Trinity Consultants
20819 72nd Ave S, Ste 610, Kent, WA 98032 / P 253.867.5600 / F 253.867.5601 / **trinityconsultants.com**

June 28, 2023

Mr. Carl Slimp
Puget Sound Clean Air Agency
1904 Third Avenue, #105
Seattle, WA 98101
CarlS@pscleanair.gov

RE: Supplemental Information for NOC 11986 - General Metals of Tacoma (GMT)

Dear Mr. Slimp:

Schnitzer Steel Industries, Inc. (Schnitzer) operates the GMT metal recycling facility in Tacoma, Washington (the facility). This letter provides supplemental information for the Notice of Construction (NOC) application 11986 for the shredder enclosure and controls at the facility.

SUMMARY

GMT owns and operates the facility in the jurisdiction of the Puget Sound Clean Air Agency (PSCAA). The facility operates a metal shredder and hammermill (the "Shredder"), originally permitted in 1998 under Order of Approval (OA) No. 7609 (this Order has since been superseded by NOC 11539 issued in February 2019). The shredder is currently unenclosed.

In August 2020, GMT submitted the NOC application 11986 to propose a shredder enclosure and emission control system (ECS) to reduce VOC, PM, and hazardous air pollutant (HAP)/toxic air pollutant (TAP) emissions. Since the original application submittal and supplemental information submitted dated April 17, 2023, GMT has updated the shredder's throughput and emission calculation methodology. Updates to the emissions calculations and dispersion modeling analysis as a result of the emission calculation changes and other relevant information, are described in the following sections.

EMISSION CALCULATION UPDATES

This section presents the updated values and methodology used to quantify pollutant emissions from the facility. Detailed emission calculations are provided in Attachment 1.

Shredder Throughput

Upon further review, GMT has updated the shredder's maximum hourly throughput of 220 tons per hour (tph) to 300 tph. The vendor literature for the shredder indicates that it was designed for a maximum feed rate of 300 tph. Therefore, GMT conservatively proposes to use the maximum design capacity for calculating maximum hourly emission rates for all pollutants. Additionally, to conservatively estimate the daily emissions from the shredder, GMT proposes a daily throughput limit of 3,000 tons per day (tpd). The maximum annual throughput of 730,000 tons per year remains unchanged from the previous submittals.

$PM_{2.5}$ and NO_X Emissions from the Shredder

To align the emission calculation methodology with Schnitzer's facility in Oakland, CA, $PM_{2.5}$ emissions are now conservatively assumed to be equal to PM_{10} emissions, instead of the prior "Negligible" representation. The annual particulate emissions were also updated to more accurately represent the relationship between annual and hourly shredder throughputs, given that emissions are driven by the throughput at the shredder instead of the hours of operation. The proposed PM_{10} and $PM_{2.5}$ emission level at the exhaust stack is 0.0048 grain per dry standard cubic feet (gr/dscf), which is consistent with the Oakland, CA facility's emission limit on particulate matter.

Moreover, GMT proposes the NO_X emissions of 0.010 lb per ton (lb/ton) shredder feed to estimate nitrogen-containing materials being converted to NO_X due to combustion of nitrogen-containing compounds in the Regenerative Thermal Oxidizers (RTOs). This updated lb/ton value is based on recent source test data at the Oakland, CA facility. The updated NO_X hourly emissions are at 4.96 lbs per hour (lb/hr), based on the 300 tph maximum throughput at the shredder.

HAPs and TAPs Emissions from the Shredder

The previously submitted facility-wide emission calculations were based on stack testing performed on the enclosed shredder located at the Schnitzer's Oakland, CA facility, as documented in Foulweather Consulting's memorandum of recommended emission factors, included in Appendix D of the application.[1] There were four chemicals reported as "tentatively identified compounds" (TICs) in the Foulweather memo:

- 1,1-Difluoroethane
- Acetaldehyde
- Hexachloroethane (PCA)
- Norflurane (HFC134a)

Hexachloroethane was not detected during any of the 28 TO-15 test runs conducted at the Oakland facility in 2017-2019 following installation of the shredder enclosure. However, for the three test runs in January 2019 (with a shredder feed of 100% light iron) hexachloroethane was shown in the lab report as a TIC. The variation in the reported concentration of hexachloroethane as a TIC in those three test runs was substantial – the highest value was approximately 20 times the lowest value. Similarly, 1,1-Difluroethane and acetaldehyde were identified as TICs in only one of six test runs in 2019; norflurane was identified as a TIC in four of six runs. None of these four compounds was ever affirmatively identified in any of the Method TO-15 runs.

Foulweather Consulting recommended that the TICs not be included in permit applications because these compounds were not affirmatively identified by the laboratory analysis; these compounds were included in GMT's original submission by mistake. GMT proposes excluding these four TICs from the calculations which estimate emissions from the shredder, following the Oakland facility's precedent in its submittals to Bay Area Air Quality Management District (BAAQMD).

