# ENGINEERING ANALYSIS



**PROJECT DESCRIPTION**

Imperial Aluminum – Scottsboro, LLC operates a secondary aluminum processing facility in Scottsboro, Alabama, and operates a reverberatory furnace under Air Permit No. 705-0044-X001. On May 1, 2023, Imperial Aluminum submitted a Synthetic Minor Operating Permit (SMOP) application for the replacement of this existing reverberatory aluminum melting furnace (X001). The proposed reverberatory furnace (X007) will have a 220,000 pound holding capacity and an 18 MMBtu/hr oxyfuel combustion system. Air emissions from the new furnace will be controlled by the existing 3-compartment, reverse air baghouse with hydrated lime injection system. Furnace X001 receives molten metal from tilting rotary #1 (X003) and #2 (X005). The current reverberatory furnace, X001, has a rated process capacity of 14,000 lbs/hr and is permitted to operate for 8,760 hrs/yr.

The facility also plans to add a receiving well to catch molten aluminum from Rotary #2. This addition will result in better filtration of dross from the molten aluminum from Rotary #2. Currently, dross from the molten aluminum from this side of the process is manually skimmed from the trough between Rotary #1 and the reverb furnace; any remaining dross must be skimmed from the hearth itself via the hearth door, which introduces air to the molten aluminum bath and facilitates the formation of more dross (and subsequent particulate matter emissions from the hearth stack) via oxidation.

**PROCESS DESCRIPTION**

Imperial Aluminum – Scottsboro, LLC processes aluminum scrap using reverberatory furnaces. This facility produces aluminum alloys and aluminum dross by-product by feeding aluminum scrap, molten aluminum, cover flux, and solid reactive flux into the furnaces. Aluminum scrap is melted, refined, and alloy content adjusted then cast to make ingots, cones, and sows. The proposed additions would allow for a reduction in particulate matter emissions from the hearth stack.

**EMISSIONS**

Calculations are made on an 8,760 hour/year basis. Where needed, calculations are based on a 7 TPH process rate and 18 MMBtu/hr to the reverberatory furnace.

Fugitive particulate matter emissions from dross handling have been approximated using the factor for particulate matter from low-silt slag batch-dropped from a front-end loader, per AP-42 Table 12.5-4. Additionally, fugitive particulate matter emissions from scrap storage piles have been approximated using Equation 1 from AP-42 Chapter 13.2.4, assuming 2.2% moisture content and 7 mph wind speed.

For the reverb furnace, emissions in the receiving well of the furnace would be uncontrolled. Imperial Aluminum will be limited in PM emissions to 6.02 lb/hr for the reverberatory furnace. Based on emission factors for reverb furnaces from EPA's AP-42 Ch. 12.8, $PM_{10}$ and $PM_{2.5}$ emissions are expected to be 60% and 50% of the total PM, respectively. Dioxin & furan (D/F) PTE is based on the 2.1E-4 gr/ton limit stipulated by NESHAP RRR. Imperial Aluminum has proposed limits of 0.760 lb/hr HCl for the reverb via NESHAP RRR. Imperial Aluminum has estimated HF emissions to be half of the HCl emissions.

Imperial Aluminum estimates emissions for natural gas combustion from the furnaces, which would emit via the uncontrolled hearth stacks, via AP-42 Chapter 1.4. Additionally, the Department has estimated chargewell emissions from combustible contaminants within the scrap via stack test data from similar sources. Although no published factors for $NO_X$, CO, and condensable PM exist for emissions from the chargewell of reverberatory furnaces, the Department has chosen to estimate emissions from the reverb chargewell at rates of 0.097 lb/ton for $NO_X$, 0.518 lb/ton for CO, and 0.043 lb/ton for $PM_{con}$. These factors were developed via a 90% confidence UPL analysis of limited stack test data from Logan Aluminum (Kentucky)'s A1 and B1 Sidewell Furnaces. Although EPA has listed an unrated 0.2 lb/ton VOC emission factor for reverb furnaces (SCC 30400103) in their WebFIRE database, the Department has chosen to use a 0.128 lb/ton VOC factor developed from the same dataset.

