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^3. The metal density of stainless steel is 0.28 lb/in^3.

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

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 NOx/min. The default emission factor for stainless steel is 0.033 lb of NOx/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^{+6}) emitted per chromium (Cr) in metal removed) per South Coast AQMD permitting.

EF, lb Cr^{+6}/lb metal removed = (0.00022 lb Cr^{+6}/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

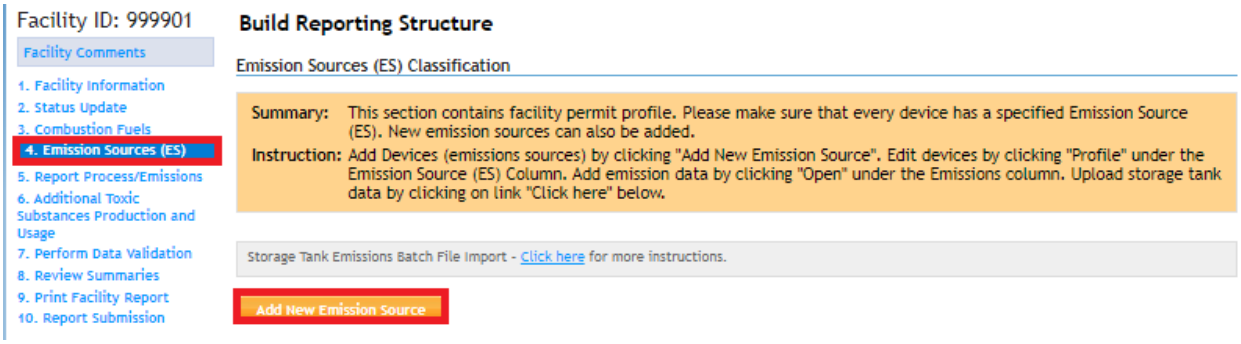
Hexavalent chromium emission factor, lb/hr

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^3/hr
489.6 in^3/hr x 0.28 lb/in^3 = 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

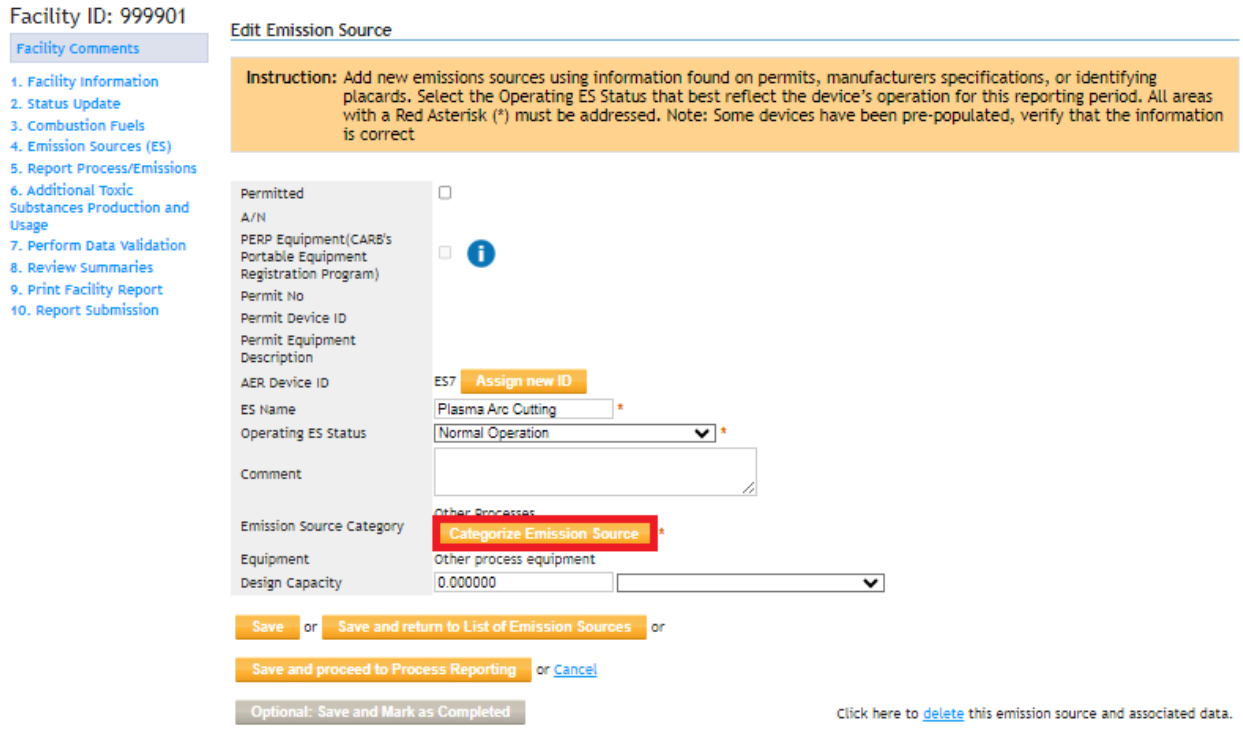
Nickel emission factor, lb/hr = 0.606 lb/hr x 0.104 ≅ 0.063 lb/hr

