TSD APPENDIX
POTENTIAL TO EMIT-EMISSION INVENTORY
For
Thurston Manufacturing Company
Draft Synthetic Minor Source Permit

An emissions inventory generally reflects either the "actual" or "potential" emissions from a source. Actual emissions generally represent a specific period of time and are based on actual operation and controls. Potential emissions, referred to as potential to emit (PTE), generally represent the maximum capacity of a source to emit a pollutant under its physical and operational design, taking into consideration regulatory restrictions, but only required control devices. PTE is often used to determine applicability to several EPA programs, including Title V, PSD and CAA Section 112 MACT.

The equation below represents the general technique for estimating emissions (in tons per year or "tpy") from each emission unit at the facility. Emissions are calculated by multiplying an emission factor by an operational parameter. To estimate actual emissions, the permittee will need to track the actual operational rates. Note that emission factors may be improved over time.

E = EF x OP x K

Where:
E = pollutant emissions in tons per year (tpy)
EF = emission factor
OP = operational rate (or capacity for PTE)
K = 1 ton/2000 lbs. for conversion from pounds per year to tpy

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Emission Unit: Paint Booth *EU-1-PB*

Activity: Primer, Top Coat & Solvent Application
Type of Coating Sprayer: HPLV Guns
Maximum Hourly Paint Use: 21 gals./hour
Maximum Yearly Paint Use: 183,960 gals./year (21 gals./hour x 8760 hours/year)

Uncontrolled PTE Emissions inventory for Spray Paint Booth

Pollutant	**Uncontrolled** Emission Factor *(lb./gal)*	Maximum Operation *(gallons/year)*	**Uncontrolled** PTE *(tons per year)*
PM	1.145	183,960	**105.3**
PM_{10}	1.145	183,960	**105.3**
$PM_{2.5}$	1.145	183,960	**105.3**
VOC	5.65	183,960	**519.7**
Xylene	3.03	183,960	**278.7**
Ethyl benzene	0.510	183,960	**46.91**
Toluene	0.291	183,960	**26.77**
Naphthalene	0.249	183,960	**22.90**
Hexane	0.176	183,960	**16.19**
Methanol	0.141	183,960	**12.93**
Total HAP	4.40	183,960	**404.4**

Uncontrolled *Emissions Factor References*

PM Average of highest Solids weights for Primer, Top Coat and Solvent used per data received in 2013:

QAP 581 (Primer) + Q900BL413 Jet Blue Polyurethane (Top Coat) + MEK (Solvent)
[(10.7 lbs./gal x 0.5869 Solid) + (10.35 lbs./gal x 0.72 Solid) + 6.71 lbs./gal x 0 Solid)**] ÷ 3** =
[6.28 lbs./gal + 7.45 lbs./gal + 0] ÷ 3 = **4.58 lbs./gal**

Control Efficiency = 0 (without control equipment)
Solids transfer efficiency for HVLP Painting = 0.75

PM Uncontrolled EF Calculation:

Average of Solids weights x (1-Control Efficiency) x (1-Transfer Efficiency) =
PM Uncontrolled EF = 4.58 lbs./gal x (1 **– 0**) x (1 - .75) = **1.145 lbs./gal**

PM_{10} Assumed to be same as for PM
$PM_{2.5}$ Assumed to be same as for PM
CO No known emissions of this pollutant from this source category.
NOx No known emissions of this pollutant from this source category.
SO_2 No known emissions of this pollutant from this source category.
Lead No known emissions of this pollutant from this source category.

VOC **VOC EF Calculation:** Average of highest **VOC** weights for Primer, Top Coat and Solvent used:
QAP582 (Primer) + DM19126/05 (Top Coat) + MEK (Solvent)
[(11.6 * 0.4375) + (8.51 * 0.6085) + (6.68 * 100)]
VOC EF = [5.08 lbs./gal + 5.18 lbs./gal + 6.68 lbs./gal**] ÷ 3** = **5.65 lbs./gal**

HAP **Individual HAP EF Calculation:** Avg. of the highest **HAP** weights for Primer, Top Coat and Solvent used:

Xylene: QAP111/05 (Primer) + DM19126/05 (Top Coat) + PAS72651 (Solvent)
(9.68 * 0.40) + (8.51* 0.60) + (6.6 * 0.018)
Xylene EF = [3.87 lbs./gal + 5.11 lbs./gal + 0.119 lbs./gal]**] ÷ 3** = **3.03 lbs./gal**

Emission Unit: Paint Booth *EU-1-PB* - Continued

Ethyl Benzene: QAP111/05 (Primer) + DM19126/05 (Top Coat) + MEK (Solvent)
(9.68 * 0.07) + (8.51* 0.10) + (6.68 * 0.0)
Ethyl benzene EF = [0.678 + 0.851 + 0.0] ÷ 3 = **0.510 lbs./gal.**

Toluene: QAP111/05 (Primer) + DM19152/05 (Top Coat) + MEK (Solvent)
(9.68 * 0.01) + (7.76 * 0.10) + (6.68 * 0.0)
Toluene EF = [0.0968 + 0.776 + 0.0] **÷ 3** = **0.291 lbs./gal**

Naphthalene: (Primer) + DM19126/05 (Top Coat) + Aromatic 150 (Solvent)
(0.0) + (8.51* 0.01) + (6.68 * 0.099)
Naphthalene EF = [0.0 + 0.0851 + 0.661] **÷ 3** = **0.249 lbs./gal**

Hexane: (Primer) + (Top Coat) + PAS72651 (Solvent)
(0.0) + (0.0) + (6.6 * 0.08)
Hexane EF = [0.0 + 0.0 + 0.176] ÷ 3 = **0.176 lbs./gal**