Additionally, the Department has estimated Non-D/F organic HAP emissions to be 0.062 lb/ton, using maximum values from the delacquering kiln test results (excluding naphthalene, which is an outlier) found in Table 6 of RTI International's 2014 memo to the EPA, *Development of the RTR Supplemental Proposal Risk Modeling Dataset for the Secondary Aluminum Production Source Category*. Table 6 of that memo did not contain factors for furnaces, but the delacquering kiln results, which appear to be post-control, should be conservative for estimating emissions from the chargewell of the furnace. Table 5 of the 2014 RTI memo compiles the metallic HAP test results of nine stack tests of group 1 furnaces and Imperial Aluminum provided a dust analysis for most of these metals. Table 5 of the 2014 RTI memo is used for the metals that Imperial Aluminum's dust analysis did not cover. The maximum of those results adds up to 733 ppm of metallic HAP species within the filterable PM emissions, or 0.073% by mass.

Calculations are attached in the Appendix to this analysis, and the results are in Table 1 below.

Table 1: PTE (TPY)

| | | | | #1 Reverb | | |
|---|---|---|---|---|---|---|
| | | Material Handling (Fugitive) | Scrap Piles (Fugitive) | Charge Well w/ Baghouse | Hearth | Totals |
| Criteria Pollutants | $PM_{Total}$ | 0.27 | 0.28 | 27.68 | 0.59 | 28.82 |
| | $PM_{filt}$ | 0.27 | 0.28 | 26.37 | 0.15 | 27.07 |
| | $PM_{10,filt}$ | 0.13 | 0.28 | 15.82 | 0.15 | 16.38 |
| | $PM_{2.5,filt}$ | 0.05 | 0.28 | 13.18 | 0.15 | 13.66 |
| | $PM_{con}$ | - | - | 1.32 | 0.44 | 1.76 |
| | $SO_2$ | - | - | - | 0.05 | 0.05 |
| | $NO_X$ | - | - | 2.98 | 7.73 | 10.71 |
| | CO | - | - | 15.89 | 6.49 | 22.38 |
| | VOC | - | - | 3.92 | 0.43 | 4.35 |
| HAPs | HCl | - | - | 3.33 | - | 3.33 |
| | HF | - | - | 0.03 | - | 0.03 |
| | D/F | - | - | 9.198E-07 | - | 9.198E-07 |
| | Other | - | - | 1.91 | 0.15 | 2.05 |
| | Total | - | - | 5.27 | 0.15 | 5.41 |
| | $CO_2e$ | - | - | *9231.918656* | *9,231.92* | *18463.84* |

Calculations in Table 2 are made on an 8,760 hour/year basis.

For the proposed unit (X007), calculations are based on 7 TPH production rate and 18 MMBTU/hr heat input to the burners in conjunction with the natural gas factors from AP-42 Ch. 1.4. Particulate matter was calculated using Imperial's requested 6.02 lb/hr particulate matter limit.

Emissions for the two existing rotary furnaces (X003 & X005) are calculated on an 8760 hr/yr basis using production values and maximum burner values in MMBTU/hr provided in their 2010 SMOP application. For particulate matter and HCl, the permitted emission limits were used. For process VOC and HF emissions, factors provided by Imperial in their 2010 application were used. For products of natural gas combustion including $SO_2$, CO, VOC, and assorted HAPs, AP-42 Ch. 1.4 factors were utilized, except $NO_X$ for which Imperial provided a more conservative, vendor-derived factor.

**Table 2: Facility Potential Emissions**

| | Pollutant | X003 | X005 | X006 | X007 | Totals |
|---|---|---|---|---|---|---|
| Criteria Pollutant Emissions (TPY) | PM | 26.37 | 26.37 | 11.39 | 28.82 | 92.95 |
| | $SO_2$ | 0.03 | 0.03 | 0.02 | 0.05 | 0.13 |
| | $NO_X$ | 11.83 | 11.83 | 3.86 | 10.71 | 38.23 |
| | CO | 3.61 | 3.61 | 3.25 | 22.38 | 32.85 |
| | VOC | 1.11 | 1.11 | 0.21 | 4.35 | 6.78 |
| | Total HAPs | 4.7 | 5.07 | 0.07 | 10.82 | 20.66 |
| GHG (TPY) | $CO_{2e}$ | 5,128.84 | 5,128.84 | 4,513.38 | 18,463.84 | 33,234.90 |



## LIMITS

Imperial Aluminum has requested filterable particulate matter ($PM_{filt}$) SMOP limits of 6.02 lb/hr to be applied to the reverb furnace. The Department accepts Imperial Aluminum’s proposed 6.02 lb/hr SMOP limit. This imposed limit is based on the baghouse’s 44,000 scfm airflow and 0.015 grain/scf. This would allow the facility to remain below the 100 TPY major source threshold. Imperial Aluminum is an area source of hazardous air pollutants (HAPs), which requires limiting total HAP emissions to under 25 TPY and individual HAP emissions to under 10 TPY each. Therefore, Imperial Aluminum’s hydrochloric acid (HCl) will be limited to 0.760 lb/hr and hydrofluoric acid (HF) will be limited to 0.380 lb/hr.