Entering Data into the AER Webtool

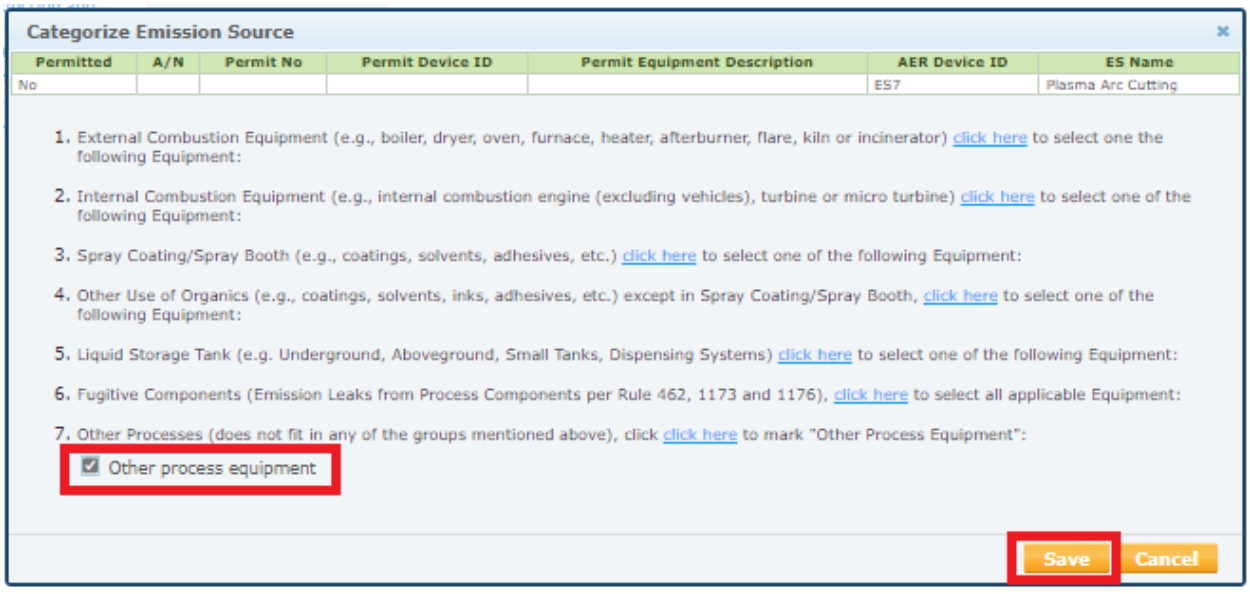
Click on Emission Sources (ES) on the menu on the left-hand side. Then click on the orange Add New Emission Source button



