating Permit Program (ROP or Title V Program), National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the Prevention of Significant Deterioration (PSD) Program. These programs have specific requirements that apply to sources that are considered major in that category. This workbook will be focusing specifically on the ROP or Title V program in which a major source would be defined as major under Title V. Table 1-2 lists some of the thresholds for determining whether your facility is a major or minor source of air contaminants and is subject to Title V, as well as some common processes that may generate those contaminants.

A facility with a calculated PTE at or above the thresholds listed in Table 1-2 is considered a **major** source of air contaminants under Title V. If the calculated PTE for the facility yields numbers below the thresholds, the facility would be considered a **minor** source of air contaminants. As a minor source, you may not have to meet certain requirements, or you may have requirements that are less stringent.

The requirements associated with being a major source under Title V are discussed in further detail in **Parts 3, 4 and 5** of this workbook. PSD sources are typically very large sources of air contaminants that have their own set of regulations. If you complete the steps to calculate your PTE in this workbook and your results indicate you may be a major source under PSD or another program contact your District Office or the Office of Environmental Assistance at 800-662-9278.

Table 1-2: Title V Major Source Emission Thresholds

Type of Pollutant	Major Source Threshold	Common Sources of Pollutant
PM	100 tons/year	Dusty activities such as grain handling, milling, sand and gravel operations
PM10	100 tons/year	Dusty activities such as grain handling, milling, sand and gravel operations
PM2.5	100 tons/year	Fuel burning activities
VOCs	100 tons/year	Solvent cleaning, painting, fuel storage and transfer
CO	100 tons/year	Fuel combustion
NOx	100 tons/year	Fuel combustion
SO ₂	100 tons/year	Fuel combustion
Lead (Pb)*	100 tons/year	Wave soldering, lead smelting and recycling
HAPs Any single HAP Any combination of HAPs	10 tons/year 25 tons/year	Solvent cleaning, painting, fuel storage and transfer * Lead compounds are considered HAPs
GHGs	75,000 – 100,000 tons/year on a Carbon Dioxide Equivalent (CO _{2e}) basis	Fuel Combustion
Any other regulated air contaminant	100 tons/year	



A facility that has the potential to emit 10 tons/year of any one hazardous air pollutant (HAP), 25 tons/year of any combination of HAPs, or 100 tons/year of any regulated air contaminant is considered a **major** source (see Table 1-2) and is subject to Title V of the Clean Air Act and are covered under the Renewable Operating Permit Program.

Table 1-3: Hazardous Air Pollutants (HAPs)