Methanol: DM18998 (Primer) + (Top Coat) + PAS71251 (Solvent**)**
(9.18 * 0.01) + (0.0) + (6.6 * 0.05)
Methanol EF = [0.0918 + 0.0 + 0.33] ÷ 3 = **0.141 lbs./gal**

Total HAP EF Calculation: Xylene EF + Ethyl Benzene EF + Toluene EF + Naphthalene EF
Total HAP EF = **4.04 lbs./gal**

Controlled PM, PM_{10} and $PM_{2.5}$ PTE Emissions inventory for Spray Paint Booth

Control Equipment: Fabric Filters and Manometer
Control Efficiency: 90%

Pollutant	Controlled Emission Factor *(lb./gal)*	Maximum Operation *(gallons/year)*	Controlled PTE *(tons per year)*
PM	0.1145	183,960	1.053
PM_{10}	0.1145	183,960	1.053
$PM_{2.5}$	0.1145	183,960	1.053

Controlled PM, PM_{10} and $PM_{2.5}$ *Emissions Factor References*

PM Average of highest Solids weights for Primer, Top Coat and Solvent used per data received in 2013:
QAP 581 (Primer) + Q900BL413 Jet Blue Polyurethane (Top Coat) + MEK (Solvent)
[(10.7 lbs./gal x 0.5869 Solid) + (10.35 lbs./gal x 0.72 Solid) + 6.71 lbs./gal x 0 Solid)**] ÷ 3** =
[6.28 lbs./gal + 7.45 lbs./gal + 0] ÷ 3 = **4.58 lbs./gal**
Control Efficiency = 0.90 {per 2015 email: 0.90}
Solids transfer efficiency for HVLP Painting = 0.75

PM Controlled EF Calculation:
Average of Solids weights x (1-Control Efficiency) x (1-Transfer Efficiency) =
PM Controlled EF = 4.58 lbs./gal x (1 – **0.90**) x (1 - .75) = **0.1145 lbs./gal**

PM_{10} Assumed to be same as for PM
$PM_{2.5}$ Assumed to be same as for PM

Emission Unit: Plasma Cutting Table *EU-2-PCT* (installed 2014)

8' x 44'downdraft table with Mega Hornet 1000 CNC plasma cutting machine & HPR260XD Plasma Torch

POTENTIAL EMISSIONS - $PM_{2.5}$ / PM_{10} SCC: 30903008 Plasma Torch

Emission Factor Equation from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994 (http://www.epa.gov/ttnchie1/efdocs/welding.pdf)

Cutting Technique:	Dry		
Base Metal:	Mild Steel	(standard carbon steel)	
Metal Thickness:	0.5	inch	*{per 2015 emails: 0.5 inch}*
Kerf (width of cut):	0.188	inch	*{per 2015 emails: 0.188 inch}*
Metal Cutting Speed:	145	inch/min	*{per HPR260XD specs - Approx. Cutting Speed for ½ Inch Mild Steel: 145 ipm}*
Metal Density:	0.283	lb./in^3	*{**Reference Density of Mild Steel: 0.283 lbs./in^3**}*
Fume Generation:	5	% of particulate generated	
Hours of Operation:	8760	hours/year	
Control Efficiency	90	%	

Emission Factor (lbs./in) = Metal Density (lbs./in^3) x Metal Thickness (in) x Average Kerf (in) x Fume Generation
Emission Factor (lbs./in) = 0.0013295 lbs./inch

Metal Feed Rate (in/hr.) = Metal Travel Speed (in/min) x Number of plasma torch units x 60 min/hr.
Metal Feed Rate (in/hr.) = 8700 inches/hr.

Emissions (lbs./hr.) = Metal Feed Rate (in/hr.) x Emission Factor (lbs./inch) x Control Efficiency
Emissions (lbs./hr.) = 11.57 lbs./hr. **Uncontrolled**
= 1.157 lbs./hr. **Controlled**

Emissions = Emissions (lbs./hr.) x Hours of Operation (hrs./yr.) x Control Efficiency / 2000 lbs./ton
Emissions = 50.7 tons/yr. **Uncontrolled**
= 5.07 tons/yr. **Controlled**

<u>Estimated Actual</u> Emissions - $PM_{2.5}$ / PM_{10}

Metal Thickness:	0.5	inch	
Kerf (width of cut):	0.188	inch	
Metal Cutting Speed:	16.67	inch/min (1,000 in/hr.)	{Per May 2015 email: 1,000 in/hr.}
Metal Density:	0.283	lbs./in^3	*{**<u>Reference Density of Mild Steel:</u> 0.283 lbs./in^3**}*
Fume Generation:	5	% of particulate generated	
Total Metal Cut	1,000,200	inches/yr.	
Hours of Operation:	1000	hours/year	{per 2015 emails: 1,000 hours/yr.}
Control Efficiency	90	%	

$PM_{2.5}$ / PM_{10} Emission Factor (lbs./in) = Metal Density (lbs./in^3) x Metal Thickness (in) x Average Kerf (in) x Fume Generation
$PM_{2.5}$ / PM_{10} Emission Factor (lbs./in) = **0.00132951 lbs./inch**

Metal Feed Rate (in/hr.) = Metal Travel Speed (in/min) x Number of units x 60 min/hr.
Metal Feed Rate (in/hr.) = 1000.2 inches/hr.

$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = Metal Feed Rate (in/hr.) x Emission Factor (lbs./inch)
$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = 1.33 lbs./hr.