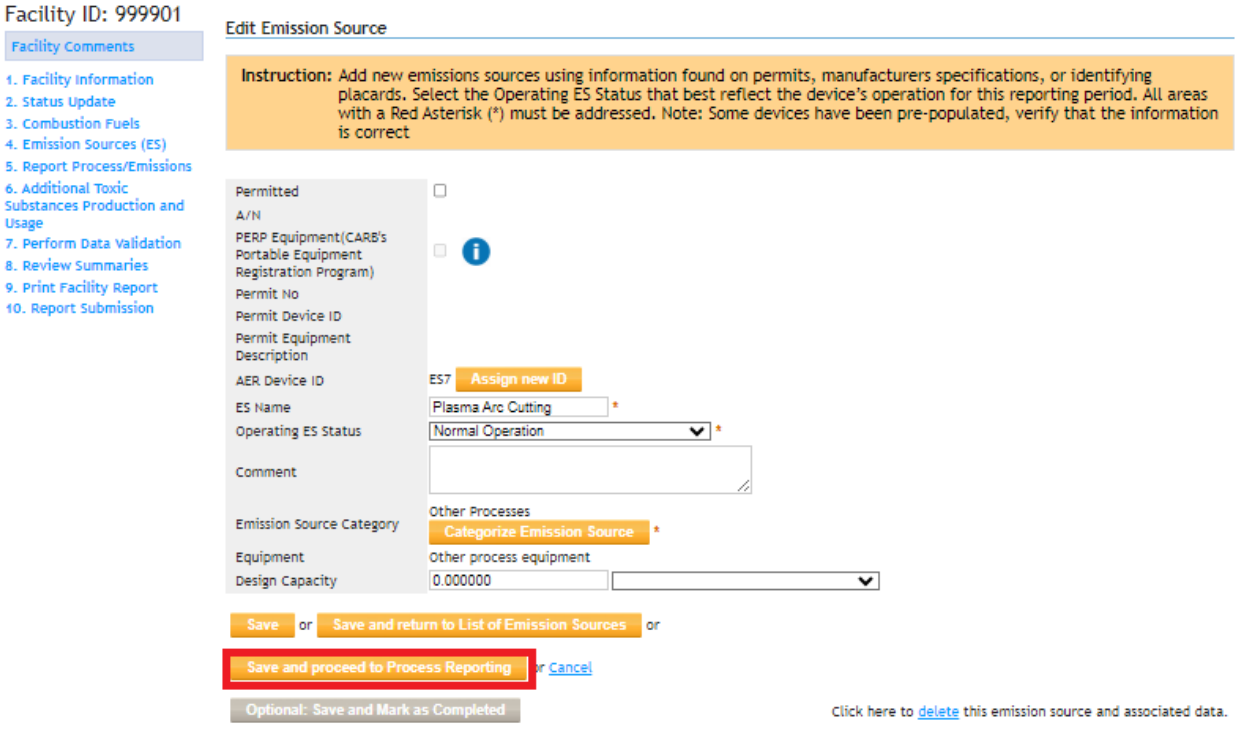
Enter data in the text boxes with the red asterisk, then click on the orange Categorize Emission Sources button.



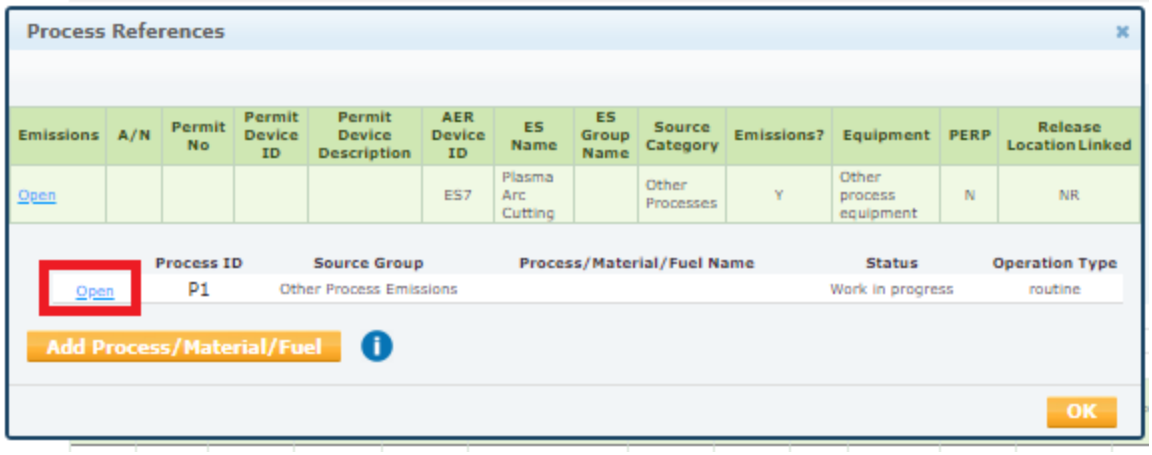
Click on the Other Process check box and click save.