To appropriately represent the total hydrogen chloride and hydrogen fluoride emissions due to the installation of the ECS, GMT proposes to use the source test results from the Oakland, CA facility rather than relying on the emission factors for individual chlorine- and fluorine-containing compounds from the Foulweather memo. A conservative safety factor is applied to the source test results for estimating the PTE for hydrogen chloride and hydrogen fluoride.

[1] Foulweather Consulting, "Recommended Test Methods and Emission Factors for Metal Shredding Operations Conducted at Schnitzer Steel Industries' Facilities," October 2019 (rev 1).

Table 1 compares the pre-project and post-project criteria pollutant and hazardous air pollutant (HAP) emissions with the aforementioned updated information. Table 2 summarizes the updated TAP emission increases from the project by removing the four TICs and the updated increased shredder hourly and daily throughputs. Note that acetaldehyde, a TIC, now shows an emission increase due to natural gas combustion at the RTOs.

Table 1. Updated Shredder Potential-to-Emit (PTE) Summary [a]

Pollutant	Pre-Project Emissions (tpy)	Post-Project Emissions (tpy)	Project Emissions Increase (tpy)
PM	96.00	11.81	-84.19
PM_{10}	42.24	9.12	-33.12
$PM_{2.5}$	42.24	9.12	-33.12
SO_2	--	0.10	**0.10**
NO_X	--	12.24	**12.24**
VOC	231.87	16.94	-214.92
CO	--	14.43	**14.43**
Total HAP	20.03	2.77	-17.26
Max Individual HAP	7.42	0.57	-6.86

a. All calculations represented are the sum of controlled shredder emissions from the RTOs, fugitive shredder emissions, and emissions from natural gas combustion and additional NO_x emissions due to the RTOs. These are the only emission sources that would be affected by the proposed project. Emissions for pollutants that will increase total emission rate due to this project are presented in bold.

Table 2. Updated TAP Emission Increases

TAP	Project Emission Increase	SQER	Averaging period	Below SQER?
	lb/averaging period			
Acetaldehyde	1.48	6.0E+01	Annual	Yes
Acrolein	1.27E-06	2.6E-02	24-hr	Yes
Copper Compounds	3.33E-05	1.9E-01	1-hr	Yes
Formaldehyde	25.76	2.7E+01	Annual	Yes
Hydrogen Chloride	4.68	6.7E-01	24-hr	No
Hydrogen Fluoride	4.01	1.0E+00	24-hr	No
Naphthalene	0.10	4.8E+00	Annual	Yes
CO	3.29	4.3E+01	1-hr	Yes
NO_X	4.96	8.7E-01	1-hr	No
Sodium Hydroxide [a]	0.011	1.5E-02	1-hr	Yes

a. Basis for determining the sodium hydroxide emissions is provided in the November 11, 2020 submittal to respond the agency's request for NOC 11986.

UPDATED AIR DISPERSION MODELING ANALYSIS

In November 2020, PSCAA requested a TAP analysis for CO, NO_2, and sodium hydroxide from the project. In the TAP analysis, it was determined that emissions of carbon monoxide and sodium hydroxide were below the respective SQERs, and no further review was necessary. Emissions of NO_X exceeded the SQER, requiring dispersion modeling for comparison to the Acceptable Source Impact Level (ASIL) of 470 µg/m^3 (1-hour average). An AERSCREEN analysis was performed in the Supplemental Information submitted on April 17, 2023 to demonstrate compliance with the ASIL for NO_X. The AERSCREEN analysis was performed with a list of conservative assumptions. The updated modeling result is presented in Table 3, which showed the modeled NO_2 impact from the project is well below the ASIL.

Due to the change of the hydrogen chloride and hydrogen fluoride emission calculation basis, emission increases of hydrogen chloride and hydrogen fluoride exceed the respective SQER. The same AERSCREEN analysis was used to determine the maximum offsite air concentration. The modeling results are presented in Table 3, which shows the modeled HCl and HF impacts are well below the ASILs.

Table 3. Updated TAP Modeling Results

Toxic Air Pollutant	Averaging Period	Hourly Emission Increase [b] (lb/hr)	Modeled Concentration (µg/m^3)	ASIL (µg/m^3)	Above ASIL?	% of ASIL
NO_2 [a]	1-hr	4.96	151.70	470	No	32%
HCl	24-hr	0.20	3.58	9	No	40%
HF	24-hr	0.17	3.06	14	No	22%

a. It is conservatively assumed all NO_X emissions are emitted in the form of NO_2.
b. Hourly emission increases represent the emissions corresponding to the averaging period (e.g., HCl lb/hr emissions = HCl lb/day emissions ÷ 24 hr/day).

If you have any questions or comments about the information presented in this letter, please do not hesitate to call me at 253.867.5600 x4803, or email me at hcheng@trinityconsultants.com.