Imperial Aluminum is subject to 2.1E-4 gr/ton limit on dioxin and furan emissions (expressed as toxic equivalents [TEQ]) via Part 63 Subpart RRR. Table 2 displays the relevant emissions limitations for the X007 Reverb furnace.

**Table 3: Limits**

| Limits | | | Emission Source |
|---|---|---|---|
| Pollutant | Units | Basis | Reverb X001 |
| Particulate | lb/hr | SMOP | 6.02 |
| HCl | lb/hr | SMOP | 0.760 |
| HF | lb/hr | SMOP | 0.380 |
| D/F | gr/ton | MACT | 2.10E-04 |

## REGULATIONS

### STATE REGULATIONS

***ADEM Admin Code r. 335-3-4-.01 Visible Emissions, “Control of Particulate Emissions”***

According to ADEM Admin. Code r. 335-3-4-.01(1)(a)-(b), the facility shall not emit particulate of an opacity greater than twenty percent (20%), as determined by a six minute average. During one six-minute period in any sixty minute period, the facility may emit particulate of an opacity no greater than forty percent (40%). The furnace will be subject to this regulation.

*Monitoring Requirements:*

Visible emissions (VE) monitoring will be required under this rule and r. 335-3-1-.04. A daily opacity observation of at least six minutes in length shall be performed daily when the source is operating. Opacity shall be determined using Method 9 of 40 CFR Part 60 Appendix A-4, by an observer certified in Method 9.

If well operated, baghouses have negligible opacity. If the hoods for the furnace efficiently capture and route emissions to the baghouse, the meltshop itself should not have visible emissions. Therefore, if VE with an opacity greater than 10% is noted at any time, corrective actions shall be taken to reduce opacity to an appropriate level, and an additional six-minute VE observation conducted.

*Recordkeeping Requirements:*

Records shall be kept of each visible emissions observation, including the time, duration, conditions, percent opacity reading, observer, and any corrective actions taken. Records shall be retained for a period of five (5) years.

***ADEM Admin. Code r. 335-3-4-.04, "Control of Particulate Emissions – Process Industries – General"***

**Rule 335-3-4-.04(2)** states that no person in a Class 2 County shall emit particulate matter greater than the amount determined by the equations below:

When $P<30$, $E=4.10P^{0.67}$
Where P = Process weight per hour in tons per hour
And E = Emissions in pounds per hour

The estimated maximum feed going through the reverb melting furnace is 7 tons/hr; therefore, the filterable particulate emission limit for each unit at maximum capacity would be 12.85 lbs/hr. For the furnace, this value would be superseded by more stringent SMOP limits.

***ADEM Admin. Code r. 335-3-14-.04, "Prevention of Significant Deterioration (PSD) Permitting"***

Secondary metal production facilities are listed as one of 28 source categories listed in ADEM Admin. Code r. 335-3-14-.04(2)(a)1 as having a 100 TPY major source threshold for criteria pollutants. Based on the emissions found in Table 2, after considering the baghouses and limits on PM, the facility would not be expected to exceed the 100 TPY threshold for any criteria pollutant. The SMOP limits for PM emissions serve dual function as anti-PSD limits. A facility must address PSD regulations for Greenhouse Gases ($CO_2$, $N_2O$, and $CH_4$) only if that facility is major for criteria pollutants. Per Rule 335-3-14-.04(2)(a)1(i)&(ii), no PSD review would be necessary for this project.

***ADEM Admin. Code r. 335-3-14-.06, "Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)"***

This regulation applies to major sources of hazardous air pollutants (HAPs) constructed after March 27, 1998. Since this facility is a Synthetic Minor source of HAPs, a 112(g) case by case MACT review would not be necessary.

