



# Guideline for Calculating and Reporting Emissions from Laser or Plasma Cutting of Metal Materials Operations

Revised March 2025

This guideline document is based on the [Emission of Fume, Nitrogen Oxide and Noise in Plasma Cutting of Stainless and Mild Steel](#). Sections of this document are provided by U.S. EPA in AP-42 Chapter 12. Note that this study evaluates emissions resulting from plasma cutting operations only, but the methodology is also used for laser cutting operations in this guideline since laser cutting emission factors are not available in AP-42.

## **PM Emissions Based on Operating Time**

For purposes of this guideline, particulate matter emissions (PM) are based on emissions of fumes. The tables from the U.S. EPA-cited document have been converted into imperial units.

### **Emissions of Fumes in Plasma Cutting of Mild and Stainless Steel**

Material, thickness	Dry (lb/min)	Semi-Dry (lb/min)	Wet (lb/min)
Mild steel, 8 mm	0.057	0.0088	0.00088
Stainless steel, 8 mm	0.088	0.0101	0.0011
Stainless steel, 35 mm	0.0075	0.00066	0.000044

If source-specific information is not available, the default emission factor for mild steel is 0.057 lb of PM per minute of cutting operation. Likewise, the default emission factor for stainless steel is 0.088 lb of PM/min.

### **Emissions of Fumes Expressed as Percent of Total Amount of Material Removed by Cutting**

Material, thickness, cutting speed	Dry (%)	Semi-Dry (%)	Wet (%)
Mild steel, 8 mm, 5 m/min	5	0.5	0.05
Stainless steel, 8 mm, 3.5 m/min	7	0.7	0.07
Stainless steel, 35 mm, 0.375 m/min	1	0.1	0.01

If source-specific information is not available, the default emission factor for mild steel is 0.05 lb of PM/lb of metal removed. The default emission factor for stainless steel is 0.07 lb of PM/lb of metal removed.

## **PM Emissions Based on Amount of Material Cut**

The amount of material removed is estimated from the volume of metal removed by the cut multiplied by the density of the metal cut.

The volume of metal removed can be estimate by the length of the cut multiplied by the kerf width (width of the cut) multiplied by the depth of the cut.

The metal density is based on SDSs. For metal scrap or maintenance metal cutting, the following default densities can be used. The metal density of mild steel is 0.284 lb/in<sup>3</sup>. The metal density of stainless steel is 0.28 lb/in<sup>3</sup>.

Amount of material, lb = length, in x kerf width, in x depth, in x metal density, lb/in<sup>3</sup>

### ***Control Technology***

The AP-42 emission factors are for operations without controls. Plasma arc cutting with controlled emissions may apply the control efficiency to the emission equation in the AER Webtool. Typically, plasma arc cutting is controlled by filters in conjunction with a collection system. The default capture (or collection) efficiency for such a system is 90 percent, and the default control efficiency for filters is 99 percent. Note that both collection and control efficiency can be higher, such as in the case of a permanent total enclosure with HEPA filters. Reporters are advised to use source-specific information where available while providing supporting documentation.

For plasma arc cutting that is not enclosed, a capture efficiency is used to identify the quantity of emissions that are captured by the control device. The capture efficiency is multiplied by the control efficiency to derive an overall control efficiency. The overall control efficiency is entered into the AER Webtool in the Process page.

The default capture efficiency is 90 percent. If the default control efficiency (99 percent) is used, the overall control efficiency would be 0.89 percent (0.9 x 0.99).

### **NOX EMISSIONS**

The tables from the U.S. EPA document have been converted into imperial units.

Emissions of Nitrogen Oxides	Dry (lb/min)	Semi-Dry (lb/min)	Wet (lb/min)
Mild steel, 8 mm	0.023	0.013	0.007
Stainless steel, 8 mm	0.023	0.011	0.006
Stainless steel, 35 mm	0.033	0.019	0.009

The default emission factor for mild steel is 0.023 lb of NO<sub>x</sub>/min. The default emission factor for stainless steel is 0.033 lb of NO<sub>x</sub>/min.

### **TAC EMISSIONS**

Default hexavalent chromium emissions from plasma cutting can be estimated by using the following emission factor (0.00022 pounds of hexavalent chromium (Cr<sup>+6</sup>) emitted per chromium (Cr) in metal removed) per South Coast AQMD permitting.