Sincerely,

TRINITY CONSULTANTS

Hui Cheng, PE
Senior Consultant

Attachments

cc: Mr. Randy Spencer, General Metals of Tacoma
Mr. Scott Sloan, General Metals of Tacoma

Attachment 1
Updated Emissions Calculations

Table 1. Shredder Criteria Pollutant Potential to Emit (PTE) Summary[1]

Pollutant	Pre-Project Hourly PTE (lb/hr)	Pre-Project Annual PTE (tpy)	Post-Project Hourly PTE (lb/hr)	Post-Project Annual PTE (tpy)	Project Hourly PTE Increase[2] (lb/hr)	Project Annual PTE Increase[2] (tpy)
PM	78.90	96.00	9.71	11.81	-69.20	-84.19
PM_{10}	34.72	42.24	7.50	9.12	-27.22	-33.12
$PM_{2.5}$	34.72	42.24	7.50	9.12	-27.22	-33.12
SO_2	-	-	0.02	0.10	**0.02**	**0.10**
NO_x	-	-	4.96	12.24	**4.96**	**12.24**
VOC	190.58	231.87	13.37	16.94	-177.21	-214.92
CO	0	0	3.29	14.43	**3.29**	**14.43**

1. All calculations represented are the sum of controlled shredder emissions from the RTOs, fugitive shredder emissions, and emissions from natural gas combustion at the RTOs. These are the only emission sources that would be affected by the proposed project.

2. Emissions for pollutants that will increase total emission rate due to this project are presented in bold.

Table 2. Shredder Toxic Air Pollutant (TAP) and Hazardous Air Pollutant (HAP) Emission Summary[1, 7]

Pollutant	Hazardous Air Pollutant (HAP)?[2] (Yes/No)	Pre-Project Hourly Emissions (lb/hr)	Pre-Project Daily Emissions (lb/day)	Pre-Project Annual Emissions (tpy)	Post-Project Hourly Emissions (lb/hr)	Post-Project Daily Emissions (lb/day)	Post-Project Annual Emissions (tpy)
1,3-Butadiene	Yes	0.02	0.22	0.03	1.50E-03	0.02	1.83E-03
Acetaldehyde	Yes	-	-	-	1.69E-04	2.02E-06	7.39E-04
Acrolein	Yes	-	-	-	1.06E-04	1.27E-06	4.64E-04
Benzene	Yes	0.52	5.17	0.63	0.04	0.36	0.04
Cadmium Compounds	Yes	3.42E-04	3.42E-03	4.16E-04	4.08E-05	4.08E-04	4.97E-05
Chlorodifluoromethane	No	1.97	19.67	2.39	0.14	1.36	0.17
Chromium (non-VI) Compounds	No	1.05E-05	1.05E-04	1.28E-05	1.25E-06	1.25E-05	1.52E-06
Chromium (VI) Compounds	No	4.65E-06	4.65E-05	5.66E-06	5.55E-07	5.55E-06	6.75E-07
Chromium Compounds (total)	Yes	1.52E-05	1.52E-04	1.84E-05	1.81E-06	1.81E-05	2.20E-06
Copper Compounds	Yes	-	-	-	3.33E-05	4.00E-07	1.46E-04
Cumene	Yes	0.06	0.60	0.07	4.15E-03	0.04	5.05E-03
Ethylbenzene	Yes	1.19	11.88	1.45	0.08	0.82	0.10
Formaldehyde	Yes	-	-	-	2.94E-03	3.53E-05	1.29E-02
Hexane (n-Hexane)	Yes	1.93	19.34	2.35	0.20	1.34	0.47
Hydrogen Chloride	Yes	-	-	-	0.47	4.68	0.57
Hydrogen Fluoride	Yes	-	-	-	0.40	4.01	0.49
Lead Compounds	Yes	2.42E-03	0.02	2.94E-03	2.88E-04	2.88E-03	3.51E-04
Methanol	Yes	0.66	6.57	0.80	0.05	0.45	0.06
Methyl Chloroform (1,1,1-Trichloroethane)	Yes	0.29	2.86	0.35	0.02	0.20	0.02
Methyl Isobutyl Ketone (MIBK)	Yes	0.07	0.65	0.08	4.51E-03	0.05	5.49E-03
Methylene Chloride	Yes	0.18	1.85	0.22	1.27E-02	0.13	0.02
Naphthalene	Yes	-	-	-	1.18E-05	1.41E-07	5.15E-05
Tetrachloroethylene (PCE)	Yes	0.31	3.12	0.38	0.02	0.22	0.03
Polychlorinated Biphenyls (PCBs)[4]	Yes	0.02	0.17	0.02	1.14E-03	1.14E-02	1.39E-03
Propylene	No	0.61	6.08	0.74	0.07	0.42	0.18
Styrene	Yes	0.29	2.91	0.35	0.02	0.20	0.02
Toluene	Yes	4.82	48.23	5.87	0.33	3.33	0.41
Xylenes (m-, o-, and p-)[5]	Yes	6.10	61.03	7.42	0.42	4.21	0.51
Highest Individual HAP[6]:	--	--	--	7.42	--	--	0.57
Total HAPs[6] (tpy)	--	--	--	20.03	--	--	2.77

1. All calculations represented are the sum of controlled shredder emissions from the RTOs, fugitive shredder emissions, and emissions from natural gas combustion at the RTOs. These are the only emission sources that would be affected by the proposed project. Total emissions for pollutants that will have an increase in emissions are presented in bold text.