***ADEM Admin. Code r. 335-3-15, "Synthetic Minor Operating Permits (SMOPs)"***

This regulation applies to sources that take limits to have the potential to emit less than 100 TPY of any criteria pollutant or 25 TPY of HAP. The following SMOP limits will be applied to the baghouse of the new reverb furnace.

- PM emissions shall not exceed 6.02 lb/hr.
- HCl emissions shall not exceed 0.760 lb/hr.
- HF emissions shall not exceed 0.380 lb/hr.

Considering the above SMOP limits, the facility does not have the potential to emit greater than 100 TPY of any criteria pollutant, and therefore would be considered a synthetic minor source for both criteria pollutants and HAPs.

To match the testing schedule required by MACT RRR, Imperial Aluminum will be required to conduct an initial compliance test for PM and HCl to show compliance with the above SMOP limits within 180 days of beginning operation. Subsequent performance tests will be conducted at least every 5 years. Performance testing shall use the methods for measuring these pollutants in MACT RRR [§ 63.1511(c)]: Method 5 for PM and Method 26A for HCl. Additionally, the Department is implementing MACT RRR's operating, monitoring, recordkeeping, and reporting requirements related to PM and HCl control as methods of showing compliance with the PM and HCl SMOP limits.

## *Class I Area*

The nearest Class I Area to the plant, the Sipsey Wilderness Area, is greater than 100 kilometers away; therefore, the proposed project is not expected to have a significant impact on this area.

**FEDERAL REGULATIONS**

***40 CFR 60 "New Source Performance Standards"***

No subparts within this part are applicable to the facility.

***40 CFR 63 Subpart A, "General Provisions"***

This subpart is applicable provided that the facility is subject to one of the applicable subparts found under 40 CFR 63 "National Emission Standards for Hazardous Air Pollutants for Source Categories", discussed below. The facility shall comply with the requirements of Subpart A as specified in Appendix A to Subpart RRR [40 CFR §63.1518].

Per the recordkeeping requirements of Subpart A, Imperial Aluminum must keep any records required by Subpart RRR for at least 5 years, with records for at least the last 2 years kept on the site itself [§63.10(b)(1)]; records of all maintenance on control devices and monitoring equipment [§63.10(b)(2)(iii)]; records of continuous monitoring readings [§63.10(b)(vi) & §63.10(c)(1)]; records of continuous monitor calibrations, evaluations, adjustments, & maintenance [§63.10(b)(vii)-(xi)]; records where monitoring equipment is inoperative or malfunctioning, including the nature and cause of each malfunction and corrective action taken (except during calibration) [§63.10(b)(vi) & §63.10(c)(5-12)]; and records of total process operating time during the reporting period [§63.10(c)(13)].

***40 CFR 63 Subpart RRR, "National Emissions Standards for Hazardous Air Pollutants – Secondary Aluminum Production."***

The reverberatory furnace is subject to 40 CFR Subpart RRR which sets emissions and operational limits for group 1 furnaces located at Secondary Aluminum production facilities. Due to the SMOP limits on HCl emissions, the facility is considered an area source under this subpart, and the furnace is only subject to the subpart's dioxins and furans (D/F) emission standards and associated operating, monitoring, reporting, and recordkeeping requirements [§63.1500(c)(4)]. However, to show compliance with the SMOP limitations on filterable PM and HCl, operating, monitoring, reporting, and recordkeeping requirements related to these pollutants (e.g., bag-leak detectors and flux limits) will be required and addressed in this section.

*Emission & Operational Standards*

Dioxin & furan emissions, as D/F TEQ, from group 1 furnaces including the #1 reverb melting furnace may not exceed $2.1\times10^{-4}$ $gr/ton_{charge/feed}$ [§63.1505(i)(3)]. An overall emission limit given as a three-day rolling average applies to each secondary aluminum processing unit (SAPU) per the formula found in §63.1505(k)(3); however, because there is just one furnace comprising the SAPU, Imperial Aluminum has elected to comply with the furnace's individual limits rather than the three-day rolling average for the SAPU [§63.1505(k)(5)].

$$L_{C_{D/F}} = \frac{\sum_{i=1}^{n}(L_{ti_{\frac{D}{F}}} \times T_{ti})}{\sum_{i=1}^{n}(T_{ti})} \qquad (1)\ \text{§63.1505(k)(3)}$$

Where:
$L_{ti\ D/F}$= The D/F emission limit for individual emission unit i in §63.1505(i)(3) of this section for a group 1 furnace; and
$L_{c\ D/F}$ = The daily D/F emission limit for the secondary aluminum processing unit which is used to calculate the 3-day. 24-hour D/F emission limit applicable to the SAPU.