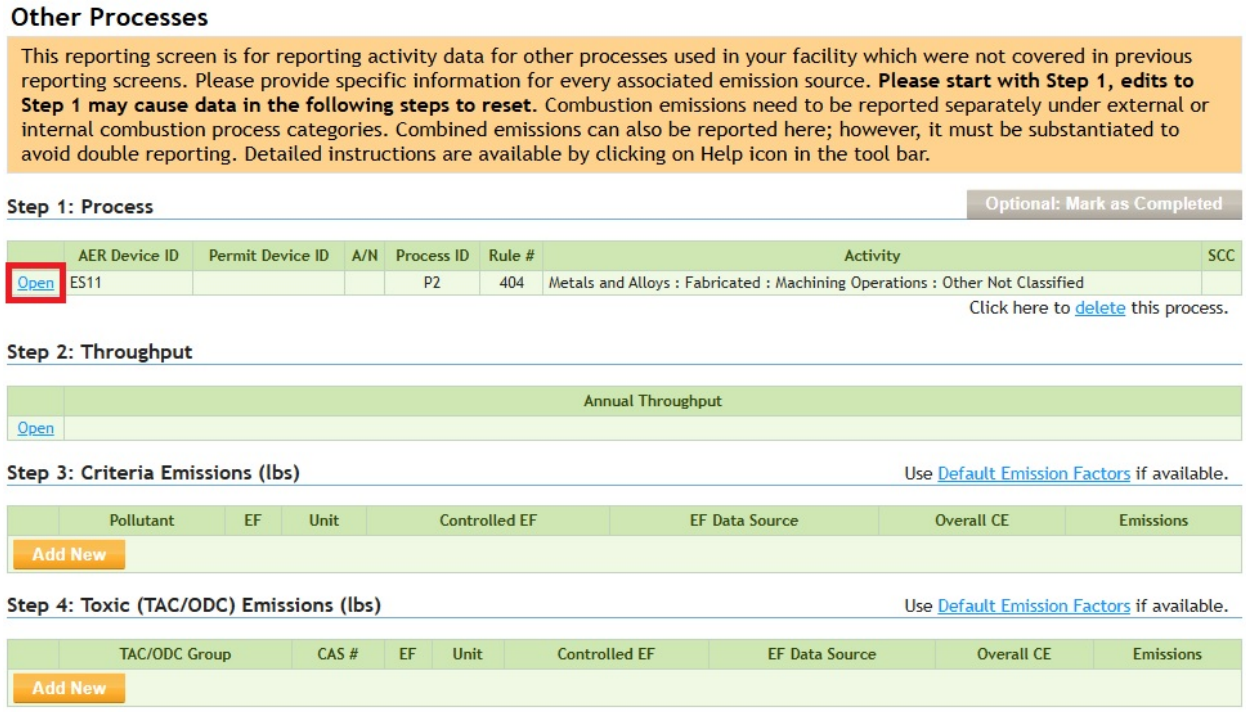
Click on the orange Save and Proceed to Process Reporting button