$PM_{2.5}$ / PM_{10} Emissions (ton/yr.) = Emissions (lbs./hr.) x Hours of Operation (hr./yr.) x Control Efficiency / 2000 lbs./ton
$PM_{2.5}$ / PM_{10} Emissions (ton/yr.) = 0.07 tons/year (based on <u>estimated actual</u> hours and speed)

Emission Unit: Plasma Cutting Table *EU-2-PCT* - Continued

8' x 44'downdraft table with Mega Hornet 1000 CNC plasma cutting machine & HPR260XD Plasma Torch

POTENTIAL EMISSIONS – Manganese (Mn) SCC: 30903008 Plasma Torch

Cutting Technique: Dry
Base Metal: Mild Steel (standard carbon steel)
Base Metal Mn content: 1.65 % weight {worst case Mn content for standard carbon steel}
Maximum Hours of Operation: 8760 hours/yr.
Control Efficiency: 90 %

Mn Emissions (lbs./hr.) = PM_{10} Emissions (lbs./hr.) * % weight Mn = 11.57 lbs./hr. * 0.0165 = 0.191 lbs./hr. **Uncontrolled**
= 1.157 lbs./hr. * 0.0165 = 0.0191 lbs./hr. **Controlled**

Mn Emissions (tons/yr.) = Mn Emissions (lbs./hr.) x 8,760 (hr./yr.) / 2000 lbs./ton = 0.8366 tons/yr. **Uncontrolled**
= 0.08366 tons/yr. **Controlled**

Estimated Actual Emissions – Manganese

Estimated Actual Mn Emissions = Estimated Actual $PM_{2.5}$/PM_{10} Emissions * % weight Mn = 1.33 lbs./hr. * 0.0165 = 0.022 lbs./hr.
= 0.07 tons/yr. * 0.0165 = 0.00116 tons/yr.

POTENTIAL EMISSIONS – NOx SCC: 30903008 Plasma Torch

Emission factor derived from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994
(http://www.epa.gov/ttnchie1/efdocs/welding.pdf)

NOx Emission Factor = 6.6 grams/minute (for mild steel; 8 mm (0.32 inch) plate thickness; 2 – 3 mm (0.08 - 0.12 inch) kerf; 2.7 - 4.5 meter/min (106 - 177 inch/ min) cutting speed; using dry cutting technique)

Cutting Technique: Dry
Base Metal: Mild Steel (standard carbon steel)
Metal Thickness: 0.5 inch ***{per 2015 emails: 0.5 inch}***
Kerf (width of cut): 0.188 inch ***{per 2015 emails: 0.188 inch}***
Metal Cutting Speed: 145 inch/min ***{per HPR260XD specs - Approx. Cutting Speed For ½ Inch Mild Steel: 145 ipm}***
Maximum Hours of Operation: 8760 hours/yr.
Control Equipment for NOx: None

NOx Emissions (lbs./hr.) = NOx Emission Factor * 60 min/hr. * 1 / 453.59 g/lbs. = **0.873 lbs./hr.**

NOx Emissions (tons/yr.) = NOx Emissions (lbs./hr.) * 8760 hours/year * ton/2000 lbs. = **3.82 ton/yr.**

Emission Unit: Shot Blast Machine *EU-3-SBM*

Make/Model:	Viking Corporation/MR-72108
Abrasive Type:	Steel Shot
No. Shot Valves for Blast Wheels:	12
Maximum Shot Valve Diameter:	2.25 inch
Maximum Shot Valve Pressure:	90 PSI
Maximum Shot Throughput:	79,000 tons/year = 1.58E+08 lbs./year = 18,040 lbs./hour = 0.1503 tons/minute
Control Equipment:	Cartridge Filter System (Dust Collector)
Control Efficiency:	99%

Pollutant	**Maximum Shot Throughput** *(ton/year)*	**<u>Uncontrolled</u> Emission Factor** *(lbs. of pollutant per ton of shot)*	**<u>Uncontrolled</u> PTE** *(ton/year)*	**<u>Controlled</u> Emission Factor**	**<u>Controlled</u> PTE** *(tons/year)*
PM	79,000	5.40	213.3	0.0540	2.13
PM_{10}	79,000	2.60	102.7	0.0260	1.03
$PM_{2.5}$	79,000	0.26	10.27	0.0026	0.103

PM, PM_{10}, $PM_{2.5}$ Emission Factors (EF):

Derived from AP-42 Table 13.2.6-1, 9/97, p.13.2.6-2 for abrasive blasting using sand (SCC 3-09-002-02)

Note: Reference 3 For AP-42 Section 13.2.6 indicates that total PM emissions from abrasive blasting using shot are about 10 percent of total PM emissions from abrasive blasting with sand.

EF for SCC 3-09-002-02 blasting using sand **x 10%** = EF for SCC 3-09-002-07 blasting using shot

PM EF = 2.7 lbs. PM/1000 lbs. shot x 10% x 2000 lbs./ton = 5.4 lbs. PM /ton of shot
PM_{10} EF = 1.3 lbs. PM_{10}/1000 lbs. shot x 10% x 2000 lbs./ton = 2.6 lbs. PM_{10} /ton of shot
$PM_{2.5}$ EF = 0.13 lbs. $PM_{2.5}$/1000 lbs. shot x 10% x 2000 lbs./ton = 0.26 lbs. $PM_{2.5}$ /ton of shot

<u>Controlled</u> PM, PM_{10}, $PM_{2.5}$ Emission Factor = <u>Uncontrolled</u> EF * [1 - control efficiency]
= <u>Uncontrolled</u> EF * 0.01