2. The summary table for all pollutants emitted from the shredder and RTOs includes several non-HAP. These pollutants are either halogenated compounds that can form acid gases in the RTOs or toxic air pollutants (TAP) emitted from natural gas combustion in the RTOs.

3. Chromium compounds are the HAP category. The report from Foulweather Consulting lists emission factors for "all chromium compounds" and chromium VI separately. In this table, emissions for "all chromium compounds" are conservatively compared to the most stringent TAP thresholds for chromium III. Emissions of chromium VI are compared to the TAP thresholds for chromium VI.

4. PCBs as a generic category are the emission factor listed in the report from Foulweather Consulting. This pollutant is a HAP and many specific PCBs are Washington TAP; emissions of this pollutant are compared the TAP category of "PCBs, NOS (not otherwise specified)"

5. Specific emission factors for isotopes of xylene are listed in the Foulweather report. All xylene emissions are conservatively grouped under the HAP of "mixed xylenes" for comparison to SQER levels in WAC 173-460-150. All xylene isotopes and mixed xylenes have the same SQER in the rule.

6. Total HAP and highest individual HAP calculations exclude any Washington TAP that is not also a HAP.

7. From Foulweather Consulting's "Recommended Test Methods and Emission Factors for Metal Shredding Operations Conducted at Schnitzer Steel Industries' Facilities" (October 2019), 1,1-difluroethane, acetaldehyde, hexachloroethane (PCA), and norflurane (HFC134a) were indicated as Tentatively Identified Compounds (TICs) and should not be included in the HAP/TAP analysis of shredder emissions.

Table 3. Shredder Parameters

Parameter	Value	Units
Maximum Annual Throughput[1]	730,000	tpy
Maximum Hourly Throughput[2]	300	tph
Maximum Daily Throughput [1]	3,000	tpd
Shredder Enclosure Capture Efficiency[3]	95	%
RTO Control Efficiency[3]	98	%
Number of Proposed RTOs	2	Control Units

1. Maximum annual and daily throughputs are based on projected maximum throughput levels.
2. Maximum hourly throughput is based on shredder capacity of 300 tons/hour per manufacturer.

3. Proposed design capture efficiency of shredder enclosure system and design parameters for the control devices.

Table 4. Shredder Stack VOC and NOx PTE Summary

Pollutant	Uncontrolled Emission Factor (lb/ton)	Uncontrolled Hourly Emissions[1] (lb/hr)	Uncontrolled Annual Emissions[1] (tpy)	Post-Project Emission Factor[2] (lb/ton)	Post-Project Hourly Emissions[3] (lb/hr)	Post-Project Annual Emissions[4] (tpy)
VOC[5]	0.64	190.58	231.87	1.21E-02	3.62	4.41
NO_X	0.010	3.00	3.65	1.00E-02	3.00	3.65

1. VOC emission factor (lb/hr) is obtained from the uncontrolled emission rate, as detailed in PTE emissions for the shredder listed in the Tacoma Schnitzer Title V Application. PTE emission rate for VOC is based on the uncontrolled emission factor documented in a memorandum by Foulweather Consulting that provides recommended emission factors for Schnitzer's facilities. NO_X emission factor is also obtained from the uncontrolled emission rate, which are based on the uncontrolled NO_X emission factor from Schnitzer's Oakland, CA facility. Uncontrolled emission rates do not account for the shredder enclosure capture efficiency of 95%.

2. Post-Project Emission Factor for VOC (lb/ton) = Uncontrolled Emission Rate (lb/hr) / Maximum Hourly Throughput (ton/hr)) * 95% Enclosure Capture * (1 - RTO Control %).
Post-Project Emission Factor for NO_X (lb/ton) = Uncontrolled Emission Rate (lb/hr) / Maximum Hourly Throughput (ton/hr)). It is conservatively assumed that all ammonia-based compounds from the shredder are converted to NOX at the RTO.