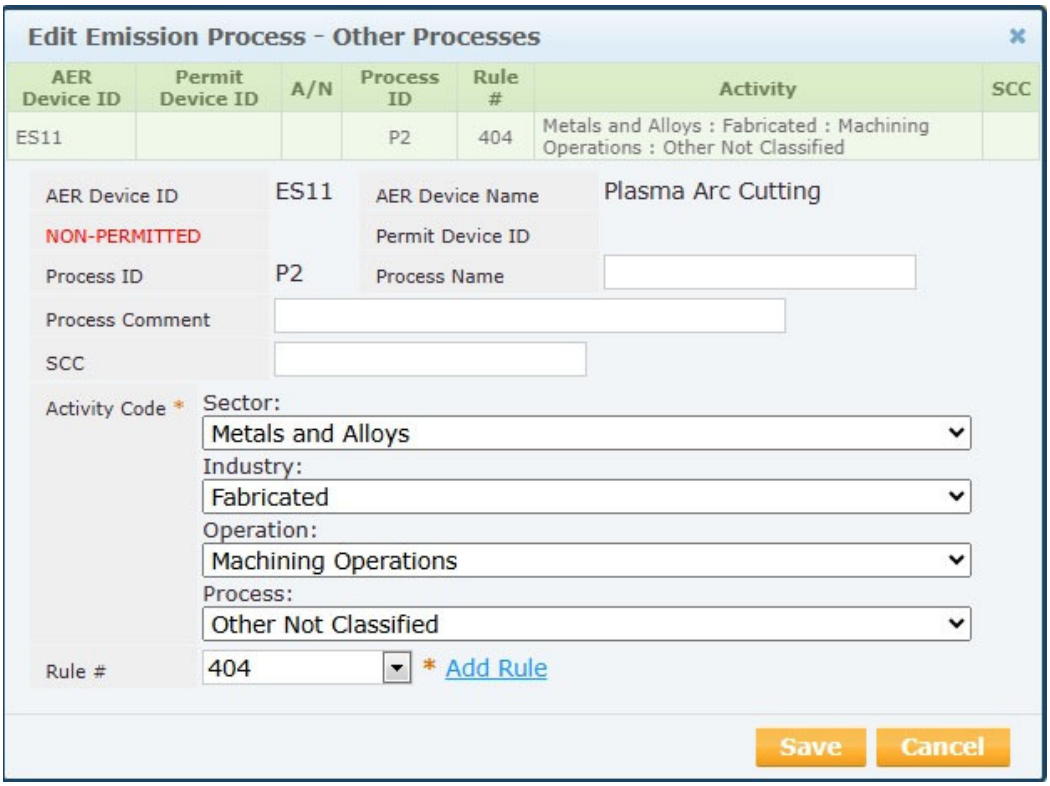
Click on the blue Open link next to Process ID P1