Emission Unit: Parts Washer *EU-4-PW*

Viking Model D72P – Pass-Through Production Spray-Cleaning Machine
- **with 200,000 BTU Natural Gas fired Heater:**

Maximum Heat Input:	0.2 MMBtu/hour
Heat Content of Natural Gas:	1,020 MMBtu/MMSCF
Potential Throughput:	0.0002 MMSCF/hour

Pollutant	Emission Factor *(lbs./MMSCF)*	Emission Rate *(lbs./hr.)*	Emission Rate *(tons/year)*
PM	1.9	3.73e-4	0.00163
PM_{10}	7.6	0.00149	0.00653
$PM_{2.5}$	7.6	0.00149	0.00653
SO_x	0.6	1.18e-4	5.15e-4
NO_x	100	0.0196	0.0859
CO	84	0.0165	0.0721
VOC	5.5	0.0011	0.00482
CO_2	119,227	23.38	102.4
N_2O	2.2	4.3e-4	1.89e-3
CH_4	0.22	4.3e-5	1.89e-4
GHGs (as Mass)	-	23.38	102.4
GHGs (as CO_2e)	-	23.51	103.0
Benzene	0.0021	4.2e-7	1.8e-6
Dichlorobenzene	0.0012	2.4e-7	1.1e-6
Formaldehyde	0.075	1.5e-5	6.6e-5
Hexane	1.8	3.6e-4	1.6e-3
Toluene	0.0034	6.8e-7	3.0e-6
Subtotal HAP - Organics	-	-	1.67e-3
Lead	0.0005	1.0e-7	4.4e-7
Cadmium	0.0011	2.2e-7	9.6e-7
Chromium	0.0014	2.8e-7	1.2e-6
Manganese	0.00038	7.6e-8	3.3e-7
Nickel	0.0021	4.2e-7	1.8e-6
Subtotal HAP - Metals	-	-	4.73e-6
TOTAL HAP			1.67E-03

Methodology
MMBtu = 1,000,000 Btu
MMCF = 1,000,000 Cubic Feet of Gas
Potential Throughput (MMCF/hr.) = Heat Input Capacity (MMBtu/hr.) x 8,760 hours/yr. x 1 MMCF/1,020 MMBtu
Emission (tons/yr.) = Throughput (MMCF/yr.) x Emission Factor (lbs./MMCF)/2,000 lbs./ton

Emission Factors are from AP 42, Chapter 1.4, Tables 1.4-1, 1.4-2, 1.4-3, SCC #1-02-006-02, 1-01-006-02, 1-03-006-02, and 1-03-006-03. The N2O Emission Factor for uncontrolled is 2.2. The N2O Emission Factor for low NOx burner is 0.64.

Global Warming Potentials (GWP) from Table A-1 of 40 CFR Part 98 Subpart A.
Emission (tons/yr.) = Throughput (MMCF/yr.) x Emission Factor (lbs./MMCF)/2,000 lbs./ton
CO2e (tons/yr.) based on 11/29/2013 federal GWPs= CO2 Potential Emission ton/yr. x CO2 GWP (1) + CH4 Potential Emission ton/yr. x CH4 GWP (25) + N2O Potential Emission ton/yr. x N2O GWP (298).

Emission Unit: Welding- Gas Metal Arc Welding (GMAW) *EU-5-GMAW*

SCC:	30905254 (GMAW w E70 electrode)
Manufacturer/Model:	Miller/Deltaweld 452
Number of Welding Units:	12
Per unit max wire/rod/electrode usage (lbs./hr.):	21.7
Total maximum hourly usage (lbs./hr.):	260.4
Control Efficiency (%):	0

Wire/ Rod/ Electrode	**Usage** lbs./yr.	**$PM_{2.5}$/ PM_{10} EF** lbs. /1,000 lbs.	**$PM_{2.5}$ /PM_{10}** tons /yr.	**Mn EF** lbs./ 1,000 lbs.	**Mn** tons/ yr.	**Ni EF** lbs./ 1,000 lbs.	**Ni** tons/ yr.	**Cr EF** lbs./ 1,000 lbs.	**Cr** tons/ yr.	**Cr-VI EF** lbs./ 1,000 lbs.	**Cr-VI** tons /yr.	**Co EF** lbs./ 1,000 lbs.	**Co** tons /yr.	**Pb EF** lbs./ 1,000 lbs.	**Pb** tons /yr.
GMAW - E70S	2,281,104	5.2	**5.931**	0.318	**0.363**	0.001	**0.001**	0.001	**0.001**	0.000	**0.000**	0.001	**0.001**	0.000	**0.000**

Note: Emission Factors (EF) for Welding Operations were taken from AP-42 Section 12.19, Tables 1 & 2

SCC:	30905212 (GMAW w E308 electrode)
Manufacturer/Model:	not specified *{observed onsite: Thermal Arc/Fabstar 4030}*
Number of Welding Units:	not specified {*assume 4*} *{Per permittee's website total 23 welders – (12) GMAW- E70S – (7) FCAW- E70T = (4) GMAW- E308L}*
Max lbs./hr. wire/rod/electrode per unit:	not specified *{284.09 if assumed 4 welders accurate}*
Maximum hourly usage (lbs./hr.):	1136.36
Control Efficiency (%):	0