CAS No.	Chemical	CAS No.	Chemical	CAS No.	Chemical	CAS No.	Chemical
75070	Acetaldehyde	91941	3,3-Dichlorobenzidene	302012	Hydrazine	78875	Propylene dichloride (1,2-Dichloropropane)
60355	Acetamide	111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)	7647010	Hydrochloric acid	75558	1,2-Propylenimine (2-Methyl aziridine)
75058	Acetonitrile			7664393	Hydrogen fluoride (hydrofluoric acid)	91225	Quinoline
98862	Acetophenone	542756	1,3-Dichloropropene	123319	Hydroquinone	106514	Quinone
53963	2-Acetylaminofluorene	62737	Dichlorvos	78591	Isophorone	100425	Styrene
107028	Acrolein	111422	Diethanolamine	58899	Lindane (all isomers)	96093	Styrene oxide
79061	Acrylamide	21697	N,N-Diethyl aniline (N,N-Dimethylaniline)	108316	Maleic anhydride	1746016	2,3,7,8-Tetrachlorodibenzo p-dioxin
79107	Acrylic acid	64675	Diethyl sulfate	67561	Methanol	79345	1,1,2,2-Tetrachloroethane (Chloromethane)
107131	Acrylonitrile	119904	3,3-Dimethoxybenzidine	72435	Methoxychlor	127184	Tetrachloroethylene (Perchloroethylene)
107051	Allyl chloride	60117	Dimethyl aminoazobenzene	74839	Methyl bromide (Bromomethane)	7550450	Titanium tetrachloride
92671	4-Aminobiphenyl	119937	3,3-Dimethyl benzidine	74873	Methyl chloride (Chloromethane)	108883	Toluene
62533	Aniline	79447	Dimethyl carbamoyl chloride	71556	Methyl chloroform (1,1,1-Trichloroethane)	95807	2,4-Toluene diamine
90040	o-Anisidine	68122	Dimethyl formamide	60344	Methyl hydrazine	584849	2,4-Toluene diisocyanate
1332214	Asbestos	57147	1,1 Dimethyl hydrazine	74884	Methyl iodide (Iodomethane)	95534	o-Toluidine
71432	Benzene	131113	Dimethyl phthalate	108101	Methyl isobutyl ketone (Hexone)	8001352	Toxaphene (chlorinated camphene)
92875	Benzidine	77781	Dimethyl sulfate	624839	Methyl isocyanate	120821	1,2,4-Trichlorobenzene
98077	Benzotrichloride	534521	4,6-Dintro-o-cresol, and salts	80626	Methyl methacrylate	79005	1,1,2-Trichloroethane
100447	Benzyl chloride	51285	2,4-Dinitrophenol	1634044	Methyl tert butyl ether	79016	Trichloroethylene
92524	Biphenyl	121142	2,4-Dinitrotoluene	101144	4,4-Methylene bis (2-chloroaniline)	95954	2,4,5-Trichlorophenol
117817	Bis (2-ethylhexyl) phthalate (DEHP)	123911	1,4-Dioxane (1,4-Diethyleneoxide)	75092	Methylene chloride (Dichloromethane)	88062	2,4,6-Trichlorophenol
542881	Bis (chloromethyl) ether	122667	1,2-Diphenylhydrazine	101688	Methylene diphenyl diisocyanate (MDI)	121448	Triethylamine
75252	Bromoform	106898	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	101779	4,4'-methyleneedianiline	1582098	Trifluralin
106990	1,3-Butadiene	106887	1,2-Epozybutane	91203	Naphtalene	540841	2,2,4-Trimethylpentane
156627	Calcium cyanamide	140885	Ethyl acrylate	98953	Nitrobenzene	108054	Vinyl acetate
133062	Captan	100414	Ethyl benzene	92933	4-Nitrobiphenyl	593602	Vinyl bromide
63252	Carbaryl	51796	Ethyl carbamate (Urethane)	100027	4-Nitrophenol	75014	Vinyl chloride
75150	Carbon disulfide	75003	Ethyl chloride (Chloroethane)	79469	2-Nitropropane	75354	Vinylidene chloride (1,1 Dichloroethylene)
56235	Carbon tetrachloride	106934	Ethylene dibromide (Dibromoethane)	684935	N-Nitroso-N-methylurea	1330207	Xylenes (isomers and mixtures)
463581	Carbonyl sulfide	107062	Ethylene dichloride (1,2-Dichloroethane)	62759	N-Nitrosodimethylamine	95476	o-Xylenes
120809	Catechol	107211	Ethylene glycol	59892	N-Nitrosomorpholine	108383	m-Xylenes
133904	Chloramben	151564	Ethylene imine (Aziridine)	56382	Parathion	106423	p-Xylenes
57749	Chlordane	75218	Ethylene oxide	82688			
7782505	Chlorine	96457	Ethylene thiourea	87865	Pentachlorophenol		COMPOUNDS
79118	Chloroacetic acid	75343	Ethylidene dichloride (1,1-Dichloroethane)	108952	Phenol		Antimony compounds
532274	2-Chloroacetophenone	50000	Formaldehyde	106503	p-Phenylenediamine		Arsenic compounds (inorganic including arsine)
108907	Chlorobenzene	76448	Heptachlor	75445	Phosgene		Beryllium compounds
510156	Chlorobenzilate	118741	Hexachlorobenzene	7803512	Phosphine		Cadmium compounds
67663	Chloroform	87683	Hexachlorobutadiene	7723140	Phosphorus		Chromium compounds
107302	Chloromethyl methyl ether	77474	Hexachlorocyclo pentadiene	85449	Phthalic anhydride		Cobalt compounds
126998	Chloroprene	67721	Hexachloroethane	1336363	Polychlorinated biphenyls (Aroclors)		Coke oven emissions
1319773	Cresols/Cresylic acid (isomers and mixtures)	822060	Hexamethylene-1,6-diisocyanate	1120714	1,3-Propane sultone		Cyanide compounds
95487	o-Cresol	680319	Hexamethyl phosphoramidate	57578	beta-Propiolactone		Fine mineral fibers
108394	m-Cresol	110543	Hexane	123386	Propionaldehyde		Glycol ethers*
106445	p-Cresol			114261	Propoxur (Baygon)		Lead compounds
98828	Cumene			75569	Propylene oxide		Manganese compounds
94757	2,4-D, salts and esters						Mercury compounds
3547044	DDE						Nickel compounds
334883	Diazomethane						Polycyclic organic matter
132649	Dibenzofurans						Radionuclides (including radon)
96128	1,2-Dibromo-3-chloropropane						Selenium compounds
84742	Dibutylphthalate						
106467	1,4-Dichlorobenzene(p)						

*Note: Ethylene glycol mono-butyl ether (EGBE) was removed from the HAP list in December 2004. Methyl ethyl ketone (MEK, 2-Butanone) was removed from the HAP list in December 2005.

