ENGINEERING ANALYSIS

PROJECT DESCRIPTION

On May 21, 2025, Adanowa Management, LLC (Adanowa) submitted a permit determination request for a hot dip galvanizing facility to be constructed at a greenfield site in Chilton County, Alabama. The proposed facility will process A36 steel by coating it with high purity molten zinc. The proposed facility will have the equipment listed below. No steel will be melted in this process. This facility has not received any prior permit determinations from the Department. A complete permit application was received on July 29, 2025.

EQUIPMENT

The following equipment is listed in the facility's permit determination request:

- Sodium hydroxide (NaOH) Degreasing Tank with 2.0 million British thermal unit per hour (MMBtu/hr) Honeywell Burner
- Hydrochloric acid (HCl) Pickling Tanks (quantity: 5)
- Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater
- Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners
- Quench Tank with Phos Seal

PROCESS DESCRIPTIONS

NaOH Degreasing Tank with 2.0 MMBtu/hr Honeywell Burner

This process consists of a degreasing tank that uses NaOH to remove oxidation and dust from steel brought into the facility. The tank is heated by a 2.0 MMBtu/hr Honeywell burner.

There is no grease on the steel when it is brought into this process.

Uncontrolled Pickling Tanks (Quantity: 5)

The steel is pickled in 5 consecutive pickling tanks containing decreasing concentrations of HCl. This further cleans the steel and removes rust. The first tank has the highest acid content at 15 percent.

Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater

Steel is immersed in a pre-flux tank containing 12 percent zinc ammonium chloride. The tank has tubes along the bottom that receive hot water from a 1.339 MMBtu/hr indirect-fired hot water boiler to heat the tank. The hot water does not mix with the material in the tank.

Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners

The steel is dipped in a galvanizing kettle containing molten zinc at a temperature of 440°C to 460°C. The contents of the tank are not hot enough to melt the steel. This unit receives heat from six 1.23 MMBtu/hr burners (total heat input of 7.38 MMBtu/hr).

Quench Tank with Phos Seal

The steel is quenched in a tank that contains a mixture of phos seal and water. Phos seal is composed of chromic acid seal, phosphoric acid, and water.

EMISSIONS

The potential to emit (PTE) for each unit and the facility-wide PTE is shown in Table 1. The detailed calculations for emissions from each unit are shown in Appendix A.

Calculation Methods for Similar Equipment

Natural Gas Fired Burners

All of the proposed burners will burn natural gas. Emissions from the burners were calculated using emission factors from AP-42 and Table C-1 to 40 CFR Part 98, and Table C-2 to 40 CFR Part 98. The emissions factors for nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOC), hexane, formaldehyde (CH_2O), sulfur dioxide (SO_2), condensable particulate matter (PM-CON), filterable particulate matter (PM-filterable), and total hazardous air pollutants (HAP-total) were given in AP-42 Table 1.4-1 and Table 1.4-2. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions from all burners were calculated using emission factors from Table C-1 and C-2 to Subpart C of Part 98. Carbon dioxide equivalent (CO_2e) was calculated by multiplying the CO_2, CH_4, and N_2O emission by their global warming potentials and taking the sum of the resulting values. 8,760 hours of operation per year and the maximum heat content of the respective burners was used for all calculations.

Evaporation Losses from Dip Tanks

Evaporation losses from the dip tanks were calculated using equation 3-24 of Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007. This equation is shown below:

$$E_i = \frac{M_i \times K_i \times A \times P_i^{sat}}{R \times T_L}$$

Value	Description	Units
E_i	Evaporation Rate	Pounds per second
M_i	Molecular Weight of Volatile Substance	Pounds per pound mole
K_i	Mass Transfer Coefficient of Volatile Substance	Feet per second
A	Evaporation Surface Area	ft^2
P_i^{sat}	Partial Pressure of Volatile Substance[1]	Pounds per square inch
R	Ideal Gas Constant	$\frac{lb - mol \times °R}{Psi \times ft^3}$
T_L	Absolute Temperature	Rankine
[1]Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007 describes this value as the saturated solvent vapor pressure. Using this value returns unrealistic results, so the partial pressure of the volatile component was used instead. The partial pressure of the volatile components is used in a similar calculation described in Section 6.2.3 of Estimating Releases and Waste-Treatment Efficiencies for the Toxic Chemical Release Inventory Form, December 1997.		

Molecular weights of volatile substances, evaporation surface areas, partial pressures of volatile substances, and absolute temperatures of storage tanks were provided by Adanowa. Mass transfer coefficients were calculated using equation 3-27 of Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007. This equation is shown below:

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{\frac{1}{3}}$$

Value	Description	Units
K_i	Mass transfer coefficient of volatile component i	Centimeters per second
K_o	Mass transfer coefficient of water	Centimeters per second
M_o	Molecular weight of water	Pounds per pound mole
M_i	Molecular weight of volatile component i	Pounds per pound mole

Molecular weights of volatile components were taken from Safety Data Sheets (SDS) provided by Adanowa. The molecular weight and mass transfer coefficient of water were taken from Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007.