Wire/ Rod/ Electrode	**Usage** lbs./yr.	**$PM_{2.5}$/ PM_{10} EF** lbs. / 1,000 lbs.	**$PM_{2.5}$/ PM_{10}** tons/ yr.	**Mn EF** lbs./ 1,000 lbs.	**Mn** tons/ yr.	**Ni EF** lbs./ 1,000 lbs.	**Ni** tons/ yr.	**Cr EF** lbs./ 1,000 lbs.	**Cr** tons/ yr.	**Cr-VI EF** lbs./ 1,000 lbs.	**Cr-VI** tons/ yr.	**Co EF** lbs./ 1,000 lbs.	**Co** tons/ yr.	**Pb EF** lbs./ 1,000 lbs.	**Pb** tons/ yr.
GMAW - E308L	9,954,514	5.4	**26.877**	0.346	**1.722**	0.184	**0.916**	0.524	**2.608**	0.000	**0.000**	0.001	**0.005**	0.000	**0.000**

Note: Emission Factors (EF) for Welding Operations were taken from AP-42 Section 12.19, Tables 1 & 2

Emission Unit: Welding- Flux Cored Arc Welding (FCAW) *EU-6-FCAW*

SCC:	30905**354 (FCAW w E70 Electrode)**
Manufacturer/Model:	Lincoln/IdealArc CV-400
Number of Welding Units:	7
Per unit max wire/rod/electrode usage (lbs./hr.):	16.5
Maximum hourly usage (lbs./hr.):	115.5
Control Efficiency (%):	0

Wire/ Rod/ Electrode	**Usage** lbs./yr.	**$PM_{2.5}$/ PM_{10} EF** lbs./ 1,000 lbs.	**$PM_{2.5}$ /PM_{10}** tons/ yr.	**Mn EF** lbs./ 1,000 lbs.	**Mn** tons/ yr.	**Ni EF** lbs./ 1,000 lbs.	**Ni** tons/ yr.	**Cr EF** lbs./ 1,000 lbs.	**Cr** tons/ yr.	**Cr-VI EF** lbs./ 1,000 lbs.	**Cr** tons/ yr.	**Co EF** lbs./ 1,000 lbs.	**Co** tons/ yr.	**Pb EF** lbs./ 1,000 lbs.	**Pb** tons /yr.
FCAW - E70T	1,011,780	15.1	**7.639**	0.891	**0.451**	0.005	**0.003**	0.004	**0.002**	0.000	**0.000**	0.000	**0.000**	0.000	**0.000**

Note: Emission Factors (EF) for Welding Operations were taken from AP-42 Section 12.19, Tables 1 & 2

Emission Unit: Fabrication Machine 1 – with Plasma Torch *EU-7-FM1*

Peddinghaus Model #FPB 500 with Hypertherm Model HySpeed HT2000 Plasma Torch cutting Mild Steel

POTENTIAL EMISSIONS - $PM_{2.5}$ / PM_{10} SCC: 30903008 Plasma Torch

Emission Factor Equation from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994 (http://www.epa.gov/ttnchie1/efdocs/welding.pdf)

Cutting Technique: Dry
Base Metal: Mild Steel (standard carbon steel)
Metal Thickness: 0.5 inch *{<u>per 2015 emails</u>: 0.5 inch}*
Kerf (width of cut): 0.128 inch *{<u>per HT2000 reference – estimated kerf width compensation for 0.5 inch thick mild steel 200A O2/Air</u>: 0.128 inch}*
Metal Cutting Speed: 118 inch/min *{<u>per HT2000 reference - Approx. Cutting Speed For 0.49 Inch Mild Steel 200A O2/Air</u>: 118 ipm}*
Metal Density: 0.283 lbs./in^3 *{<u>Reference Density of Mild Steel</u>: 0.283 lbs./in^3}*
Fume Generation: 5 % of particulate generated
Hours of Operation: 8760 hours/yr.
Control Efficiency 90 %

$PM_{2.5}$ / PM_{10} Emission Factor (lbs./in) = Metal Density (lbs./in^3) x Metal Thickness (in) x Average Kerf (in) x Fume Generation
$PM_{2.5}$ / PM_{10} Emission Factor (lbs./in) = 0.0009052 lbs./inch

Metal Feed Rate (in/hr.) = Metal Travel Speed (in/min) x Number of plasma torch units x 60 min/hr.
Metal Feed Rate (in/hr.) = 7080 inches/hr.

$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = Metal Feed Rate (in/hr.) x Emission Factor (lbs./inch) x Control Efficiency
$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = 6.41 lbs. /hr. Uncontrolled
= 0.641 lbs./hr. Controlled

$PM_{2.5}$ / PM_{10} Emissions (tons/yr.) = Emissions (lbs./hr.) x Hours of Operation (hr./yr.) x Control Efficiency / 2000 lbs./ton
$PM_{2.5}$ / PM_{10} Emissions (tons/yr.) = 28.1 tons/yr. Uncontrolled
= 2.81 tons/yr. Controlled

POTENTIAL EMISSIONS – Manganese (Mn) SCC: 30903008 Plasma Torch

Cutting Technique: Dry
Base Metal: Mild Steel (standard carbon steel)
Base Metal Mn content: 1.65 % weight {worst case Mn content for standard carbon steel}
Maximum Hours of Operation: 8760 hours/yr.
Control Efficiency: 90 %

Mn Emissions (lbs./hr.) = PM_{10} Emissions (lbs./hr.) * % weight Mn x Control Efficiency = 6.41 lbs./hr. * 0.0165 = 0.106 lbs./hr. Uncontrolled
= 0.641 lbs./hr. * 0.0165 = 0.0106 lbs./hr. Controlled

Mn Emissions (tons/yr.) = Mn Emissions (lbs./hr.) x 8,760 (hr./yr.) / 2000 lbs./ton = 0.464 tons/yr. Uncontrolled
= 0.0464 tons/yr. Controlled