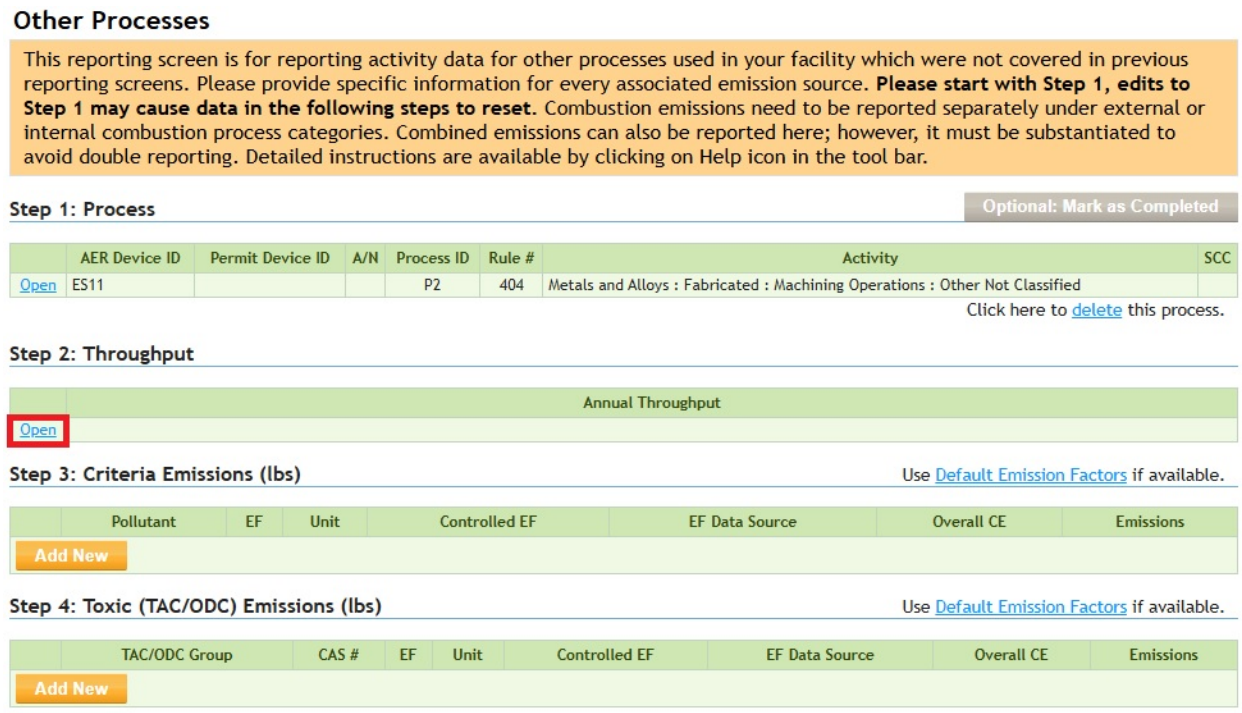
Click on the blue Open link in Step 1



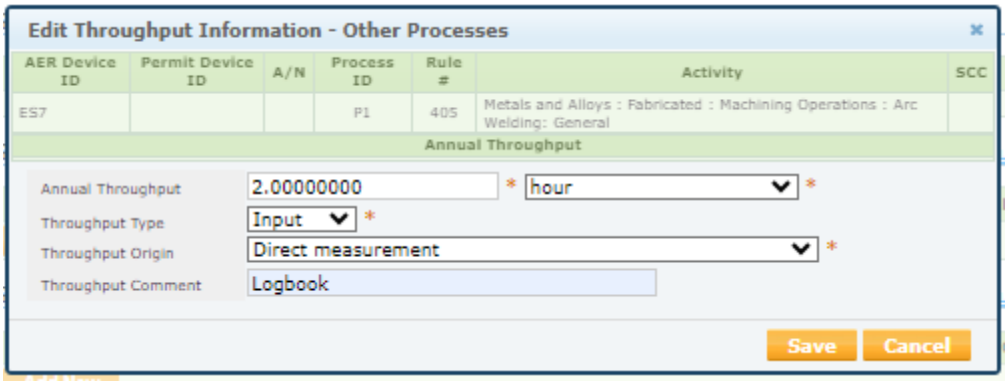
Choose the following options and click save.