3. Hourly Emissions (lb/hr) = Emission Factor (lb/ton) * Maximum Hourly Throughput (tons/hr).

4. Annual Emissions (tpy) = Emission Factor (lb/ton) * Maximum Annual Throughput (ton/yr) / 2000 (lb/ton).

5. The incoming feedstock to the shredder includes the primary categories of light iron and auto bodies. As described in the Foulweather Consulting memorandum of recommended emission factors, a site-specific VOC emission factor should be derived based on the nominal average mix of auto bodies and light iron fed to the shredder on a facility-specific basis. The nominal mix and derivation of a facility-specific emission factor for Schnitzer's Tacoma shredder is provided below. VOC emission factors are provided on an as-methane basis

Auto Bodies	35%	0.84	lbs VOC / ton steel
Light Iron	65%	0.525	lbs VOC / ton steel
Tacoma-specific VOC EF		0.635	lbs VOC / ton steel

Table 5. Shredder Stack Particulate Matter PTE Summary

Pollutant	Uncontrolled Emission Factor (lb/ton)	Uncontrolled Hourly Emissions[1] (lb/hr)	Uncontrolled Annual Emissions[1] (tpy)	Exhaust Flow Rate[2] (scfm)	Grain Loading Rate[2] (gr./dscf)	Post-Project Hourly Emissions[3] (lb/hr)	Post-Project Annual Emissions[4] (tpy)
PM	0.263	78.90	96.00	140,000	0.0048	5.76	7.01
PM_{10}[5]	0.116	34.72	42.24	140,000	0.0048	5.76	7.01
$PM_{2.5}$[5]	0.116	34.72	42.24	140,000	0.0048	5.76	7.01

1. PM emission factors (lb/hr) are obtained from uncontrolled emission rates, as detailed in PTE emissions for the shredder listed in the Tacoma Schnitzer Title V Application. PTE emission rates for PM are based on the uncontrolled emission factors documented in a memorandum by Foulweather Consulting that provides recommended emission factors for Schnitzer's facilities. Uncontrolled emission rates do not account for the shredder enclosure capture efficiency of 95%.

2. Exhaust Flow Rate is based on vendor guarantees for the venturi scrubbers. Controlled PM_{10} and $PM_{2.5}$ emissions are conservatively assumed to be equivalent to PM emissions. Grain Loading Rate representing the outlet concentration at the exhaust stack, is based on the operations at Schnitzer's Oakland, CA facility.

3. Hourly Emissions (lb/hr) = Exhaust Grain Loading Rate (gr./dscf) x Exhaust Air Flow Rate (dscf/min) x (60 min/hr) x (lb/7,000 gr.).

4. Annual Emissions (tpy) = Hourly Emissions (lb/hr) * Maximum Annual Throughput (ton/yr) / Maximum Hourly Throughput (ton/hr) / 2000 (lb/ton).

5. Uncontrolled fugitive emission factors from source testing reflect TSP emissions and include both filterable and condensable particulate. No credible size speciation data for TSP/PM_{10}/$PM_{2.5}$ appear to be available for metal shredding facilities. Data from US EPA AP-42, Chapter 11.19.2 (crushed stone processing) appear to be the best fit. Based on the emission factors for tertiary crushing (uncontrolled) in Table 11.19.2-2, a PM_{10} fraction of 44% can be calculated. No data are available for $PM_{2.5}$ fractions for uncontrolled rock crushing (or metal shredding) activities; $PM_{2.5}$ emissions are conservatively assumed to be equal to PM_{10} emissions.