Emissions From Other Materials

According to the SDS's provided by the facility, the A36 steel that is coated contains chromium, manganese, and nickel. No cutting or melting of A36 steel is performed at this facility, so metal hazardous air pollutants (HAPs) and particulate matter (PM) from the metal are not expected to be emitted.

Calculation Descriptions

NaOH Degreasing Tank with 2.0 MMBtu/hr Honeywell Burner

This tank contains sodium hydroxide. Use of sodium hydroxide is not expected to generate regulated criteria pollutants or HAPs.

According to AP-42 Section 4.6 for solvent degreasing, the greases removed in degreasing processes can be composed of chlorinated hydrocarbons. This could result in VOC emission directly from the greases, and HCl emissions that are produced through dehydrochlorination reactions. Dehydrochlorination reactions occur when NaOH reacts with chlorinated greases and they produce HCl. There is no grease on Adanowa's steel when it is brought into this process, so VOC emission and HCl emissions from dehydrochlorination reactions are not expected.

Emissions from the natural gas fired 2.0 MMBtu/hr Honeywell burner were calculated using the methods described in the Natural Gas Fired Burners section of this document. The maximum heat content of this burner is 2.0 MMBtu/hr.

Uncontrolled Pickling Tanks

These five tanks contain hydrochloric acid, which is a HAP. HCl emissions from these tanks were estimated using the methods in the Evaporation Losses from Dip Tanks section above. Use of hydrochloric acid is not expected to generate regulated criteria pollutants or HAPs.

These tanks are not heated, so no combustion emissions are expected.

Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater

The pre-flux tank uses a salt solution composed of zinc chloride, ammonium chloride, sodium chloride, potassium chloride, and a proprietary foaming agent. According to the SDS, the proprietary foaming agent is not a carcinogen and only composes up to 1.5 weight percent of the salt solution. Based on the information in the permit determination request, any regulated criteria pollutant or HAP emissions from the materials in this tank would be negligible.

Emissions from the natural gas fired 1.339 MMBtu/hr Hurst Hot Water Boiler were calculated using the methods described in the Natural Gas Fired Burners section of this document. The maximum heat content of this burner is 1.339 MMBtu/hr.

Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners

The galvanizing kettle is used to melt high purity zinc that contains trace amounts of lead and cadmium. The PM emissions were calculated using an emission factor from AP-42 Table 12.14-2. The lead (Pb) and cadmium emissions were calculated with a mass balance based on the compositions in the SDS provided by Adanowa.

Emissions from the six natural gas fired burners were calculated using the methods described in the Natural Gas Fired Burners section of this document. The maximum heat content of this unit is 7.38 MMBtu/hr.

Adanowa estimated NO_X emissions at 1.45 tons per year (TPY). This estimate is based on an emission rate of 50 parts per million (ppm) of NO_X that was provided by the manufacturer. The Department chose to use a more conservative emission factor of 100 pounds of NO_X per million standard cubic feet of natural gas combusted from AP-42 Table 1.4-1. The NO_X emissions from this unit are estimated to be 3.17 tons per year when the AP-42 emission factor is used.

Quench Tank with Phos Seal

In the quench tank, a mixture of chromic acid, phosphoric acid, and water is used to quench the steel. Quenching emissions are caused by the quenchant material being vaporized [Emission Estimation Technique Manual for Structural & Fabricated Metal Product Manufacture, National Pollutant Inventory, December 1999], so this tank would emit chromic acid and phosphoric acid. Chromium and phosphorus are HAPs. These acids are not expected to generate additional regulated criteria pollutants or HAPs.

Only the masses of chromium and phosphorus in their respective acids were included in the chromium and phosphorus emission calculations for this unit.

This tank is not heated, so no combustion emissions are expected from this unit.

Pollutant	NaOH Degreasing Tank with 2.0 MMBtu/hr Honeywell Burner	Uncontrolled Pickling Tanks	Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater	Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners	Phos Seal Quench Tank	Facility-Wide Emissions
NO_X	0.86	-	0.57	3.17	-	4.60
CO	0.72	-	0.48	2.66	-	3.87
VOC	4.72E-02	-	3.16E-02	0.17	-	0.25
PM-Filt	4.90E-02	-	3.28E-02	4.17	-	4.25
PM-CON	1.63E-02	-	1.09E-02	1.81E-01	-	2.08E-01
SO_2	5.15E-03	-	3.45E-03	1.90E-02	-	2.76E-02
Hexane	1.55E-02	-	1.03E-02	5.70E-02	-	8.29E-02
CH_2O	6.44E-04	-	4.31E-04	2.38E-03	-	3.45E-03
Cd	-	-	-	2.47E-04	-	2.47E-04
Pb	-	-	-	2.47E-04	-	2.47E-04
Cr	-	-	-	-	9.28E-03	-
HCl	-	1.04	-	-	-	1.04
Phosphorus	-	-	-	-	5.21E-03	5.21E-03
HAP-Total	1.62E-02	1.04	1.09E-02	6.01E-02	1.45E-02	1.14
CO_2	1,025	-	686	3,781	-	5,492
CH_4	1.93E-02	-	1.29E-02	7.13E-02	-	0.10
N_2O	1.93E-03	-	1.29E-03	7.13E-03	-	1.04E-02
CO_2e	1,026	-	687	3,785	-	5,498

Table 1 – Facility Wide Potential to Emit

REGULATIONS

STATE REGULATIONS

ADEM Admin. Code r. 335-3-4-.01(1)(a and b), "Control of Particulate Emissions – Visible Emissions"

Applicability

The Honeywell burner, Hurst burner, HASCO burners, and galvanizing kettle will be subject to these requirements.