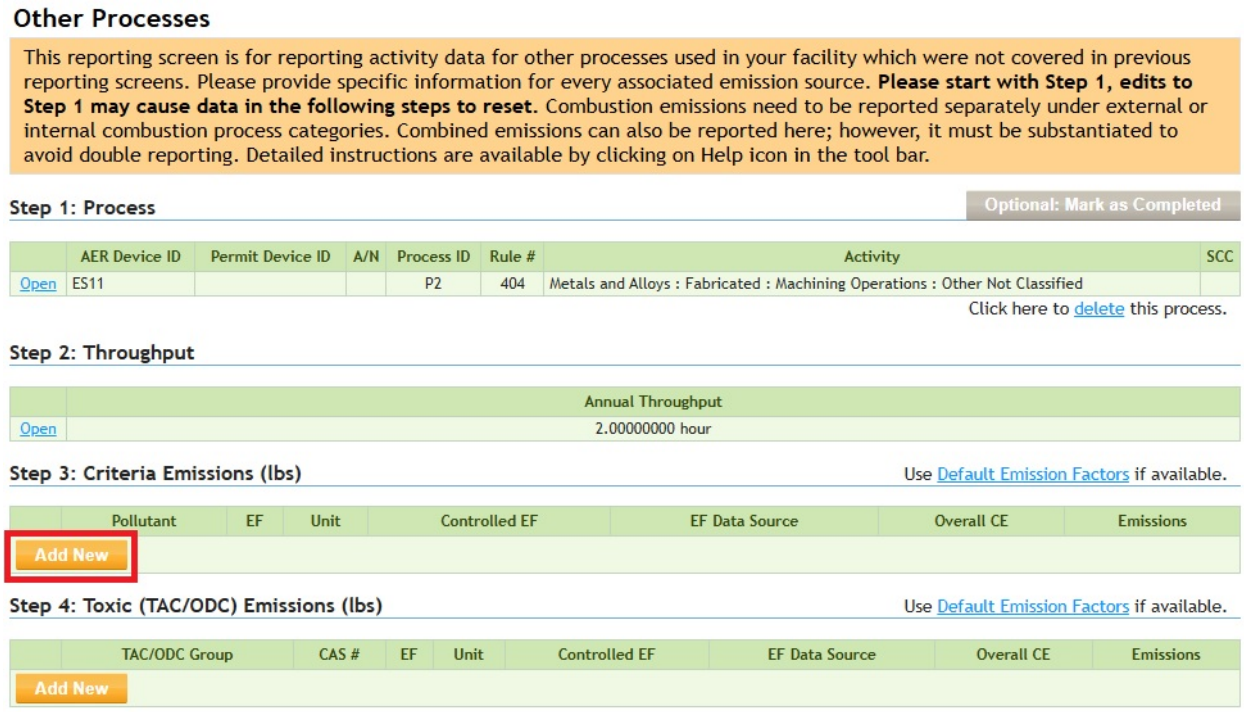
Click on the blue Open link in Step 2



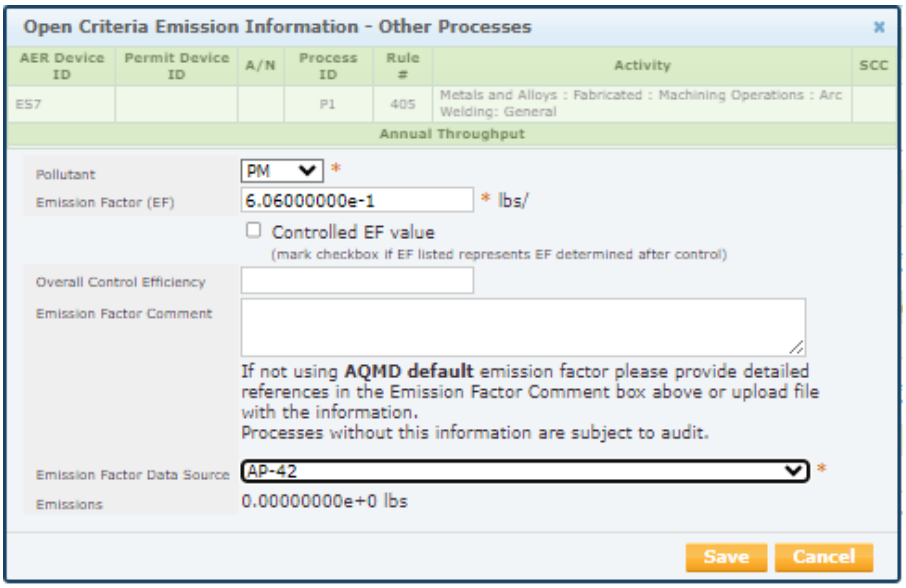
Add the throughput, throughput type, throughput origin, and throughput comment. Then, click the orange Save button.



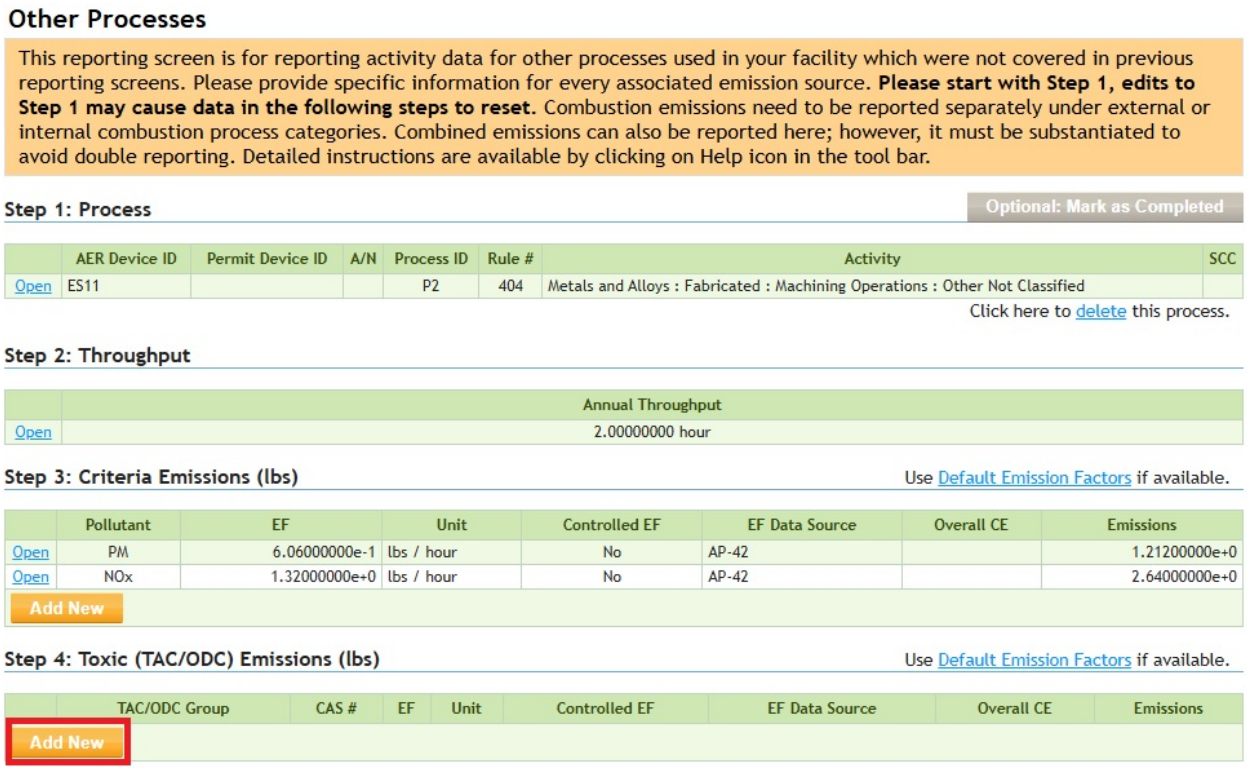
Click on the orange Add New button in Step 3