Table 6. Shredder Stack TAP and HAP Emission Summary

Pollutant	HAP[1] (Yes/No)	TAP (Yes/No)	Uncontrolled Emission Factor[2] (lb/ton) Auto Bodies	Light Iron	Tacoma-Specific	Hourly Emissions[3,6] (lb/hr)	Daily Emissions[4,6] (lb/day)	Annual Emissions[5,6] (tpy)
1,3-Butadiene	Yes	Yes	6.20E-05	7.84E-05	7.27E-05	4.14E-04	4.14E-03	5.04E-04
Benzene	Yes	Yes	4.38E-03	2.95E-04	1.72E-03	9.83E-03	9.83E-02	1.20E-02
Cadmium Compounds	Yes	Yes	--	--	1.14E-06	2.37E-05	2.37E-04	2.89E-05
Chlorodifluoromethane	No	Yes	1.62E-04	1.00E-02	6.56E-03	3.74E-02	3.74E-01	4.55E-02
Chromium (non-VI) Compounds	No	Yes	--	--	3.50E-08	7.28E-07	7.28E-06	8.86E-07
Chromium (VI) Compounds	No	Yes	--	--	1.55E-08	3.22E-07	3.22E-06	3.92E-07
Chromium Compounds (total)	Yes	No	--	--	5.05E-08	1.05E-06	1.05E-05	1.28E-06
Cumene	Yes	Yes	2.14E-04	1.93E-04	2.00E-04	1.14E-03	1.14E-02	1.39E-03
Ethylbenzene	Yes	Yes	9.03E-03	1.23E-03	3.96E-03	2.26E-02	2.26E-01	2.75E-02
Hexane (n-Hexane)	Yes	Yes	1.35E-02	2.65E-03	6.45E-03	3.68E-02	3.68E-01	4.47E-02
Lead Compounds	Yes	Yes	--	--	8.05E-06	1.67E-04	1.67E-03	2.04E-04
Methanol	Yes	Yes	1.34E-03	2.65E-03	2.19E-03	1.25E-02	1.25E-01	1.52E-02
Methyl Chloroform (1,1,1-Trichloroethane)	Yes	Yes	1.22E-04	1.40E-03	9.53E-04	5.43E-03	5.43E-02	6.61E-03
Methyl Isobutyl Ketone (MIBK)	Yes	Yes	9.13E-05	2.86E-04	2.18E-04	1.24E-03	1.24E-02	1.51E-03
Methylene Chloride	Yes	No	1.55E-04	8.64E-04	6.16E-04	3.51E-03	3.51E-02	4.27E-03
Tetrachloroethylene (PCE)	Yes	Yes	1.51E-04	1.52E-03	1.04E-03	5.93E-03	5.93E-02	7.22E-03
Polychlorinated Biphenyls (PCBs)	Yes	Yes	2.69E-06	8.35E-05	5.52E-05	3.15E-04	3.15E-03	3.83E-04
Propylene	No	Yes	3.71E-04	2.92E-03	2.03E-03	1.16E-02	1.16E-01	1.41E-02
Styrene	Yes	Yes	1.67E-04	1.40E-03	9.68E-04	5.52E-03	5.52E-02	6.72E-03
Toluene	Yes	Yes	3.57E-02	5.51E-03	1.61E-02	9.16E-02	9.16E-01	1.11E-01
Xylenes (m-, o-, and p-)	Yes	Yes	4.59E-02	6.58E-03	2.03E-02	1.16E-01	1.16E+00	1.41E-01

1. A Hazardous Air Pollutant (HAP) is any pollutant listed pursuant to Section 112(b) of the Clean Air Act.

2. Emission factors are taken from Appendix B of a report from Foulweather Consulting; this report evaluated the results of a stack test performed on Schnitzer's facility in Oakland. Emission factors were provided for shredder feed of 100% auto bodies and 100% light iron; the emission factor used for emissions at Schnitzer Tacoma is based on the infeed mix of these two categories. The emission factors provided are in Appendix B of the Foulweather Consulting report are provided specifically for the Puget Sound Clean Air Agency (PSCAA). Tentatively Identified Compounds (TICs), including 1,1-difluroethane, acetaldehyde, hexachloroethane (PCA), and norflurane (HFC134a), are not included in estimating TAP/HAP emissions from the shredder.

The incoming feedstock to the shredder is split between the primary categories of light iron and auto bodies. The percentage of each feed is based on operating data from Schnitzer.

Auto Bodies	35%
Light Iron	65%

3. Hourly Emissions (lb/hr) = Emission Factor (lb/ton) * Maximum Hourly Throughput (tons/hr) * 95% Enclosure Capture * (1 - Control Device Efficiency (%)).

4. Daily Emissions (lb/day) = Emission Factor (lb/ton) * Maximum Daily Throughput (tons/day) * 95% Enclosure Capture * (1 - Control Device Efficiency (%)).

5. Annual Emissions (tpy) = Emission Factor (lb/ton) * Maximum Annual Throughput (ton/yr) / 2000 (lb/ton) * 95% Enclosure Capture * (1 - Control Device Efficiency (%)).

6. The 98% control efficiency from the RTOs is not applied to the particulate HAP/TAP pollutants (cadmium, chromium or lead compounds). Instead, the calculations apply a control efficiency for the venturi scrubbers based on the controlled and uncontrolled PM emissions for the process.

Table 7. Acid Gas Emission Summary

Pollutant[1]	Emission Factor[2] (lb/ton)	Hourly Emissions[3] (lb/hr)	Daily Emissions[4] (lb/day)	Annual Emissions[5] (tpy)
Hydrogen Fluoride	1.56E-03	0.47	4.68	0.57
Hydrogen Chloride	1.34E-03	0.40	4.01	0.49

1. HCl and HF emissions occur when the chlorine-containing and fluorine-containing compounds are going through combustion at the RTOs.
2. Emission factors for HF and HCl are based on Oakland, CA's most recent source test results, averaging the lb/ton values observed from the two stacks and applying a conservative safety factor.
3. Hourly Emissions (lb/hr) = Emission Factor (lb/ton) * Maximum Hourly Throughput (tons/hr)
4. Daily Emissions (lb/day) = Emission Factor (lb/ton) * Maximum Daily Throughput (tons/day)
5. Annual Emissions (tpy) = Emission Factor (lb/ton) * Maximum Annual Throughput (ton/yr) / 2000 (lb/ton)

