

ENGINEERING ANALYSIS

PROJECT DESCRIPTION

On December 12, 2019, the Department received an application from Technocon International, Inc., doing business as Alliance Metals (Alliance), for a new secondary aluminum production facility consisting of a furnace shop and a dross mill to be constructed in Leighton, Alabama. The feedstock material will be aluminum scrap with some metallic impurities, and the products will be aluminum sows and aluminum alloy ingots; the solid byproducts (salt cake, dust cake, and dross fines) would go to landfill. The Department requested and received additional information on December 31, 2019.

PROCESS DESCRIPTION

In the furnace building, scrap feedstock will first be conveyed through an eddy current separator to remove ferrous material from the aluminum scrap. Two furnaces, a 25-ton rotary melt furnace and a 30-ton reverberatory (reverb) holding furnace in series, will comprise the secondary aluminum processing unit (SAPU) within the meltshop. The rotary furnace, heated by one 20 MMBtu/hr natural gas burner, will melt separated aluminum scrap with flux at a temperature lower than the melting point of remaining metallic impurities including brass and iron; the estimated 8.33 tons per hour of molten aluminum would either be poured into sow molds to solidify for storage/sales or would be transported to the reverb furnace for alloying. Salt cake including flux and non-aluminum metallic impurities remaining in the rotary furnace after pouring would be removed and sent to landfill. The reverb furnace, heated by two 5 MMBtu/hr natural gas burners, will hold aluminum from the rotary furnace at melt temperatures to be demagged (via chlorine addition) and alloyed to customer specifications; aluminum alloy product would be poured into ingot molds to solidify for storage/sales. A common baghouse (**SAPU-1**) with lime injection would control the emissions from both furnaces; dust cake collected from the baghouse would be sent to landfill.

The dross mill, consisting of two crushers and a triple-decker screen, will recover aluminum from the reverb furnace's dross to feed back into the SAPU. Dross will enter the jaw crusher for initial size reduction and be screened to aluminum fines, which would be fed back into the rotary furnace, and dross fines, which would go to landfill. Oversized pieces from the triple-decker screen would be processed again by an impact crusher and recycled back to the screen. Particulate matter emissions from both crushers and the screen would be controlled by a second baghouse (**DM-1**). The crushers would be driven by electric motors rather than large engines.

EMISSIONS

Calculations are made on an 8,760 hour/year basis assuming that all aluminum from the rotary furnace is passed through to the reverberatory furnace for further alloying. Where needed, calculations are based on 9.104 TPH scrap and 0.75 TPH solid flux to the rotary furnace and an output 8.33 TPH molten aluminum and 1.524 TPH salt cake. For the reverb furnace, emissions are based on inputs of 8.33 TPH molten aluminum, 0.833 TPH aluminum alloys, and 0.083 TPH chlorine gas and outputs of 8.33 TPH molten alloyed aluminum and 0.916 TPH dross. A maximum input of 10 TPH is expected at the dross mill.

Alliance expects negligible particulate emissions from the eddy current separator. Fugitive particulate matter emissions from salt cake and dross removal from the rotary and reverb furnaces respectively 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. NO_x, SO₂, and VOC fugitive emissions from the pouring & casting of aluminum have been estimated from the factors for SCC 30400114 from EPA's FIRE database.

Products of combustion for the furnaces are based on EPA's AP-42 Ch. 1-4 factors for natural gas combustion. The rotary furnace has several burners totaling to 20 MMBtu/hr, and the reverb furnace is heated by two 5 MMBtu/hr burners. Particulate matter from combustion of natural gas would be intermixed with the particulate matter generated by melting scrap.

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Per Alliance’s application, uncontrolled potential emissions of particulate matter are significantly higher than the limits imposed by ADEM Admin. Code r. 335-3-4-.04 for both the SAPU and the dross mill. The rule limits PM from SAPU-1 to 14.97 lb/hr and PM from DM-1 to 15.67 lb/hr at the maximum mass inputs specified by the application. To keep potential to emit (PTE) <100 TPY, Alliance has proposed 14.6 lb/hr and 7.3 lb/hr SMOP limits on total PM from those respective units. There would be no limit on PM₁₀ and PM_{2.5} specifically, but Alliance assumes that for the furnaces, PM₁₀ emissions would be 90% and PM_{2.5} emissions would be 80% of the controlled total PM emissions; for the dross mill, Alliance assumes PM₁₀ emissions would be 75% and PM_{2.5} emissions would be 50% of the controlled total PM emissions

Alliance estimates the VOC emissions from the reverb furnace using SCC 30400103 from EPA’s FIRE database as cited in Michigan DEQ’s Fact Sheet #9841. For each furnace, dioxin & furan (D/F) PTE is based on the limit stipulated by NESHAP RRR. Alliance estimates uncontrolled HAP emissions (HCl & Cl₂) using factors derived from tests at similar facilities as shown in table 1 below.