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.



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
Open	ES11			P2	404	Metals and Alloys : Fabricated : Machining Operations : Other Not Classified	

Click here to delete this process.

Step 2: Throughput

	Annual Throughput
Open	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
Open	PM	6.06000000e-1	lbs / hour	No	AP-42		1.21200000e+0
Open	NOx	1.32000000e+0	lbs / hour	No	AP-42		2.64000000e+0

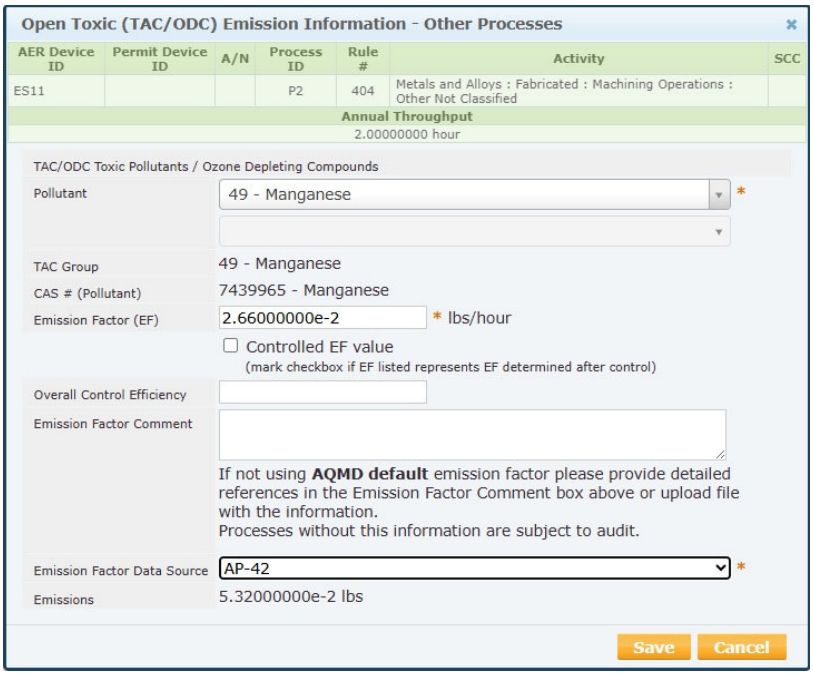
Add New

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

Add New

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: 49 - Manganese *

TAC Group: 49 - Manganese

CAS # (Pollutant): 7439965 - Manganese

Emission Factor (EF): 2.66000000e-2 * 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: AP-42 *

Emissions: 5.32000000e-2 lbs

Save Cancel

Repeat for the other TAC emissions.