Table 8. Shredder Fugitive Criteria Pollutant PTE Summary

Pollutant	Fugitive Emission Factor[1] (lb/ton)	Hourly Emissions[2] (lb/hr)	Annual Emissions[3] (tpy)
PM^{4}	1.32E-02	3.95	4.80
$PM_{10}{}^{4}$	5.79E-03	1.74	2.11
$PM_{2.5}{}^{4}$	5.79E-03	1.74	2.11
VOC[5]	3.18E-02	9.53	11.59

1. Fugitive Emission Factor (lb/ton) = Uncontrolled Emission Rate (lb/hr) / Maximum Hourly Throughput (ton/hr) * (1 - enclosure efficiency)

2. Hourly Emissions (lb/hr) = Emission Factor (lb/ton) * Maximum Hourly Throughput (tons/hr).

3. Annual Emissions (tpy) = Emission Factor (lb/ton) * Maximum Annual Throughput (ton/yr) / 2000 (lb/ton).

4. Particulate emissions account for both filterable and condensable emissions

5. VOC emissions are provided on an as-methane basis

Table 9. Shredder Fugitive TAP and HAP Emission Summary

Pollutant	HAP[1] (Yes/No)	TAP (Yes/No)	Tacoma-specific Fugitive Emission Factor[2] (lb/ton)	Hourly Emissions[3] (lb/hr)	Daily Emissions[4] (lb/day)	Annual Emissions[5] (tpy)
1,3-Butadiene	Yes	Yes	3.63E-06	1.09E-03	1.09E-02	1.33E-03
Benzene	Yes	Yes	8.62E-05	2.59E-02	2.59E-01	3.15E-02
Cadmium Compounds	Yes	Yes	5.70E-08	1.71E-05	1.71E-04	2.08E-05
Chlorodifluoromethane	Yes	Yes	3.28E-04	9.84E-02	9.84E-01	1.20E-01
Chromium (non-VI) Compounds	No	Yes	1.75E-09	5.25E-07	5.25E-06	6.39E-07
Chromium (VI) Compounds	No	Yes	7.75E-10	2.33E-07	2.33E-06	2.83E-07
Chromium Compounds (total)	Yes	No	2.53E-09	7.58E-07	7.58E-06	9.22E-07
Cumene	Yes	Yes	1.00E-05	3.01E-03	3.01E-02	3.66E-03
Ethylbenzene	Yes	Yes	1.98E-04	5.94E-02	5.94E-01	7.23E-02
Hexane (n-Hexane)	Yes	Yes	3.22E-04	9.67E-02	9.67E-01	1.18E-01
Lead Compounds	Yes	Yes	4.03E-07	1.21E-04	1.21E-03	1.47E-04
Methanol	Yes	Yes	1.10E-04	3.29E-02	3.29E-01	4.00E-02
Methyl Chloroform (1,1,1-Trichloroethane)	Yes	Yes	4.76E-05	1.43E-02	1.43E-01	1.74E-02
Methyl Isobutyl Ketone (MIBK)	Yes	Yes	1.09E-05	3.27E-03	3.27E-02	3.98E-03
Methylene Chloride	Yes	No	3.08E-05	9.24E-03	9.24E-02	1.12E-02
Tetrachloroethylene (PCE)	Yes	Yes	5.20E-05	1.56E-02	1.56E-01	1.90E-02
Polychlorinated Biphenyls (PCBs)	Yes	Yes	2.76E-06	8.28E-04	8.28E-03	1.01E-03
Propylene	No	Yes	1.01E-04	3.04E-02	3.04E-01	3.70E-02
Styrene	Yes	Yes	4.84E-05	1.45E-02	1.45E-01	1.77E-02
Toluene	Yes	No	8.04E-04	2.41E-01	2.41E+00	2.93E-01
Xylenes (m-, o-, and p-)	Yes	Yes	1.02E-03	3.05E-01	3.05E+00	3.71E-01

1. A Hazardous Air Pollutant (HAP) is any pollutant listed pursuant to Section 112(b) of the Clean Air Act.

2. Fluorinated and chlorinated acid gasses emitted from the shredder stack are not included in the list of fugitive shredder emissions since those compounds are formed only when passing through the RTOs.
Fugitive Emission Factor (lb/ton) = [Uncontrolled Emission Factor (lb/ton) * (1 - Shredder Enclosure Capture Efficiency (%)].