Additionally, the furnace must be labeled [§63.1506(b)], the associated fume hood and ductwork must be installed and operated correctly [§63.1506(c)], the daily charge/feed weight must be recorded [§63.1506(d)], the daily chlorine flux weight must be recorded (solid and gaseous), and the *total reactive chlorine flux injection rate*, which is a mass ratio of chlorine in the flux to the charge/feed, must be maintained at or below the average rate established during the last performance test [§63.1506(m)(5)]. Emissions from the sidewell of the furnace must be captured and controlled, or Imperial Aluminum must meet the requirements of §63.1506(m)(6).

For the furnace baghouse, Imperial Aluminum must correct bag leak alarms [§63.1506(m)(1)], maintain the 3-hour block average inlet temperature below the average temperature (plus 25 ºF) established during the last performance test [§63.1506(m)(3)], and maintain free-flowing lime injection at the rate established by the last performance test [§63.1506(m)(4)].

*Monitoring Requirements*

For each furnace within the SAPU, Imperial Aluminum must prepare and implement an OM&M plan [§63.1510(b)&(s)], inspect required labels [§63.1510(c)], maintain and inspect the required fume hood and ductwork including conducting annual flow measurements [§63.1510(d)], maintain calibrated scales to determine charge/feed weight [§63.1510(e)], maintain calibrated scales to determine flux weight [§63.1510(j)(1)], and calculate and record the *total reactive chlorine flux injection rate* [§63.1510(j)(2-4)].

For the furnace baghouse, Imperial Aluminum must maintain and continuously operate a bag leak detection system [§63.1510(f)], must continuously monitor and record inlet temperature [§63.1510(h)], and must inspect the lime injection system to verify free-flowing lime [§63.1510(i)]. The lime injection system must continuously, as opposed to intermittently, inject lime unless otherwise approved by EPA [§63.1510(i)(3)].

Imperial Aluminum will conduct an initial D/F performance test on the furnace within 180 days of beginning operation [§63.1511(b)]. Method 23 in Part 60 Appendix A must be used [§63.1511(c)]. Operational standards including lime injection feed rate, baghouse inlet temperature, and total reactive chlorine flux injection rates shall be established [§63.1511(g), §63.1512(d),(k),(n-p)].

*Recordkeeping & Reporting Requirements*

In addition to recordkeeping required by Subpart A [§63.10(b)], Imperial Aluminum must maintain records of the operating hours of the furnace, each baghouse leak detection system alarm plus corrective actions taken [§63.1517(b)(1)(i)], lime injection inspections and feeder settings [§63.1517(b)(4)], flux additions [§63.1517(b)(5)], charge/feed additions [§63.1517(b)(7)], label inspections [§63.1517(b)(13)], fume hood & ductwork annual inspections [§63.1517(b)(14)], the OM&M plan [§63.1517(b)(16)], and records of deviations and corrective actions taken [§63.1517(b)(18)].

Imperial Aluminum must submit semiannual excess emissions/summary reports with 60 days of each reporting period meeting the requirements of §63.1516(b). Malfunctions must be reported per §63.1516(d).

**RECOMMENDATIONS**

Based on the information above, I recommend that Imperial Aluminum be issued Synthetic Minor Operating Permit No. 705-0044-X007 for the replacement of the reverb melting furnace and receiving well addition.

____________________________ July 14, 2023

William Cousins Date
Industrial Minerals Section
Energy Branch
Air Division

# Reverberatory Furnace products of combustion (hearth)

| Data: | | | | |
|---|---|---|---|---|
| $H_2S$ mol% | 0.00% | mol% | | |
| Op Hours | 8760 | Hrs | | |
| Heat Content | 1,000 | Btu/scf (Ind.) | | |
| Flowrate | 18.000 | MScf/Hr (Ind.) | | |
| Heat Input | 18,000,000 | Btu/hr | | |
| Use btu/scf(EPA) for PM, NOx, CO, VOC. Factors for EPA STP (also ADEM STP). SO2 factor already for Industry STP (from Al. Oil & Gas Board) | | | | |
| Ind. STP: | 68 | °F | 14.696 | psia |
| EPA STP: | 68 | °F | 14.696 | psia |
| Heat Content | 1,000 | Btu/scf (EPA) | | |
| Fuel HHV Correction Factor | 0.980 | | | |