Emission Standards

Except for one 6-minute period in any 60-minute period, no person shall emit particulate emissions to the atmosphere of an opacity of greater than twenty percent (20%), as determined by a six (6) minute average [ADEM Admin. Code r. 335-3-4-.01(1)(a)].

No 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, as determined by a six (6) minute average [ADEM Admin. Code r. 335-3-4-.01(1)(b)].

Compliance Test Methods and Procedures

If visible emissions are observed, opacity should be determined using Method 9 of 40 CFR Part 60, Appendix A-4. Method 9 must be completed by a person certified to conduct it [ADEM Admin. Code r. 335-3-4-.01(2)]. Method 9 observations must only be conducted during daylight hours.

Emission Monitoring

Continuous compliance with the opacity standards should be demonstrated by conducting weekly checks to determine the presence or absence of visible emissions from the emission points.

The HASCO burners emit directly to the atmosphere, but the Honeywell burner, Hurst burner, and galvanizing kettle emit into a building that vents to the atmosphere. The HASCO burner's stack and all openings of the building venting the Honeywell burner, Hurst burner, and galvanizing kettle should be checked weekly to determine the presence or absence of visible emissions. The weekly checks should be performed while the units are in operation.

If visible emissions are observed, corrective action shall be initiated within 1 hour. If visible emissions are still present after corrective action has been conducted, a visible emissions observation must be conducted with Method 9. The visible emissions observation must last for a period of at least 12 minutes to confirm that the opacity standards are not exceeded.

Recordkeeping and Reporting Requirements

Records of deviations from the opacity standards in ADEM Admin. Code r. 335-3-4-.01(1) should be maintained. This shall include the cause of the visible emissions, the corrective actions taken, records of any Method 9 observations, and the date, time, and duration of the deviation.

Records of weekly visual inspections should be maintained. These shall include the date, time, and result of each inspection.

ADEM Admin. Code r. 335-3-4-.03(1), "Fuel Burning Equipment"

Applicability

The Honeywell burner, Hurst burner, and HASCO burners are indirect fired equipment that meet the definition of Fuel-Burning Equipment in ADEM Admin. Code r. 335-3-1-.02(ee) and are therefore subject to the requirements of ADEM Admin. Code r. 335-3-4-.03(1).

Emission Standards

No person shall cause or permit the emission of particulate matter from fuel-burning equipment in a Class 1 County in excess of the amount shown in Table 4-1 of ADEM Admin. Code r. 335-3 for the heat input allocated to such source. For sources in Class 1 Counties, interpolation of the data in Table 4-1 of ADEM Admin. Code r. 335-3 for heat input values between 10 MMBtu/hr and 250 MMBtu/hr shall be accomplished by the use of Equation 1 [ADEM Admin. Code r. 335-3-4-.03(1)]:

Equation 1: $E = 1.38 \times H^{-0.44}$

Value	Description	Units
E	Emissions in pounds per million Btu	Pounds of PM per Million Btu
H	Heat input in million of Btu/hr	Million Btu per Hour

New fuel-burning sources emitting particulate matter shall be subject to the rules and regulations for Class 1 Counties, ADEM Admin. Code r. 335-34-.03(1), regardless of their location [ADEM Admin. Code r. 335-34-.03(4)].

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

Applicability

ADEM Admin. Code r. 335-4-.04 applies to the galvanizing kettle.

Emission Standards

No person shall cause or permit the emission of particulate matter in any one hour from any source in a Class I County in excess of the amount shown in Table 4-2 of ADEM Admin. Code r. 335-3 for the process weight per hour allocated to such source. For sources in Class I Counties, interpolation of the data in Table 4-2 of ADEM Admin. Code r. 335-3 for the process weight per hour values up to 60,000 lbs/hr shall be accomplished by use of Equation 2 [ADEM Admin. Code r. 335-3-4-.04(1)]

Equation 2: $E = 3.59 \times P^{0.62}$

Value	Description	Units
E	Emissions in pounds per hour	Pounds of PM per Hour
P	Process weight per hour in tons per hour, must be less than 30 tons per hour	Tons per Hour

and interpolation and extrapolation of the data for process weight per hour values equal to or in excess of 60,000 lbs/hr shall be accomplished by use of Equation 3:

Equation 3: $E = 17.31 \times P^{0.16}$

Value	Description	Units
E	Emissions in pounds per hour	Pounds of PM per Hour
P	Process weight per hour in tons per hour, must be greater than or equal to 30 tons per hour	Tons per Hour

ADEM Admin. Code r. 335-3-5-.01(1)(b), "Fuel Combustion"

Applicability

The Honeywell burner, Hurst burner, and HASCO burners are indirect fired equipment that meet the definition of Fuel-Burning Equipment/Installation in ADEM Admin. Code r. 335-3-1-.02(ee) and are therefore subject to the requirements of ADEM Admin. Code r. 335-3-5-.01(1)(b).