Factors	lb HCl	lb Cl ₂
Rotary	3.87	0.8*
Reverb	3.07	0.8

*no rotary factor provided by Alliance; assumed equal to reverb factor in this analysis

Given the above emission factors and the maximum feedrate to each furnace in the application, the estimated uncontrolled HCl and Cl₂ emissions from the SAPU are above 10 TPY of each pollutant. HCl and Cl₂ PTE for the furnaces accounts for a 9.5 TPY SMOP limit on each of the two HAPs applied to the SAPU as a whole, expressed as 2.17 lb/hr for each HAP.

				SAPU		Dross Mill			Totals
		Pouring & Casting (Fugitive)	Material Handling (Fugitive)	Rotary Furnace	Reverb Furnace	Jaw Crusher	Impact Crusher	Screeener	
Criteria Pollutants	PM _{Total}	-	0.09	63.95*		31.97*			96.01
	PM ₁₀	-	0.05	57.55*		23.98*			81.58
	PM _{2.5}	-	0.02	51.16*		15.99*			67.16
	NOX	0.01	-	8.59	4.29	-	-	-	12.89
	CO	-	-	7.21	3.61	-	-	-	10.82
	SO ₂	0.02	-	0.05	0.03	-	-	-	0.10
	VOC	0.14	-	0.47	7.54	-	-	-	8.15
HAPs	HCl	-	-	9.5*		-	-	-	9.50
	Cl ₂	-	-	9.5*		-	-	-	9.50
	D/F	-	-	1.196E-06	1.204E-06	-	-	-	2.40E-06
	Other	-	-	0.16	0.08	-	-	-	0.24
	Total	-	-	0.24*		-	-	-	19.24
	CO _{2e}	-	-	10,257.69	5,128.84	-	-	-	15386.53

*limit or related calculation applicable to common emission point

LIMITS

Alliance has proposed Synthetic Minor Operating Permit (SMOP) limits to keep PTE below major source thresholds for PM, HCl, and Cl₂. Emissions from SAPU-1 will be limited to 14.6 lb/hr PM, 2.17 lb/hr HCl, and 2.17 lb/hr Cl₂; additionally, Alliance will limit its 3-day, 24-rolling average feed/charge rate to the rate they were operating during the most recent performance test. Emissions from DM-1 will be limited to 7.3 lb/hr PM. Both SMOP limits for particulate matter are more stringent than those prescribed by rule 335-3-4-.04(1).

Being a synthetic minor source of HAP emissions including HCl and Cl₂ will make Alliance's Leighton Foundry an area source with respect to NESHAP RRR. The rule limits D/F emissions from furnaces at area sources of HAP emissions to 2.1×10^{-4} gr/ton_{charge/feed}, applied to the SAPU as a whole. Further, Alliance must operate SAPU-1 with a bag leak detection system, inlet temperature at or below the established level, lime injection feedrate at or above the established level, and total reactive chlorine flux injection rate at or below the established level.

REGULATIONS

STATE REGULATIONS

ADEM Admin. Code r. 335-3-4-.01 "Visible Emission"

Rule 335-3-4-.01(1)(a) states that no person shall emit to the atmosphere from any source of emissions, particulate matter of an opacity greater than twenty percent (20%) over a six (6) minute period. **Rule 335-3-4-.01(1)(b)** states that during one six minute period in any sixty minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. SAPU-1 and DM-1, as well as the meltshop itself, will be subject to this regulation. If well operated, baghouses have negligible opacity. If the hoods for each furnace efficiently capture and route emissions to SAPU-1, the meltshop itself should not have visible emissions. However, if visible emissions are observed, the opacity should be determined using Method 9 of 40 CFR Part 60 Appendix A and corrected.

ADEM Admin. Code r. 335-3-4-.04, "Process Industries - General"

Rule 335-3-4-.04(1) states that no person in a Class 1 County (including Colbert County) shall emit particulate matter greater than the amount determined by the equations below:

$$\text{When } P < 30, E = 3.59P^{0.62}$$

$$\text{When } P \geq 30, E = 17.31P^{0.16}$$

Where P = Process weight in tons per hour

And E = Emissions in pounds per hour

Alliance's application indicates at maximum 10.77 TPH of material to the SAPU; therefore the particulate emission limit on SAPU-1 would be 15.67 lbs/hr. However, this is superseded by the chosen, more stringent SMOP limit of 14.6 lb/hr. Similarly, 10 TPH of material to the dross mill yields a PM limit of 14.97 lb/hr on DM-1 superseded by the chosen SMOP limit of 7.3 lb/hr.