3. Hourly Emissions (lb/hr) = Fugitive Emission Factor (lb/ton) * Maximum Hourly Throughput (tons/hr).

4. Daily Emissions (lb/day) = Fugitive Emission Factor (lb/ton) * Maximum Daily Throughput (tons/day).

5. Annual Emissions (tpy) = Fugitive Emission Factor (lb/ton) * Maximum Annual Throughput (ton/yr) / 2000 (lb/ton).

Table 10. RTO Natural Gas Consumption Parameters

Parameter	Value	Units
Maximum Daily Hours of Operation (Operating Capacity)[1]	24	hr/day
Daily Hours of Operation (Standby Capacity)[1]	0	hr/day
Maximum Annual Hours of Operation (Operating Capacity)[2]	8760	hr/yr
Single RTO Burner Maximum Heat Rating (Startup Capacity)[3]	20	MMBtu/hr
Natural Gas HHV[4]	1.02E-03	MMBtu/scf
Single RTO Gas Firing Rate (Operating Capacity)[5]	1.96E-02	MMscf/hr

1. The daily maximum hours of operation for the RTO is assumed to be 24 hours. Actual hours of operation are expected to be much less than this, and the RTOs will spend a significant amount of time in a standby mode.
2. Annual Hours of Operation of the RTO conservatively assumes the daily maximum hours of operation for 365 days.
3. Estimated heat rating for RTO operation at operating capacity based on a similar Schnitzer facility. Calculations are conservatively based on the maximum burner capacity of 20 MMBtu/hr.
4. Natural Gas HHV obtained from AP-42 Section 1.4 on Natural Gas Combustion
5. Gas Firing Rate (MMscf/hr) = Heat Rating (MMBTU/hr) / Natural Gas HHV (MMBtu/scf) / (10^6 scf/MMscf).

Table 11. Criteria Pollutant PTE Summary for Two RTOs

Pollutant	Emission Factor[1] (lb/MMscf)	Maximum Hourly Emissions[2] (lb/hr)	Annual Emissions[3] (tpy)
SO_2	0.6	0.02	0.10
NO_x	50	1.96	8.59
VOC	5.5	0.22	0.94
CO	84	3.29	14.43

1. Minimal combustion emissions are expected for most pollutants from the flameless RTOs; however, emissions are conservatively estimated based on AP-42 in place of manufacturer specifications. Emission factors obtained from AP-42 Section 1.4 Natural Gas Combustion, Tables 1.4-1 and Table 1.4-2. PM_{10} and $PM_{2.5}$ emissions are conservatively assumed to be equivalent to PM emissions.

2. Maximum Hourly Emissions (lb/hr) = Emission Factor (lb/MMscf) * Maximum Gas Firing Rate (MMscf/hr) * 2 RTOs.
3. Annual Emissions (tpy) = Emission Factor (lb/MMscf) / 2000 (lb/ton) * [Gas Firing Rate at Operating Capacity (MMscf/hr) * Annual Hours of Operation at Operating Capacity (hr/yr)] * 2 RTOs.

Table 12. TAP PTE Summary for Two RTOs

TAP	CAS	Emission Factor (lb/MMscf)	Maximum Hourly Emissions[1] (lb/hr)	Daily Emissions[2] (lb/day)	Annual Emissions[3] (tpy)	Emission Factor Source[4]
Acetaldehyde	75-07-0	4.30E-03	1.69E-04	2.02E-06	7.39E-04	1
Acrolein	107-02-8	2.70E-03	1.06E-04	1.27E-06	4.64E-04	1
Benzene	71-43-2	2.10E-03	8.24E-05	9.88E-07	3.61E-04	2
Copper Compounds	7440-50-8	8.50E-04	3.33E-05	4.00E-07	1.46E-04	2
Ethylbenzene	100-41-4	9.50E-03	3.73E-04	4.47E-06	1.63E-03	1
Formaldehyde	50-00-0	7.50E-02	2.94E-03	3.53E-05	1.29E-02	2
Hexane (n-Hexane)	110-54-3	1.80E+00	7.06E-02	8.47E-04	3.09E-01	2
Naphthalene	91-20-3	3.00E-04	1.18E-05	1.41E-07	5.15E-05	1
Propylene	115-07-1	7.31E-01	2.87E-02	3.44E-04	1.26E-01	1
Toluene	108-88-3	3.66E-02	1.44E-03	1.72E-05	6.29E-03	1

1. Maximum Hourly Emissions (lb/hr) = Emission Factor (lb/MMscf) * Maximum Gas Firing Rate (MMscf/hr) * 2 RTO units operating in parallel.
2. Maximum Daily Emissions (lb/day) = Annual Emissions (tpy) / (365 days/yr) * 2000 (lb/ton).
3. Annual Emissions (tpy) = Emission Factor (lb/MMscf) / 2000 (lb/ton) * [Gas Firing Rate at Operating Capacity (MMscf/hr) * Annual Hours of Operation at Operating Capacity (hr/yr) + Gas Firing Rate at Standby Capacity (MMscf/hr) * Annual Hours of Operation at Standby Capacity (hr/yr)] * 2 RTOs.

4. PSCAA has provided an informal list of TAP they will be reviewing for sources that use natural gas combustion. The emission factors for each TAP listed are taken from either (1) Ventura County Air Pollution Control District AB 2588 Combustion Emission Factors, Natural Gas Fired Combustion Equipment or (2) AP-42 Section 1.4 Natural Gas Combustion, Tables 1.4-3 and 1.4-4