Emission Standards

No person shall cause or permit the operation of a fuel burning installation in a Sulfur Dioxide Category II County in such a manner that sulfur oxides, measured as sulfur dioxide, are emitted in excess of 4.0 pounds per MMBtu heat input [ADEM Admin. Code r. 335-3-5-.01(1)(b)].

Chilton County is a Category II County [ADEM Admin. Code r. 335-3-B – Appendix B].

ADEM Admin. Code, Chapter 335-3-6, "Control of Organic Emissions"

Applicability

This regulation does not apply to sources with the potential to emit less than 100 TPY of VOC. According to Table 1, this facility does not have the potential to emit more than 100 TPY of VOC, so it is not subject to ADEM Admin. Code Chapter 6 [ADEM Admin. Code r. 335-3-6-.01(1)(b)].

ADEM Admin. Code r. 335-3-14-.01(7) "Public Participation"

Applicability

According to the permit determination request, this facility will be constructed at a greenfield site as defined in ADEM Admin. Code r. 335-3-14-.01(7)(a)(1)(i). A fifteen day public comment period will be required before the issuance of Air Permit No. 403-0018-X001. No emission sources should be constructed before the issuance of the final Air Permit.

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

Applicability

Based on the emissions found in Table 1, this facility would not exceed the 250 TPY major source threshold for criteria pollutants for this type of facility (hot dip galvanizing facilities are not one of the 28 source categories listed in Rule 335-3-14-.04). Therefore, no PSD review would be required.

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

Applicability

Because HAP emissions greater than 10 TPY of any single HAP or 25 TPY of any combination of HAPs are not expected from Adanowa, a 112(g) case by case MACT review would not be necessary.

ADEM Admin. Code r. 335-3-15, "Synthetic Minor Operating Permits"
ADEM Admin. Code r. 335-3-16, "Major Source Operating Permits"

Applicability

To become a major source under this regulation, the facility must have the potential to emit greater than 100 TPY of a criteria pollutant, 10 TPY of a single HAP, or 25 TPY of a combination of HAPs. According to Table 1, this facility does not have the potential to exceed the major source thresholds for Title V, nor does the facility require limitations to remain below these thresholds. Therefore, Adanowa will be considered a true minor source with respect to these rules.

CLASS 1 AREA

The nearest Class I Area would be the Sipsey Wilderness. However, the facility is located more than 100 km from this area.

FEDERAL REGULATIONS

FUEL BURNING EQUIPMENT

40 CFR 60, Subpart Dc "Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units" [NSPS Dc]

Applicability

- The affected facility to which NSPS Dc applies is each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour (MMBtu/h)) or less, but greater than or equal to 2.9 MW (10 MMBtu/h).
  - The fuel burning equipment at this facility does not have maximum design heat input capacities above 10 MMBtu/hr. Therefore, it is not subject to NSPS Dc.

40 CFR 63, Subpart DDDDD "National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters" [MACT DDDDD]

Applicability

- You are subject to MACT DDDDD if you own or operate an industrial, commercial, or institutional boiler or process heater as defined in 40 CFR §63.7575 that is located at, or is part of, a major source of HAP, except as specified in 40 CFR §63.7491. For the purposes of MACT DDDDD, a major source of HAP is as defined in 40 CFR §63.2, except that for oil and natural gas production facilities, a major source of HAP is as defined in 40 CFR §63.7575 [40 CFR §63.7485].
  - This regulation does not apply because Adanowa is not a major source of HAPs.

40 CFR 63, Subpart JJJJJJ, "National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources" [MACT 6J]

Applicability

- You are subject to MACT 6J if you own or operate an industrial, commercial, or institutional boiler as defined in 40 CFR §63.11237 that is located at, or is part of, an area source of hazardous air pollutants (HAP), as defined in 40 CFR §63.2, except as specified in 40 CFR §63.11195 [40 CFR §63.11193].
  - Industrial boiler means a boiler used in manufacturing, processing, mining, and refining or any other industry to provide steam, hot water, and/or electricity [40 CFR §63.11237].
  - Institutional boiler means a boiler used in institutional establishments such as, but not limited to, medical centers, nursing homes, research centers, institutions of higher education, elementary and secondary schools, libraries, religious establishments, and governmental buildings to provide electricity, steam, and/or hot water [40 CFR §63.11237].

- Commercial boiler means a boiler used in commercial establishments such as hotels, restaurants, and laundries to provide electricity, steam, and/or hot water [40 CFR §63.11237].
- Boiler means an enclosed device using controlled flame combustion in which water is heated to recover thermal energy in the form of steam and/or hot water. Controlled flame combustion refers to a steady-state, or near steady-state, process wherein fuel and/or oxidizer feed rates are controlled. A device combusting solid waste, as defined in §241.3 of Title 40 Chapter I, is not a boiler unless the device is exempt from the definition of a solid waste incineration unit as provided in section 129(g)(1) of the Clean Air Act. Waste heat boilers, process heaters, and autoclaves are excluded from the definition of Boiler [40 CFR §63.11237].
    - The Honeywell burner and HASCO burners do not heat water that is heated to recover thermal energy in the form of steam and/or hot water, so they do not meet the definition of boiler, and are not subject to MACT 6J.