Table 1-4: Class I and Class II Ozone Depleting Substances

Class I Substances	Class II Substances	
<p>Group I: chlorofluorocarbon-11 (CFC-11) chlorofluorocarbon-12 (CFC-12) chlorofluorocarbon-113 (CFC-113) chlorofluorocarbon-114 (CFC-114) chlorofluorocarbon-115 (CFC-115)</p> <p>Group II: halon-1211 halon-1301 halon-2402</p> <p>Group III: chlorofluorocarbon-13 (CFC-13) chlorofluorocarbon-111 (CFC-111) chlorofluorocarbon-112 (CFC-112) chlorofluorocarbon-211 (CFC-211) chlorofluorocarbon-212 (CFC-212) chlorofluorocarbon-213 (CFC-213) chlorofluorocarbon-214 (CFC-214) chlorofluorocarbon-215 (CFC-215) chlorofluorocarbon-216 (CFC-216) chlorofluorocarbon-217 (CFC-217)</p> <p>Group IV: carbon tetrachloride</p> <p>Group V: methyl chloroform</p>	hydrochlorofluorocarbon-21 (HCFC-21) hydrochlorofluorocarbon-22 (HCFC-22) hydrochlorofluorocarbon-31 (HCFC-31) hydrochlorofluorocarbon-121 (HCFC-121) hydrochlorofluorocarbon-122 (HCFC-122) hydrochlorofluorocarbon-123 (HCFC-123) hydrochlorofluorocarbon-124 (HCFC-124) hydrochlorofluorocarbon-131 (HCFC-131) hydrochlorofluorocarbon-132 (HCFC-132) hydrochlorofluorocarbon-133 (HCFC-133) hydrochlorofluorocarbon-141 (HCFC-141) hydrochlorofluorocarbon-142 (HCFC-142) hydrochlorofluorocarbon-221 (HCFC-221) hydrochlorofluorocarbon-222 (HCFC-222) hydrochlorofluorocarbon-223 (HCFC-223) hydrochlorofluorocarbon-224 (HCFC-224) hydrochlorofluorocarbon-225 (HCFC-225) hydrochlorofluorocarbon-226 (HCFC-226) hydrochlorofluorocarbon-231 (HCFC-231) hydrochlorofluorocarbon-232 (HCFC-232) hydrochlorofluorocarbon-233 (HCFC-233) hydrochlorofluorocarbon-234 (HCFC-234) hydrochlorofluorocarbon-235 (HCFC-235)	hydrochlorofluorocarbon-241 (HCFC-241) hydrochlorofluorocarbon-242 (HCFC-242) hydrochlorofluorocarbon-243 (HCFC-243) hydrochlorofluorocarbon-244 (HCFC-244) hydrochlorofluorocarbon-251 (HCFC-251) hydrochlorofluorocarbon-252 (HCFC-252) hydrochlorofluorocarbon-253 (HCFC-253) hydrochlorofluorocarbon-261 (HCFC-261) hydrochlorofluorocarbon-262 (HCFC-262) hydrochlorofluorocarbon-271 (HCFC-271)

Table 1-5: Compounds Not Considered VOCs

<ul style="list-style-type: none"> • Carbon monoxide • Carbon dioxide • Carbonic acid • Metallic carbides or carbonates • Boron carbide • Silicon carbide • Ammonium carbonate • Ammonium bicarbonate • Methane • Ethane • Methyl chloroform* • Acetone • Cyclic, branched, or linear completely methylated siloxanes • Parachlorobenzotrifluoride • Perchloroethylene • Trichlorofluoromethane (CFC-11) • Dichlorodifluoromethane (CFC-12) • 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113) • 1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114) • Chloropentafluoroethane (CFC-115) • 1,1-dichloro-1-fluoroethane (HCFC-141b) 	<ul style="list-style-type: none"> • 1 chloro-1,1-difluoroethane (HCFC-142b) • Chlorodifluoromethane (HCFC-22) • 1,1,1-trifluoro-2,2-dichloroethane (HCFC-123) • 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124) • Trifluoromethane (HFC-23) • Pentafluoroethane (HFC-125) • 1,1,2,2-tetrafluoroethane (HFC-134) • 1,1,1,2-tetrafluoroethane (HFC-134a) • 1,1,1-trifluoroethane (HFC-143a) • 1,1-difluoroethane (HFC-152a) • 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca) • 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb) • 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC 43-10mee) • Difluoromethane (HFC-32) • Ethyl fluoride (HFC-161) • 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) • 1,1,2,2,3-pentafluoropropane (HFC-245ca) • 1,1,2,3,3-pentafluoropropane (HFC-245ea) 	<ul style="list-style-type: none"> • 1,1,1,2,3-pentafluoropropane (HFC-245eb) • 1,1,1,3,3-pentafluoropropane (HFC-245fa) • 1,1,1,2,3,3-hexafluoropropane (HFC-236ea) • 1,1,1,3,3-pentafluorobutane (HFC365mfc) • Chlorofluoromethane (HCFC-31) • 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a) • 1-chloro-1-fluoroethane (HCFC-151a) • 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxybutane • 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane • 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane • 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane • Methyl acetate* • Methylene chloride* • Perfluorocarbon compounds* • Tertiary butyl acetate • Other compounds in materials other than surface coatings that have a vapor pressure ≤ 0.1 mm Hg at the temperature at which they are used.
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*Refer to Rule 122(f) for more information about this compound