EF, lb Cr<sup>+6</sup>/lb metal removed = (0.00022 lb Cr<sup>+6</sup>/lb Cr in metal removed) x (weight fraction of Cr in metal from SDS)

So, if the stainless steel cut contains 20 percent chromium, the hexavalent chromium emission factor would be 0.000044 pound per pound of metal cut.

Other TAC emissions are estimated by multiplying the weight fraction of the TACs from SDSs by the PM emissions above. If SDS values are not available, the following defaults from the U.S. EPA referenced document may be used.

Components in Fume	Manganese (%)	Copper (%)	Nickel (%)
Mild Steel	1.4	1.4	0 (not detected)
Stainless Steel	4.4	0 (not detected)	10.3

**EXAMPLE**

Stainless steel (8 mm thickness) was cut for a two hour duration in the data year using a semi-wet process. Since we record two hours per year, the emission factors need to be converted from mins to hours.

PM emission factor, lb/hr = 0.0101 lb PM/min x 60 min/hr = 0.606 lb/hr

NOx emission factor, lb/hr = 0.011 lb NOx/min x 60 min/hr = 0.66 lb/hr

Manganese emission factor, lb/hr = 0.606 lb/hr x 0.044 ≈ 0.0267 lb/hr

Hexavalent chromium emission factor, lb/hr

8 mm thickness, 3.5 m cut per min x 3/16 inch kerf  
 0.315 in x 137.8 in/min x 60 min/hr x 0.188 in = 489.6 in<sup>3</sup>/hr  
 489.6 in<sup>3</sup>/hr x 0.28 lb/in<sup>3</sup> = 137.1 lb metal cut/hr  
 137.1 lb metal cut/hr x 0.20 lb Cr/lb metal cut from SDS x 0.00022 lb Cr+6/Cr ≈ 0.00603 lb/hr

Nickel emission factor, lb/hr = 0.606 lb/hr x 0.104 ≈ 0.063 lb/hr

**Entering Data into the AER Webtool**

Click on Emission Sources (ES) on the menu on the left-hand side. Then click on the orange Add New Emission Source button

Facility ID: 999901

Build Reporting Structure

Emission Sources (ES) Classification

Summary: This section contains facility permit profile. Please make sure that every device has a specified Emission Source (ES). New emission sources can also be added.

Instruction: Add Devices (emissions sources) by clicking "Add New Emission Source". Edit devices by clicking "Profile" under the Emission Source (ES) Column. Add emission data by clicking "Open" under the Emissions column. Upload storage tank data by clicking on link "Click here" below.

Storage Tank Emissions Batch File Import - [Click here](#) for more instructions.

Add New Emission Source

Enter data in the text boxes with the red asterisk, then click on the orange Categorize Emission Sources button.

Facility ID: 999901

Facility Comments

- 1. Facility Information
- 2. Status Update
- 3. Combustion Fuels
- 4. Emission Sources (ES)
- 5. Report Process/Emissions
- 6. Additional Toxic Substances Production and Usage
- 7. Perform Data Validation
- 8. Review Summaries
- 9. Print Facility Report
- 10. Report Submission

Edit Emission Source

**Instruction:** Add new emissions sources using information found on permits, manufacturers specifications, or identifying placards. Select the Operating ES Status that best reflect the device's operation for this reporting period. All areas with a Red Asterisk (\*) must be addressed. Note: Some devices have been pre-populated, verify that the information is correct

Permitted <input type="checkbox"/> A/N PERP Equipment(CARB's Portable Equipment Registration Program) <input type="checkbox"/> <span style="color: blue; font-size: 1.2em;">i</span> Permit No Permit Device ID Permit Equipment Description AER Device ID ES Name Operating ES Status Comment Emission Source Category Equipment Design Capacity	ES7 <span style="background-color: orange; color: white; padding: 2px;">Assign new ID</span> Plasma Arc Cutting * Normal Operation * <input type="text"/> Other Processes <span style="background-color: red; color: white; padding: 2px;">Categorize Emission Source</span> * Other process equipment 0.000000
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Save or Save and return to List of Emission Sources or  
Save and proceed to Process Reporting or [Cancel](#)  
Optional: Save and Mark as Completed

[Click here to delete](#) this emission source and associated data.

Click on the Other Process check box and click save.