| AP-42 EF (NG) | | |
|---|---|---|
| $PM_{filt}$= | 1.9 | Lb/MMScf |
| $PM_{con}$= | 5.7 | Lb/MMScf |
| $NO_X$= | 100 | Lb/MMScf |
| CO= | 84 | Lb/MMScf |
| VOC= | 5.5 | Lb/MMScf |
| HAP= | 1.89 | Lb/MMScf |
| $SO_2$= | 0.60 | Lb/MMScf |

| GWP* | |
|---|---|
| $N_2O$= | 298 |
| $CO_2$= | 1 |
| $CH_4$= | 25 |

Based on NG with Btu/Content of 1020

*Revised 11/29/2013

| (Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for $C_1$ | | |
|---|---|---|
| $N_2O$= | 0.0001 | kg/MMBtu |
| $CO_2$= | 53.06 | kg/MMBtu |
| $CH_4$= | 0.001 | kg/MMBtu |

| (Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for $C_3$ | | |
|---|---|---|
| $N_2O$= | 0.0006 | kg/MMBtu |
| $CO_2$= | 61.46 | kg/MMBtu |
| $CH_4$= | 0.003 | kg/MMBtu |

## Heater Emission Calculations

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PMfilt | 1.9 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 0.147 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| Pmcon | 5.7 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 0.441 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| $SO_2$ | 0.60 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 0.046 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| $NO_X$ | 100 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 7.729 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| CO | 84 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 6.493 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| VOC | 5.5 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 0.425 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| HAP | 1.89 Lb | 18.000 MMBtu | Scf (EPA) | 8,760 Hr | 1 Ton | 0.980 | = | 0.146 Tons |
| | MMScf (EPA) | Hr | 1,000 Btu | Year | 2,000 Lb | | | Year |
| $CO_2$ | 18 MMBtu | 53.06 kg | 0.001 Metric Ton | 8,760 Hr | 1.1023 Tons | | = | 9,222 Tons |
| | Hr | MMBtu | kg | Year | 1 Metric Ton | | | Year |
| $N_2O$ | 18 MMBtu | 0.0001 kg | 0.001 Metric Ton | 8,760 Hr | 1.1023 Tons | | = | 0.01738 Tons |
| | Hr | MMBtu | kg | Year | 1 Metric Ton | | | Year |
| $CH_4$ | 18 MMBtu | 0.001 kg | 0.001 Metric Ton | 8,760 Hr | 1.1023 Tons | | = | 0.17381 Tons |
| | Hr | MMBtu | kg | Year | 1 Metric Ton | | | Year |
| Mass Sum | 9,222.39 Tons | + | 0.0174 Tons | + | 0.1738 Tons | | = | 9,223 Tons |
| | Year | | Year | | Year | | | Year |
| | $CO_2$ | | $N_2O$ | | $CH_4$ | | | |
| $CO_2e$ | 9,222.39 TPY X 1 | | 0.0174 TPY X 298 | | 0.1738 TPY X 25 | | = | 9,232 Tons |
| | 9,222.39 | + | 5.18 | + | 4.35 | | | Year |
| | $CO_2$ | | $N_2O$ | | $CH_4$ | | | |

[1] AP-42 emission factors taken from Chapter 1.4. Based on natural gas with 1020 btu/scf, and corrected in calculations. From Chapter 1.5, propane emission factors are equivalent on a heat basis to methane factors, except the $NO_X$ factor is 1.5x higher.

Other calculations (fugitives and furnace chargewells)

| **Fugitives (material handling)[4]** | | | |
|---|---|---|---|
| 61340 | tpy dross & salt cake | | |
| 0.0088 | lb pmt/ton low silt | 0.269896 | TPY pmt |
| 0.0043 | lb pm10/ton low silt | 0.131881 | TPY pm10 |
| 0.0016 | lb pm2.5/ton low silt | 0.049072 | TPY pm2.5 |

| **Fugitives (storage)[5]** | | | |
|---|---|---|---|
| 175000 | TPY metal scrap | | |
| 2.2 | %moisture | | |
| 7 | mph wind | | |
| 0.74 | pm30 factor | | |
| 0.0032092 | lb/ton | 0.2808 | tpy PM |
| 0.0032*PM30*((mph/5)^1.3)/((moist/2)^1.4) | | | |