- Gas-fired boilers as defined in 40 CFR §63.11237 are not subject to MACT 6J [40 CFR §63.11195 and 40 CFR §63.11195(e)].
    - Gas-fired boiler includes any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or for periodic testing, maintenance, or operator training on liquid fuel. Periodic testing, maintenance, or operator training on liquid fuel shall not exceed a combined total of 48 hours during any calendar year [40 CFR §63.11237].
        - According to the information in the application, the Hurst burner only burns natural gas, so it meets the definition of gas-fired boiler. Therefore it is not subject to MACT 6J.

METAL PROCESSING

40 CFR 63, Subpart N "National Emission Standards for Chromium Emissions From Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks" [MACT N]

Applicability

- The affected source to which the provisions of this MACT N apply is each chromium electroplating or chromium anodizing tank at facilities performing hard chromium electroplating, decorative chromium electroplating, or chromium anodizing [40 CFR §63.340(a)].
    - Adanowa performs hot dip galvanizing, not hard chromium electroplating, decorative chromium electroplating, or chromium anodizing, so it is not subject to MACT N.

40 CFR 63, Subpart CCC "National Emission Standards for Hazardous Air Pollutants for Steel Pickling—HCl Process Facilities and Hydrochloric Acid Regeneration Plants" [MACT CCC]

Applicability

- The provisions of MACT CCC apply to the following facilities and plants in 40 CFR §63.1155(a)(1) that are major sources for hazardous air pollutants (HAP) or are parts of facilities that are major sources for HAP [40 CFR §63.1155(a)]:
    - Adanowa is not a major source of HAPs, so it is not subject to MACT CCC.

40 CFR 63, Subpart GGGGGG, "National Emission Standards for Hazardous Air Pollutants for Primary Nonferrous Metals Area Sources—Zinc, Cadmium, and Beryllium" [MACT 6G]

Applicability

- You are subject to MACT 6G if you own or operate a primary zinc production facility or primary beryllium production facility that is an area source of hazardous air pollutant (HAP) emissions [40 CFR §63.11160(a)].
  - Primary zinc production facility means an installation engaged in the production, or any intermediate process in the production, of zinc or zinc oxide from zinc sulfide ore concentrates through the use of pyrometallurgical techniques [40 CFR §63.11167].
    - Adanowa does not produce zinc from zinc sulfide ore, so it does not meet the definition of Primary zinc production facility.
  - Primary beryllium production facility means any establishment engaged in the chemical processing of beryllium ore to produce beryllium metal, alloy, or oxide, or performing any of the intermediate steps in these processes. A primary beryllium production facility may also be known as an extraction plant [40 CFR §63.11167].
    - Adanowa does not process beryllium, so it does not meet the definition of primary beryllium production facility.
  - Since Adanowa is not a primary zinc production facility or primary beryllium production facility, it is not subject to MACT 6G.

40 CFR 63, Subpart TTTTTT, "National Emission Standards for Hazardous Air Pollutants for Secondary Nonferrous Metals Processing Area Sources" [MACT 6T]

Applicability

- You are subject to MACT 6T if you own or operate a secondary nonferrous metals processing facility (as defined in 40 CFR §63.11472) that is an area source of hazardous air pollutant (HAP) emissions [40 CFR §63.11462(a)].
  - Secondary nonferrous metals processing facility means a brass and bronze ingot making, secondary magnesium processing, or secondary zinc processing plant that uses furnace melting operations to melt post-consumer nonferrous metal scrap to make products including bars, ingots, blocks, or metal powders [40 CFR §63.11472].
    - Adanowa does not use furnace melting operations to melt post-consumer nonferrous metal scrap to make products including bars, ingots, blocks, or metal powders, so it is not subject to MACT 6T.

40 CFR 63, Subpart WWWWWW, "National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Plating and Polishing Operations" [MACT 6W]

Applicability

- You are subject to MACT 6W if you own or operate a plating and polishing facility that is an area source of hazardous air pollutant (HAP) emissions and meets the criteria specified in 40 CFR §63.11504(a)(1) through 40 CFR §63.11504(a)(3) [40 CFR §63.11504(a)].
  - Plating and polishing facility means a facility engaged in one or more of the following processes that uses or emits any of the plating and polishing metal HAP, as defined in this section: electroplating processes other than chromium electroplating (*i.e.,* non-chromium

electroplating); electroless plating; other non-electrolytic metal coating processes performed in a tank, such as chromate conversion coating, nickel acetate sealing, sodium dichromate sealing, and manganese phosphate coating; thermal spraying; and the dry mechanical polishing of finished metals and formed products after plating or thermal spraying. Plating is performed in a tank or thermally sprayed so that a metal coating is irreversibly applied to an object. Plating and polishing does not include any bench-scale processes [40 CFR §63.11511].

- The zinc kettle and quench tank could potentially be other non-electrolytic metal coating processes performed in tanks/chromate conversion coating processes.