**Categorize Emission Source** ✕

Permitted	A/N	Permit No	Permit Device ID	Permit Equipment Description	AER Device ID	ES Name
No					ES7	Plasma Arc Cutting

1. External Combustion Equipment (e.g., boiler, dryer, oven, furnace, heater, afterburner, flare, kiln or incinerator) [click here](#) to select one the following Equipment:
2. Internal Combustion Equipment (e.g., internal combustion engine (excluding vehicles), turbine or micro turbine) [click here](#) to select one of the following Equipment:
3. Spray Coating/Spray Booth (e.g., coatings, solvents, adhesives, etc.) [click here](#) to select one of the following Equipment:
4. Other Use of Organics (e.g., coatings, solvents, inks, adhesives, etc.) except in Spray Coating/Spray Booth, [click here](#) to select one of the following Equipment:
5. Liquid Storage Tank (e.g. Underground, Aboveground, Small Tanks, Dispensing Systems) [click here](#) to select one of the following Equipment:
6. Fugitive Components (Emission Leaks from Process Components per Rule 462, 1173 and 1176), [click here](#) to select all applicable Equipment:
7. Other Processes (does not fit in any of the groups mentioned above), click [click here](#) to mark "Other Process Equipment":
 

Other process equipment

Save Cancel

Click on the orange Save and Proceed to Process Reporting button

Facility ID: 999901

Facility Comments


- 1. Facility Information
- 2. Status Update
- 3. Combustion Fuels
- 4. Emission Sources (ES)
- 5. Report Process/Emissions
- 6. Additional Toxic Substances Production and Usage
- 7. Perform Data Validation
- 8. Review Summaries
- 9. Print Facility Report
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Edit Emission Source

**Instruction:** Add new emissions sources using information found on permits, manufacturers specifications, or identifying placards. Select the Operating ES Status that best reflect the device's operation for this reporting period. All areas with a Red Asterisk (\*) must be addressed. Note: Some devices have been pre-populated, verify that the information is correct

Permitted

A/N

PERP Equipment(CARB's Portable Equipment Registration Program)  

Permit No

Permit Device ID

Permit Equipment Description

AER Device ID ES7 [Assign new ID](#)

ES Name Plasma Arc Cutting \*

Operating ES Status Normal Operation \*

Comment

Emission Source Category Other Processes [Categorize Emission Source](#) \*

Equipment Other process equipment

Design Capacity 0.000000

[Save](#) or [Save and return to List of Emission Sources](#) or


[Save and proceed to Process Reporting](#) or [Cancel](#)

[Optional: Save and Mark as Completed](#)

[Click here to delete](#) this emission source and associated data.

Click on the blue Open link next to Process ID P1

Process References												
Emissions	A/N	Permit No	Permit Device ID	Permit Device Description	AER Device ID	ES Name	ES Group Name	Source Category	Emissions?	Equipment	PERP	Release Location Linked
<a href="#">Open</a>					ES7	Plasma Arc Cutting		Other Processes	Y	Other process equipment	N	NR
Process ID		Source Group		Process/Material/Fuel Name			Status	Operation Type				
<a href="#">Open</a>	P1	Other Process Emissions					Work in progress	routine				

[Add Process/Material/Fuel](#) 

[OK](#)

Click on the blue Open link in Step 1

**Other Processes**

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. **Please start with Step 1, edits to Step 1 may cause data in the following steps to reset.** Combustion emissions need to be reported separately under external or internal combustion process categories. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

**Step 1: Process**

Optional: Mark as Completed

	AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
<a href="#">Open</a>	ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

Click here to [delete](#) this process.

**Step 2: Throughput**

Annual Throughput	
<a href="#">Open</a>	

**Step 3: Criteria Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>							

**Step 4: Toxic (TAC/ODC) Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>								

Choose the following options and click save.

**Edit Emission Process - Other Processes** ✕

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

AER Device ID	ES11	AER Device Name	Plasma Arc Cutting
<b>NON-PERMITTED</b>		Permit Device ID	<input type="text"/>
Process ID	P2	Process Name	<input type="text"/>
Process Comment	<input type="text"/>		
SCC	<input type="text"/>		

Activity Code \* Sector:

Industry:

Operation:

Process:

Rule #  \* [Add Rule](#)

Click on the blue Open link in Step 2

**Other Processes**

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. **Please start with Step 1, edits to Step 1 may cause data in the following steps to reset.** Combustion emissions need to be reported separately under external or internal combustion process categories. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

**Step 1: Process**

Optional: Mark as Completed

	AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
<a href="#">Open</a>	ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

Click here to [delete](#) this process.