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, the facility would not be expected to exceed the 100 TPY threshold. A facility must address PSD regulations for Greenhouse Gases (CO₂, N₂O, and CH₄) 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 not a major 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)” and 335-3-16, “Major Source Operating Permits (MSOPs)”

After considering the 14.6 lb/hr and 7.3 lb/hr PM limits on SAPU-1 and DM-1, respectively, the facility does not have the potential to emit greater than 100 TPY of any single criteria pollutant. The 2.17 lb/hr limits Alliance has proposed on HCl and Cl₂ emissions from SAPU-1 would restrict the facility to less than 10 TPY of any single HAP, after which the facility would also not be expected to emit greater than 25 TPY of all HAP species. Additionally, Alliance has proposed to limit the feed/charge rate to the SAPU to the average rate recording during the most recent performance test, as evaluated by a 3-day, 24-hour rolling average, to ensure conservative testing conditions when determining compliance with the above limits. Given the above, the facility will be considered a synthetic minor source for both criteria pollutants and HAP.

To match the testing schedule required by Subpart RRR, Alliance will conduct an initial compliance test on the above SMOP limits within 180 days of beginning operation. Subsequent performance tests will be conducted every 5 years.

Class I Area

The nearest Class I Area to the plant, the Sipsey Wilderness Area, is within 100 kilometers. However, the emissions from the proposed facility are not expected to have a significant impact on the Class I area.

FEDERAL REGULATIONS

40 CFR 60 “New Source Performance Standards”

No subparts within this part are applicable to the proposed 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”.

40 CFR 63 Subpart RRR, “National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production”

This subpart is applicable to each secondary aluminum processing unit (SAPU) and their constituent group 1 furnaces at both area and major sources of HAP. Due to the SMOP limits on HCl and Cl₂ emissions, the Leighton Foundry will be considered an area source under this subpart, and the SAPU comprised of the rotary and reverb furnaces will be subject to the subpart’s D/F emission standards and associated operating, monitoring, reporting, and recordkeeping requirements [§63.1500(c)(4)]. Dross mills are not regulated by this subpart.

Emission & Operational Standards

Dioxin & furan emissions, as D/F TEQ, from group 1 furnaces including the proposed rotary and reverb furnaces may not exceed 2.1×10^{-4} gr/ton_{charge/feed} [§63.1505(i)(3)]. An overall emission limit applies to the SAPU per the

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formula found in §63.1505(k)(3); however, because the two furnaces comprising the SAPU have identical emission limits in units of grains per ton, the daily D/F emission limit for the SAPU stipulated by the regulation will always be 2.1×10^{-4} gr/ton_{charge/feed} for any combination of feedrates to the furnaces.

Additionally, each 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, 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 sidewall of the reverberatory furnace must be captured and controlled, or Alliance must meet the requirements of §63.1506(m)(6).

For baghouse SAPU-1, Alliance must correct bag leak alarms [§63.1506(m)(1)], maintain the 3-hour block average inlet temperature below the average temperature (plus 25 °F) 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, Alliance 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)]. Emissions from the sidewall of the reverberatory furnace must be captured and controlled, or Alliance must meet the monitoring requirements of §63.1510(n).

For baghouse SAPU-1, Alliance 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)].

Alliance will conduct an initial D/F performance test on the furnaces comprising the SAPU within 180 days of beginning operation [§63.1511(b)]. Because emissions from both furnaces are ducted to a common baghouse, SAPU-1, compliance with the SAPU's D/F limit 2.1×10^{-4} gr/ton_{charge/feed} may be demonstrated by testing at the outlet of the baghouse [§63.1511(h)]. Method 23 in Part 60 Appendix A must be used [§63.1511(c)]. Subsequent performance tests must be conducted every five years [§63.1511(f)]. 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)], Alliance must maintain records of the operating hours of each 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)].

Alliance 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

This analysis indicates that the proposed emission sources would meet the requirements of all federal and state rules and regulations. Based on the expected emissions from the new Leighton Foundry, I recommend that Alliance Metals be issued Synthetic Minor Operating Permit Nos. 701-0062-X001 & -X002.

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Date

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