- Plating and polishing metal HAP means any compound of any of the following metals: cadmium, chromium, lead, manganese, and nickel, or any of these metals in the elemental form, with the exception of lead. Any material that does not contain cadmium, chromium, lead, or nickel in amounts greater than or equal to 0.1 percent by weight (as the metal), and does not contain manganese in amounts greater than or equal to 1.0 percent by weight (as the metal), as reported on the Material Safety Data Sheet for the material, is not considered to be a plating and polishing metal HAP [40 CFR §63.11511].
  - Adanowa uses high purity zinc to coat steel parts in the zinc kettle. According to the Safety Data Sheets submitted in the permit determination request, the zinc used does not contain cadmium, chromium, lead, or nickel in amounts greater than or equal to 0.1 percent by weight (as the metal), and does not contain manganese in amounts greater than or equal to 1.0 percent by weight (as the metal), so it does not meet the definition of plating and polishing HAP in 40 CFR §63.11511.
  - Adanowa uses a dilute phos seal solution in the quench tank. The phos seal solution contains chromic acid. Adanowa submitted a calculation showing that the "as used" compositions of chromium and chromic acid calculated in accordance with 40 CFR §63.11505(d)(6) do not exceed the thresholds in 40 CFR §63.11511 for the tank contents to meet the definition of Plating and polishing metal HAP.
- Since Adanowa's materials do not meet the definition of plating and polishing metal HAP, it is not considered a plating and polishing facility and is not subject to MACT 6W.

40 CFR 63, Subpart XXXXXX, "National Emission Standards for Hazardous Air Pollutants Area Source Standards for Nine Metal Fabrication and Finishing Source Categories" [MACT 6X]

Applicability

- You are subject to MACT 6X if you own or operate an area source that is primarily engaged in the operations in one of the nine source categories listed in 40 CFR §63.11514(a)(1) through 40 CFR §63.11514(a)(9). Descriptions of these source categories are shown in Table 1 of MACT 6X. "Primarily engaged" is defined in 40 CFR §63.11522, "What definitions apply to this subpart?" [40 CFR §63.11514(a)].
  - Adanowa is not primarily engaged in manufacturing, fabricating, or forging of one or more products listed in one of the nine metal fabrication and finishing source category descriptions in Table 1 to MACT XXXXXX. Adanowa is engaged in Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers (NAICS Code 332812), which is not covered under MACT XXXXXX. Therefore, MACT XXXXXX does not apply to this facility.

RECOMMENDATIONS

This analysis indicates that Adanowa should be able to meet the requirements of all federal and state rules and regulations. Based on the emissions from this project, I recommend that Adanowa be issued Air Permit No.: 403-0018-X001 for this facility.

Draft

Jason Mote
Industrial Minerals Section
Energy Branch
Air Division
ADEM

Date

APPENDIX A: CALCULATIONS

Pollutant	NaOH Degreasing Tank with 2.0 MMBtu/hr Honeywell Burner		Uncontrolled Pickling Tanks					Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater		Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners		Phos Seal Quench Tank	Facility-Wide Emissions
	Chemical Use	Fuel Combustion	15% Tank	13.60% Tank	12.20% Tank	10.80% Tank	9.40% Tank	Chemical Use	Fuel Combustion	Zinc Melting	Fuel Combustion		
NO_X	-	0.86	-	-	-	-	-	-	0.57	-	3.17	-	4.60
CO	-	0.72	-	-	-	-	-	-	0.48	-	2.66	-	3.87
VOC	-	4.72E-02	-	-	-	-	-	-	3.16E-02	-	0.17	-	0.25
PM-Filt	-	4.90E-02	-	-	-	-	-	-	3.28E-02	4.11	0.06	-	4.25
PM-CON	-	1.63E-02	-	-	-	-	-	-	1.09E-02	-	1.81E-01	-	2.08E-01
SO_2	-	5.15E-03	-	-	-	-	-	-	3.45E-03	-	1.90E-02	-	2.76E-02
Hexane	-	1.55E-02	-	-	-	-	-	-	1.03E-02	-	5.70E-02	-	8.29E-02
CH_2O	-	6.44E-04	-	-	-	-	-	-	4.31E-04	-	2.38E-03	-	3.45E-03
Cd	-	-	-	-	-	-	-	-	-	1.23E-04	1.23E-04	-	2.47E-04
Pb	-	-	-	-	-	-	-	-	-	1.23E-04	1.23E-04	-	2.47E-04
Cr	-	-	-	-	-	-	-	-	-	-	-	9.28E-03	-
HCl	-	-	0.46	0.30	0.13	9.83E-02	4.64E-02	-	-	-	-	-	1.04
Phosphorus	-	-	-	-	-	-	-	-	-	-	-	5.21E-03	5.21E-03
HAP-Total	-	1.62E-02	0.46	0.30	0.13	9.83E-02	4.64E-02	-	1.09E-02	2.47E-04	5.98E-02	1.45E-02	1.14
CO_2	-	1,025	-	-	-	-	-	-	686	-	3,781	-	5,492
CH_4	-	1.93E-02	-	-	-	-	-	-	1.29E-02	-	7.13E-02	-	0.10
N_2O	-	1.93E-03	-	-	-	-	-	-	1.29E-03	-	7.13E-03	-	1.04E-02
CO_2e	-	1,026	-	-	-	-	-	-	687	-	3,785	-	5,498