**Step 2: Throughput**

Annual Throughput	
<a href="#">Open</a>	

**Step 3: Criteria Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>							

**Step 4: Toxic (TAC/ODC) Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>								

Add the throughput, throughput type, throughput origin, and throughput comment. Then, click the orange Save button.

**Edit Throughput Information - Other Processes**

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES7			P1	405	Metals and Alloys : Fabricated : Machining Operations : Arc Welding: General	

**Annual Throughput**

Annual Throughput:  \*  \*

Throughput Type:  \*

Throughput Origin:  \*

Throughput Comment:

[Save](#) [Cancel](#)



Click on the orange Add New button in Step 3

**Other Processes**

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. **Please start with Step 1, edits to Step 1 may cause data in the following steps to reset.** Combustion emissions need to be reported separately under external or internal combustion process categories. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

**Step 1: Process**

Optional: Mark as Completed

	AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
<a href="#">Open</a>	ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

Click here to [delete](#) this process.

**Step 2: Throughput**

	Annual Throughput
<a href="#">Open</a>	2.00000000 hour

**Step 3: Criteria Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>							

**Step 4: Toxic (TAC/ODC) Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>								

Choose PM as the pollutant, and the emission factor, and chose AP-42 for the emission factor data source. Then click the orange Save button.

**Open Criteria Emission Information - Other Processes**

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES7			P1	405	Metals and Alloys : Fabricated : Machining Operations : Arc Welding: General	

Annual Throughput

Pollutant: PM \*

Emission Factor (EF): 6.06000000e-1 \* lbs/

Controlled EF value  
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency:

Emission Factor Comment:

If not using **AQMD default** emission factor please provide detailed references in the Emission Factor Comment box above or upload file with the information. Processes without this information are subject to audit.

Emission Factor Data Source: AP-42 \*

Emissions: 0.00000000e+0 lbs

[Save](#) [Cancel](#)



Repeat this process for NOx.  
Click on the orange Add New button in Step 4

**Other Processes**

This reporting screen is for reporting activity data for other processes used in your facility which were not covered in previous reporting screens. Please provide specific information for every associated emission source. **Please start with Step 1, edits to Step 1 may cause data in the following steps to reset.** Combustion emissions need to be reported separately under external or internal combustion process categories. Combined emissions can also be reported here; however, it must be substantiated to avoid double reporting. Detailed instructions are available by clicking on Help icon in the tool bar.

**Step 1: Process**

Optional: Mark as Completed

	AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
<a href="#">Open</a>	ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

[Click here to delete](#) this process.

**Step 2: Throughput**

	Annual Throughput
<a href="#">Open</a>	2.00000000 hour

**Step 3: Criteria Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	Pollutant	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Open</a>	PM	6.06000000e-1	lbs / hour	No	AP-42		1.21200000e+0
<a href="#">Open</a>	NOx	1.32000000e+0	lbs / hour	No	AP-42		2.64000000e+0

[Add New](#)

**Step 4: Toxic (TAC/ODC) Emissions (lbs)**

Use [Default Emission Factors](#) if available.

	TAC/ODC Group	CAS #	EF	Unit	Controlled EF	EF Data Source	Overall CE	Emissions
<a href="#">Add New</a>								

Choose Manganese, enter the emission factor and choose AP-42 for the emission factor data source.

**Open Toxic (TAC/ODC) Emission Information - Other Processes**

AER Device ID	Permit Device ID	A/N	Process ID	Rule #	Activity	SCC
ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

**Annual Throughput**  
2.00000000 hour

TAC/ODC Toxic Pollutants / Ozone Depleting Compounds

Pollutant:  \*

TAC Group: 49 - Manganese

CAS # (Pollutant): 7439965 - Manganese

Emission Factor (EF):  \* lbs/hour

Controlled EF value  
(mark checkbox if EF listed represents EF determined after control)

Overall Control Efficiency:

Emission Factor Comment:

If not using **AQMD default** emission factor please provide detailed references in the Emission Factor Comment box above or upload file with the information. Processes without this information are subject to audit.

Emission Factor Data Source:  \*

Emissions: 5.32000000e-2 lbs

[Save](#) [Cancel](#)

Repeat for the other TAC emissions.