| #1 Furnace Emissions (from the chargewell) | | | |
|---|---|---|---|
| 7 | TPH throughput | 2000 | lb/ton |
| 8760 | hr/yr | 7000 | gr/lb |
| ~~0.20~~ | ~~lb VOC/ton aluminum (WebFire)[2]~~ | ~~6.13~~ | ~~TPY VOC~~ |
| 0.062 | lb VHAP/ton aluminum (2014 RTI, max delaq)[1] | 1.89 | TPY VHAP |
| 2.10E-04 | grains DF/ton aluminum (RRR limit) | 9.20E-07 | TPY D/F |
| 6.02 | lb PM/hr (SMOP/anti-PSD limit) | 26.37 | TPY $PM_{filt}$ |
| 0.6 | ratio PM10:PM (filt) (AP42)[3] | 15.82 | TPY $PM_{10,filt}$ |
| 0.5 | ratio PM2.5:PM (filt) (AP42)[3] | 13.18 | TPY $PM_{2.5,filt}$ |
| 0.073% | MHAP% to PMfilt (2014 RTI, max furnace)[1] | 0.02 | TPY mHAP |
| 0.097181 | lb NOX/ton aluminum (90% UPL)[6] | 2.98 | TPY NOX |
| 0.042906 | lb PMcon/ton aluminum (90% UPL)[6] | 1.32 | TPY Pmcon |
| 0.518185 | lb CO/ton aluminum (90% UPL)[6] | 15.89 | TPY CO |
| 0.127883 | lb VOC/ton aluminum (90% UPL)[6] | 3.92 | TPY VOC |
| 0.76 | lb HCl/hr (SMOP limit) | 3.33 | TPY HCl |
| 0.01 | HF:HCl (consv. estimate from #1 3/22/22 test) | 0.03 | TPY HF |

[1]*Development of the RTR Supplemental Proposal Risk Modeling Dataset for the Secondary Aluminum Production Source Category* , RTI International, 12/7/14 (https://www.regulations.gov/document/EPA-HQ-OAR-2010-0544-0239) (naphthalene outlier datapoint excluded)

[3]AP-42, Chapter 12.8 "Secondary Aluminum Operations" (https://www3.epa.gov/ttnchie1/ap42/ch12/final/c12s08.pdf)

[4]AP-42, Chapter 12.5.1 "Steel Minimills" (https://www.epa.gov/sites/default/files/2020-11/documents/c12s0501.pdf)

[5]AP-42, Chapter 13.2.5 "Industrial Wind Erosion" (https://www.epa.gov/sites/default/files/2020-10/documents/13.2.5_industrial_wind_erosion.pdf)

[6]90% UPL analysis of isolated sidewell stack test results from similar sidewell/reverb type furnaces

unused, cited for comparison:

[2]0.2 lb-VOC/ton-aluminum, WebFIRE, Clearinghouse for Inventories & Emission Factors, SCC 30400103 (https://cfpub.epa.gov/webfire/)

It has come to Air Division's attention via stack test reults from Logan Aluminum (Kentucky)'s A1 sidewell furnace that side or charge-well emissions, which occur in the part of reverb/sidewell furnaces that have no burners, can include products of combustion from contaminants within the scrap. However, this emissions stream is typically only tested for PM, D/F, and acid gases, and no published factors to estimate these emissions from sidewells exist. Upper Prediction Limit (UPL) analyses are used by EPA to establish MACT limits from more robust datasets of stack test results than what Air Division currently has access to, but Air Division has conducted 90% UPL analysis at low n regardless. Use of this method of estimating emissions from reverb chargewells is not ideal and is driven by lack of published factors for these emissions from the side or chargewells of reverb furnaces, but is preferable to undercounting emissions. In future analyses, we will incorporate more test data into these figures below.