POTENTIAL EMISSIONS – NOx SCC: 30903008 Plasma Torch

Emission factor derived from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994
(http://www.epa.gov/ttnchie1/efdocs/welding.pdf)
NOx Emission Factor = 6.6 grams/minute (for mild steel; 8 mm (0.32 inch) plate thickness; 2 – 3 mm (0.08 - 0.12 inch) kerf; 2.7 - 4.5 meter/min (106 - 177 inch/ min) cutting speed; using dry cutting technique)

Cutting Technique: Dry
Base Metal: Mild Steel (standard carbon steel)
Metal Thickness: 0.5 inch
Kerf (width of cut): 0.128 inch *{<u>per HT2000 reference – estimated kerf width compensation for 0.5 inch thick mild steel 200A O2/Air</u>: 0.128 inch}*
Metal Cutting Speed: 118 inch/min *{<u>per HT2000 reference - Approx. Cutting Speed For 0.49 Inch Mild Steel 200A O2/Air</u>: 118 ipm}*
Maximum Hours of Operation: 8760 hours/yr.
Control Equipment for NOx: None

NOx Emissions (lbs./hr.) = NOx Emission Factor * 60 min/hr. * 1 / 453.59 g/lbs. = 0.873 lbs./hr.
NOx Emissions (tons/yr.) = NOx Emissions (lbs./hr.) * 8760 hours/year * ton/2000 lbs. = 3.82 ton/yr.

Emission Unit: Fabrication Machine 2 – with Plasma Torch *EU-8-FM2*

Peddinghaus Model #FPB 1800 with Hypertherm Model HPR260XD Plasma Torch cutting Mild Steel

POTENTIAL EMISSIONS - $PM_{2.5}$ / PM_{10} SCC: 30903008 Plasma Torch

Emission Factor Equation from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994 (http://www.epa.gov/ttnchie1/efdocs/welding.pdf)

Cutting Technique:	Dry		
Base Metal:	Mild Steel	(standard carbon steel)	
Metal Thickness:	0.5	inch	*{per 2015 emails: 0.5 inch}*
Kerf (width of cut):	0.11	inch	*{per HPR260XD specs – estimated kerf width compensation for 0.47 inch thick mild steel 260A O2/Air: 0.11 inch}*
Metal Cutting Speed:	145	inch/min	*{per HPR260XD specs - Approx. Cutting Speed for ½ Inch Mild Steel 260A O2/Air: 145 ipm;*
Metal Density:	0.283	lbs./in^3	*{Reference Density of Mild Steel: 0.283 lbs./in^3}*
Fume Generation:	5	% of particulate generated	
Hours of Operation:	8760	hours/yr.	
Control Efficiency	90	%	

$PM_{2.5}$ / PM_{10} Emission Factor (lbs. /in) = Metal Density (lbs./in^3) x Metal Thickness (in) x Average Kerf (in) x Fume Generation
$PM_{2.5}$ / PM_{10} Emission Factor (lbs./in) = 0.0007779 lbs./inch

Metal Feed Rate (in/hr.) = Metal Travel Speed (in/min) x Number of plasma torch units x 60 min/hr.
Metal Feed Rate (in/hr.) = 8700 inches/hr.

$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = Metal Feed Rate (in/hr.) x Emission Factor (lbs./inch) x Control Efficiency
$PM_{2.5}$ / PM_{10} Emissions (lbs./hr.) = 6.77 lbs./hr. Uncontrolled
= 0.677 lbs./hr. Controlled

$PM_{2.5}$ / PM_{10} Emissions (tons/yr.) = Emissions (lbs./hr.) x Hours of Operation (hr./yr.) x Control Efficiency / 2000 lbs./ton
$PM_{2.5}$ / PM_{10} Emissions (tons/yr.) = 29.6 tons/yr. Uncontrolled
= 2.96 tons/yr. Controlled

POTENTIAL EMISSIONS – Manganese (Mn) SCC: 30903008 Plasma Torch

Cutting Technique:	Dry
Base Metal:	Mild Steel (standard carbon steel)
Base Metal Mn content:	1.65 % weight {worst case Mn content for standard carbon steel}
Maximum Hours of Operation:	8760 hours/yr.
Control Efficiency:	90 %

Mn Emissions (lbs./hr.) = PM_{10} Emissions (lbs./hr.) * % weight Mn x Control Efficiency = 6.77 lbs./hr. * 0.0165 = 0.112 lbs./hr. Uncontrolled
= 0.677 lbs./hr. * 0.0165 = 0.0112 lbs./hr. Controlled

Mn Emissions (tons/yr.) = Mn Emissions (lbs./hr.) x 8,760 (hr./yr.) / 2000 lbs./ton = 0.489 tons/yr. Uncontrolled
= 0.0489 tons/yr. Controlled

POTENTIAL EMISSIONS – NOx SCC: 30903008 Plasma Torch

Emission factor derived from "Emission of Fume, Nitrogen Oxides and Noise in Plasma Cutting of Stainless and Mild Steel" by Broman B. et al, The Swedish Institute of Production Engineering Research, ITW Document 1E-174-93, March 1994
(http://www.epa.gov/ttnchie1/efdocs/welding.pdf)
NOx Emission Factor = 6.6 grams/minute (for mild steel; 8 mm (0.32 inch) plate thickness; 2 – 3 mm (0.08 - 0.12 inch) kerf; 2.7 - 4.5 meter/min (106 - 177 inch/ min) cutting speed; using dry cutting technique)

Cutting Technique:	Dry		
Base Metal:	Mild Steel	(standard carbon steel)	
Metal Thickness:	0.5	inch	
Kerf (width of cut):	0.11	inch	*{per HPR260XD specs – estimated kerf width compensation for 0.47 inch thick mild steel 260A O2/Air: 0.11 inch}*
Metal Cutting Speed:	145	inch/min	*{per HPR260XD specs - Approx. Cutting Speed for ½ Inch Mild Steel 260A O2/Air: 145 ipm}*
Maximum Hours of Operation:	8760 hours/yr.		
Control Equipment for NOx:	None		

NOx Emissions (lbs./hr.) = NOx Emission Factor * 60 min/hr. * 1 / 453.59 g/lbs. = 0.873 lbs./hr.
NOx Emissions (tons/yr.) = NOx Emissions (lbs./hr.) * 8760 hours/year * ton/2000 lbs. = 3.82 ton/yr.