Figure 1 – Facility-Wide Emissions

Constants for All Tanks																	
MHCl	36.46	lb/lbmol															
KHCl	2.15E-02	ft/s															
A	Redacted	ft2															
R	10.73	lb-mol*R/psi*ft3															
TL	568.67	R															
	Tank 1															**PTE**	
	HCl Concentration		0.15	Weight Fraction	HCl Partial Pressure	0.05	mmHg										
										Partial Pressure HCl						**lb/hr**	**TPY**
	36.46	lb	2.15E-02	ft	[redacted]	ft^2	9.67E-04	psi	1	lb-mol*R	1		3600	s		0.11	0.46
		lb-mol		s					10.73	psi*ft3	568.67	R		hr			
	Tank 2																
	HCl Concentration		0.136	Weight Fraction	HCl Partial Pressure	0.032	mmHg										
																lb/hr	**TPY**
	36.46	lb	2.15E-02	ft	[redacted]	ft^2	6.19E-04	psi	1	lb-mol*R	1		3600	s		6.78E-02	0.30
		lb-mol		s					10.73	psi*ft3	568.67	R		hr			
	Tank 3																
	HCl Concentration		0.122	Weight Fraction	HCl Partial Pressure	0.0145	mmHg										
																lb/hr	**TPY**
	36.46	lb	2.15E-02	ft	[redacted]	ft^2	2.80E-04	psi	1	lb-mol*R	1		3600	s		3.07E-02	0.13
		lb-mol		s					10.73	psi*ft3	568.67	R		hr			
	Tank 4																
	HCl Concentration		0.108	Weight Fraction	HCl Partial Pressure	0.0106	mmHg										
																lb/hr	**TPY**
	36.46	lb	2.15E-02	ft	[redacted]	ft^2	2.05E-04	psi	1	lb-mol*R	1		3600	s		2.24E-02	0.10
		lb-mol		s					10.73	psi*ft3	568.67	R		hr			
	Tank 5																
	HCl Concentration		0.094	Weight Fraction	HCl Partial Pressure	0.005	mmHg										
																lb/hr	**TPY**
	36.46	lb	2.15E-02	ft	[redacted]	ft^2	9.67E-05	psi	1	lb-mol*R	1		3600	s		1.06E-02	4.64E-02
		lb-mol		s					10.73	psi*ft3	568.67	R		hr			

Figure 2 – Uncontrolled HCl Pickling Tanks (Quantity: 5) Emission Calculations

Constants for All Tanks																					
M Chromic Acid	118.01	lb/lbmol																			
K Chromic Acid	1.45E-02	ft/s																			
M Phosphoric Acid	97.994	lb/lbmol																			
K Phosphoric Acid	1.55E-02	ft/s																			
A	Redacted	ft2																			
R	10.73	lb-mol*R/psi*ft3																			
TL	1320	R																			
																		PTE			
Chromium																		Chromic Acid		Chromium	
	118.01	lb	1.45E-02	ft	[redacted]	ft^2	0.42	mol Cr Acid	1.10E-04	Chromic Acid Partial Pressure (psi)	1	lb-mol*R			3600	s		lb/hr	TPY	lb/hr	TPY
		lb-mol		s				mol solution			10.73	psi*ft3	1320	R		hr		4.81E-03	2.11E-02	2.12E-03	9.28E-03
Phosphorus																					
																		Phosphoric Acid		Phosphorus	
	97.994	lb	1.55E-02	ft	[redacted]	ft^2	5.10E-02	mol P Acid	5.80E-04	Phosphoric Acid Partial Pressure (psi)	1	lb-mol*R			3600	s		lb/hr	TPY	lb/hr	TPY
		lb-mol		s				mol solution			10.73	psi*ft3	1320	R		hr		2.70E-03	1.18E-02	8.53E-04	5.21E-03

Figure 3 – Quench Tank Emission Calculations

Data:				
H_2S mol%	0.00%	mol%		
Op Hours	8760	Hrs		
Heat Content	1,020	Btu/scf (Ind.)		
Flowrate	1.961	MScf/Hr (Ind.)		
Heat Input	2,000,000	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	1,020	Btu/scf (EPA)		
Fuel HHV Correction Factor	1.000			

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	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.016 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
PM-CON	5.7 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**4.90E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
SO_2	0.60 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**5.15E-03 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
NO_X	100 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.859 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CO	84 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.721 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
VOC	5.5 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**4.72E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
Hexane	1.8 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**1.55E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CH_2O	0.075 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**6.44E-04 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
HAP	1.89 Lb	2.000 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**1.62E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CO_2	2 MMBtu	53.06 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**1,025 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**
N_2O	2 MMBtu	0.0001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**1.93E-03 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**
CH_4	2 MMBtu	0.001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**1.93E-02 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**

Mass Sum	1,024.71 Tons	+	0.0019 Tons	+	0.0193 Tons	=	**1,025 Tons**
	Year		Year		Year		**Year**
	CO_2		**N_2O**		**CH_4**		
CO_2e	1,024.71 TPY X 1		0.0019 TPY X 298		0.0193 TPY X 25	=	**1,026 Tons**
	1,024.71	+	0.58	+	0.48		**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.