| NOX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | n | 6 |
| | | run | mat. | lb/hr | TPH | lb/ton | conf. | 90% |
| Logan A1 | 10/9/2018 | 1 | UBC | 0.076 | 14.7895 | 0.005139 | mean | 0.0310 |
| Logan A1 | 10/9/2018 | 2 | UBC | 0.12 | 15.48333 | 0.007750 | stdev | 0.041508 |
| Logan A1 | 10/10/2018 | 3 | Class 1 | 0.39 | 12.64114 | 0.030852 | stdev$^2$ | 0.001723 |
| Logan B1 | 4/28/2021 | 1 | UBC | 0.17 | 16.369 | 0.010385 | | |
| Logan B1 | 4/28/2021 | 2 | UBC | 0.31 | 16.8905 | 0.018354 | | |
| Logan B1 | 4/28/2021 | 3 | Class 1 | 1.8 | 15.847 | 0.113586 | | |
| | | | | | =T.INV(conf.,n-1) | | t.inv | 1.475884 |
| mean+t.inv*SQRT(stdev^2*(1/1+1/n)) | | | | | | | UPL (lb/t) | 0.097181 |

| CO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | n | 6 |
| | | run | mat. | lb/hr | | lb/ton | conf. | 90% |
| Logan A1 | 10/9/2018 | 1 | UBC | 1.6 | 14.7895 | 0.1082 | mean | 0.2117 |
| Logan A1 | 10/9/2018 | 2 | UBC | 2.4 | 15.48333 | 0.1550 | stdev | 0.192249 |
| Logan A1 | 10/10/2018 | 3 | Class 1 | 4.8 | 12.64114 | 0.3797 | stdev$^2$ | 0.03696 |
| Logan B1 | 4/28/2021 | 1 | UBC | 0.84 | 16.369 | 0.051317 | | |
| Logan B1 | 4/28/2021 | 2 | UBC | 0.99 | 16.8905 | 0.058613 | | |
| Logan B1 | 4/28/2021 | 3 | Class 1 | 8.2 | 15.847 | 0.517448 | | |
| | | | | | =T.INV(conf.,n-1) | | t.inv | 1.475884 |
| mean+t.inv*SQRT(stdev^2*(1/1+1/n)) | | | | | | | UPL (lb/t) | 0.518185 |

| VOC | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | n | 6 |
| | | run | mat. | lb/hr | TPH | lb/ton | conf. | 90% |
| Logan A1 | 10/9/2018 | 1 | UBC | 0.42 | 14.7895 | 0.0284 | mean | 0.0392 |
| Logan A1 | 10/9/2018 | 2 | UBC | 0.32 | 15.48333 | 0.0207 | stdev | 0.055656 |
| Logan A1 | 10/10/2018 | 3 | Class 1 | 1.9 | 12.64114 | 0.1503 | stdev$^2$ | 0.003098 |
| Logan B1 | 4/28/2021 | 1 | UBC | 0.056 | 16.369 | 0.003421 | | |
| Logan B1 | 4/28/2021 | 2 | UBC | 0.053 | 16.8905 | 0.003138 | | |
| Logan B1 | 4/28/2021 | 3 | Class 1 | 0.46 | 15.847 | 0.029028 | | |
| | | | | | =T.INV(conf.,n-1) | | t.inv | 1.475884 |
| mean+t.inv*SQRT(stdev^2*(1/1+1/n)) | | | | | | | UPL (lb/t) | 0.127883 |

| PM-con | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | n | 3 |
| run | | run | mat. | lb/hr | TPH | lb/ton | conf. | 90% |
| Logan A1 | 10/9/2018 | 1 | UBC | 0.13 | 14.7895 | 0.0088 | mean | 0.020555 |
| Logan A1 | 10/9/2018 | 2 | UBC | 0.39 | 15.48333 | 0.0252 | stdev | 0.010265 |
| Logan A1 | 10/10/2018 | 3 | Class 1 | 0.35 | 12.64114 | 0.0277 | stdev$^2$ | 0.000105 |
| | | | | | =T.INV(conf.,n-1) | | t.inv | 1.885618 |
| mean+t.inv*SQRT(stdev^2*(1/1+1/n)) | | | | | | | UPL (lb/t) | 0.042906 |

Reference:

EPA Office of Air Quality Planning and Standards, *Approach for Applying the Uper Prediction Limit to Limited Datasets* and *Use of the Upper Prediction Limit for Caluclating MACT Floors* (https://www.regulations.gov/docket/EPA-HQ-OAR-2003-0119)

ADEM note:

Why do the Logan Aluminum tests with Class 1 scrap, which they define as "clean, undercoated cans or cups, skeleton, slitter or trim scrap that is compacted or briquetted" result in higher PoC emissions than UBC scrap? We are unsure, but hyptothesize that the UBC shred scrap is processed in a delaquering kiln, while the Class 1 scrap is not necessarily clean so much as clean enough to charge directly to the furnace.