Emission Units: Makeup Air Combustion Units 1 and 2 ***EXEMPT***

Exemption added by 2014 amended rule is 40 CFR 49.153 (c) (11) (iii):

Furnaces or boilers used for space heating that use only gaseous fuel, with a total maximum heat input (i.e., from all units combined) of 10 MMBtu/hour or less in attainment areas.

Makeup air combustion unit on south side: Weather-Rite; Model #: AR TT218VTL; Input BTU: 1,944,000
Makeup air combustion unit on north side: Rupp; Model #: DCM227; Maximum BTU/hr.: 4,860,000
Combined South Side [1.944 MMBtu/hour] + North Side [4.860 MMBtu/hour] = 6.8 MMBtu/hour

Maximum Heat Input:	6.8 MMBtu/hr.
Heat Content of Natural Gas:	1,020 MMBtu/MMSCF
Potential Throughput:	0.0068 MMSCF/hr.

Pollutant	Emission Factor (lbs./MMSCF)	Emission Rate (lbs. /hr.)	Emission Rate (tons/year)
PM	1.9	0.01275	0.05585
PM_{10}	7.6	0.05066	0.22189
$PM_{2.5}$	7.6	0.05066	0.22189
SO_x	0.6	0.00401	0.01757
NO_x	100	0.6664	2.91883
CO	84	0.561	2.45718
VOC	5.5	0.0374	0.1638
CO_2	119,227	794.92	3481.75
N_2O	2.2	0.01462	0.06404
CH4	0.22	0.001462	0.006404
GHGs (as Mass)	-	794.92	3481.75
GHGs (as CO2e)	-	799.31	3500.99
Benzene	0.0021	0.00001428	0.00006255
Dichlorobenzene	0.0012	0.00000816	0.00003574
Formaldehyde	0.075	0.00051	0.0022338
Hexane	1.8	0.01224	0.0536112
Toluene	0.0034	0.00002312	0.0001013
Subtotal HAP - Organics	-	-	0.0560446
Lead	0.0005	0.0000034	0.00001489
Cadmium	0.0011	0.00000748	0.00003276
Chromium	0.0014	0.00000952	0.00004170
Manganese	0.00038	0.000000304	0.00000133
Nickel	0.0021	0.00001428	0.00006255
Subtotal HAP - Metals	-	-	0.00015323
TOTAL HAP			0.0562

Methodology
MMBtu = 1,000,000 Btu
MMCF = 1,000,000 Cubic Feet of Gas
Potential Throughput (MMCF/hr.) = Heat Input Capacity (MMBtu/hr.) x 8,760 hours/yr. x 1 MMCF/1,020 MMBtu
Emission (tons/yr.) = Throughput (MMCF/yr.) x Emission Factor (lbs./MMCF)/2,000 lbs./ton

Emission Factors are from AP 42, Chapter 1.4, Tables 1.4-1, 1.4-2, 1.4-3, SCC #1-02-006-02, 1-01-006-02, 1-03-006-02, and 1-03-006-03. The N_2O Emission Factor for uncontrolled is 2.2. The N_2O Emission Factor for low NOx burner is 0.64.

Global Warming Potentials (GWP) from Table A-1 of 40 CFR Part 98 Subpart A.
Emission (tons/yr.) = Throughput (MMCF/yr.) x Emission Factor (lbs./MMCF)/2,000 lbs./ton
CO_2e (tons/yr.) based on 11/29/2013 federal GWPs= CO_2 Potential Emission ton/yr. x CO_2 GWP (1) + CH_4 Potential Emission ton/yr. x CH_4 GWP (25) + N2O Potential Emission ton/yr. x N_2O GWP (298).

SUMMARY OF FACILITY-WIDE ANNUAL EMISSIONS

Regulated NSR Pollutant	Uncontrolled PTE (tons/year) Emission Unit ID	Controlled PTE (tons/year) Emission Unit ID	Proposed Allowable Emissions (tons/year)	2011 Actual Emissions (tons/year) [Based on avail. Info]	2012 Actual Emissions (tons/year) [Based on avail. Info]	Minor NSR Source Threshold (tons/year)	Major Source Threshold (tons/year)
PM	105.8 **EU-1-PB** 50.7 **EU-2-PCT** 213.3 **EU-3-SBM** 0.00163 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 28.1 **EU-7-FM1** 29.6 **EU-8-FM2**	10.53 **EU-1-PB** 5.07 **EU-2-PCT** 2.13 **EU-3-SBM** 0.00163 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 2.81 **EU-7-FM1** 2.96 **EU-8-FM2**					
Total PM	**467.46**	**63.95**	**64 {Sum of Controlled PTE for each Emission Unit}**			**10**	**100 or 250**
PM_{10}	105.3 **EU-1-PB** 50.7 **EU-2-PCT** 102.7 **EU-3-SBM** 0.00653 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 28.1 **EU-7-FM1** 29.6 **EU-8-FM2**	10.53 **EU-1-PB** 5.07 **EU-2-PCT** 1.03 **EU-3-SBM** 0.00653 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 2.81 **EU-7-FM1** 2.96 **EU-8-FM2**					
Total PM_{10}	**356.86**	**62.86**	**63 {Sum of Controlled PTE for each Emission Unit}**			**5**	**100 or 250**
$PM_{2.5}$	105.3 **EU-1-PB** 50.7 **EU-2-PCT** 10.27 **EU-3-SBM** 0.00653 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 28.1 **EU-7-FM1** 29.6 **EU-8-FM2**	10.53 **EU-1-PB** 5.07 **EU-2-PCT** 0.103 **EU-3-SBM** 0.00653 **EU-4-PW** 32.81 **EU-5-GMAW** 7.64 **EU-6-FCAW** 2.81 **EU-7-FM1** 2.96 **EU-8-FM2**					
Total $PM_{2.5}$	**264.43**	**61.93**	**62 {Sum of Controlled PTE for each Emission Unit}**			**3**	**100 or 250**
CO	0.07 **EU-4-PW**	0.07 **EU-4-PW**				**10**	**100 or 250**
NO_x	3.82 **EU-2-PCT** 0.09 **EU-4-PW** 3.82 **EU-7-FM1** 3.82 **EU-8-FM2**	3.82 **EU-2-PCT** 0.09 **EU-4-PW** 3.82 **EU-7-FM1** 3.82 **EU-8-FM2**					
Total NO_x	**11.55**	**11.55**	**11.6 {Sum of Controlled PTE for each Emission Unit}**			**10**	**100 or 250**
SO_2	0.0	0.0				**10**	**100 or 250**
VOC	519.7 **EU-1-PB** 0.005 **EU-4-PW**	519.7 **EU-1-PB** 0.005 **EU-4-PW**					
Total VOC	519.7	519.7	**75 {requested}**	10.87	11.37	**5**	**100 or 250**
Lead	0.0	0.0				**0.1**	**100 or 250**
GHG (as Mass)	102.4 **EU-4-PW**	102.4 **EU-4-PW**	**102.4**				**100 or 250**
GHG (as CO_2-e)	103.0 **EU-4-PW**	103.0 **EU-4-PW**	**103.0**				**100,000**

SUMMARY OF FACILITY-WIDE ANNUAL EMISSIONS –Continued

Regulated HAP Pollutants	Uncontrolled PTE *(tons/year)* Emission Unit ID	Controlled PTE *(tons/year)* Emission Unit ID	Proposed Allowable Emissions* *(tons/year)*	2011 Actual Emissions *(tons/year)* [Based on avail. Info]	2012 Actual Emissions *(tons/year)* [Based on avail. Info]	Title V Major Source Threshold *(tons/year)*
Chromium	2.609 ***EU-5-GMAW*** 0.002 ***EU-6-FCAW***	2.609 ***EU-5-GMAW*** 0.002 ***EU-6-FCAW***				
Total Chromium	**2.611**	**2.611**	**2.611 {Sum of Controlled PTE for each Emission Unit}**			**10**
Cobalt	0.01 ***EU-5-GMAW***	0.01 ***EU-5-GMAW***	**0.01 {Sum of Controlled PTE for each Emission Unit}**			**10**
Manganese	0.84 ***EU-2-PCT*** 2.09 ***EU-5-GMAW*** 0.45 ***EU-6-FCAW*** 0.46 ***EU-7-FM1*** 0.49 ***EU-8-FM2***	0.084 ***EU-2-PCT*** 2.09 ***EU-5-GMAW*** 0.45 ***EU-6-FCAW*** 0.046 ***EU-7-FM1*** 0.049 ***EU-8-FM2***				
Total Manganese	**4.33**	**2.72**	**2.72 {Sum of Controlled PTE for each Emission Unit}**			**10**
Nickel	0.917 ***EU-5-GMAW*** 0.003 ***EU-6-FCAW***	0.917 ***EU-5-GMAW*** 0.003 ***EU-6-FCAW***				
Total Nickel	**0.920**	**0.920**	**0.920 {Sum of Controlled PTE for each Emission Unit}**			**10**
{Subtotal HAP – Metals}	**7.871**	**6.261**				
Xylene	278.7 ***EU-1-PB***	278.7 ***EU-1-PB***	**9 {requested}**	5.0	3.9	**10**
ethyl benzene	46.91 ***EU-1-PB***	46.91 ***EU-1-PB***	**9 {requested}**	0.97	0.80	**10**
toluene	26.77 ***EU-1-PB***	26.77 ***EU-1-PB***	**9 {requested}**	0.14	0.07	**10**
naphthalene	22.90 ***EU-1-PB***	22.90 ***EU-1-PB***	**9 {requested}**	0.05	0.05	**10**
Hexane	16.19 ***EU-1-PB***	16.19 ***EU-1-PB***				**10**
Methanol	12.93 ***EU-1-PB***	12.93 ***EU-1-PB***				**10**
{Subtotal HAP – Organics}	**404.4**	**404.4**		6.16	4.82	
Highest HAP-Individual	**278.7**	**278.7**	**9 {requested}**	5.0	3.9	**10**
Total HAP	**412.3**	**410.7**	**24 {requested}**			**25**

*§49.152 Definitions. (d) *Allowable emissions* means "allowable emissions" as defined in §52.21(b)(16) of this chapter, except that the allowable emissions for any emissions unit are calculated considering any emission limitations that are enforceable as a practical matter on the emissions unit's potential to emit.