Figure 4 – NaOH Degreasing Tank with 2.0 MMBtu/hr Honeywell Burner Emission Calculations

Data:				AP-42 EF (NG)			Based on NG with Btu/Content of 1020			
H_2S mol%	0.00%	mol%		PM_{filt}=	1.9	Lb/MMScf	(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_1			*Revised 11/29/2013
Op Hours	8760	Hrs		PM_{con}=	5.7	Lb/MMScf				
Heat Content	1,020	Btu/scf (Ind.)		NO_X=	100	Lb/MMScf				
Flowrate	**1.313**	MScf/Hr (Ind.)		CO=	84	Lb/MMScf	N_2O=	0.0001	kg/MMBtu	
Heat Input	1,339,000	Btu/hr		VOC=	5.5	Lb/MMScf	CO_2=	53.06	kg/MMBtu	
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)				HAP=	1.89	Lb/MMScf	CH_4=	0.001	kg/MMBtu	
				SO_2=	0.60	Lb/MMScf	(Table C-1 & C-2) 40 CFR Part 98 Sub C GHG Emission Factors for C_3			
				GWP*						
Ind. STP:	68	°F	14.696 psia	N_2O=	298					
EPA STP:	68	°F	14.696 psia	CO_2=	1		N_2O=	0.0006	kg/MMBtu	
Heat Content	1,020	Btu/scf (EPA)		CH_4=	25		CO_2=	61.46	kg/MMBtu	
Fuel HHV Correction Factor	**1.000**						CH_4=	0.003	kg/MMBtu	

Heater Emission Calculations

Pollutant							=	Result
PMfilt	1.9 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**0.011 Tons / Year**
PM-CON	5.7 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**3.28E-02 Tons / Year**
SO_2	0.60 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**3.45E-03 Tons / Year**
NO_X	100 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**0.575 Tons / Year**
CO	84 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**0.483 Tons / Year**
VOC	5.5 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**3.16E-02 Tons / Year**
Hexane	1.8 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**1.03E-02 Tons / Year**
CH_2O	0.075 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**4.31E-04 Tons / Year**
HAP	1.89 Lb / MMScf (EPA)	1.339 MMBtu / Hr	Scf (EPA) / 1,020 Btu	8,760 Hr / Year	1 Ton / 2,000 Lb	1.000	=	**1.09E-02 Tons / Year**
CO_2	1.339 MMBtu / Hr	53.06 kg / MMBtu	0.001 Metric Ton / kg	8,760 Hr / Year	1.1023 Tons / 1 Metric Ton		=	**686 Tons / Year**
N_2O	1.339 MMBtu / Hr	0.0001 kg / MMBtu	0.001 Metric Ton / kg	8,760 Hr / Year	1.1023 Tons / 1 Metric Ton		=	**1.29E-03 Tons / Year**
CH_4	1.339 MMBtu / Hr	0.001 kg / MMBtu	0.001 Metric Ton / kg	8,760 Hr / Year	1.1023 Tons / 1 Metric Ton		=	**1.29E-02 Tons / Year**
Mass Sum	686.04 Tons / Year (CO_2)	+	0.0013 Tons / Year (N_2O)	+	0.0129 Tons / Year (CH_4)		=	**686 Tons / Year**
CO_2e	686.04 TPY X 1 = 686.04 (CO_2)	+	0.0013 TPY X 298 = 0.39 (N_2O)	+	0.0129 TPY X 25 = 0.32 (CH_4)		=	**687 Tons / Year**

[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.

Figure 5 – Pre-Flux Tank with 1.339 MMBtu/hr Hurst Hot Water Heater Emission Calculations

Data:				
H_2S mol%	0.00%	mol%		
Op Hours	8760	Hrs		
Heat Content	1,020	Btu/scf (Ind.)		
Flowrate	7.235	MScf/Hr (Ind.)		
Heat Input	7,380,000	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	1,020	Btu/scf (EPA)		
Fuel HHV Correction Factor	1.000			

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	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.060 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
PM-CON	5.7 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.181 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
SO_2	0.60 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**1.90E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
NO_X	100 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**3.169 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CO	84 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**2.662 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
VOC	5.5 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**0.174 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
Hexane	1.8 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**5.70E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CH_2O	0.075 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**2.38E-03 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
HAP	1.89 Lb	7.380 MMBtu	Scf (EPA)	8,760 Hr	1 Ton	1.000	=	**5.98E-02 Tons**
	MMScf (EPA)	Hr	1,020 Btu	Year	2,000 Lb			**Year**
CO_2	7.38 MMBtu	53.06 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**3,781 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**
N_2O	7.38 MMBtu	0.0001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**7.13E-03 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**
CH_4	7.38 MMBtu	0.001 kg	0.001 Metric Ton	8,760 Hr	1.1023 Tons		=	**7.13E-02 Tons**
	Hr	MMBtu	kg	Year	1 Metric Ton			**Year**

Mass Sum	3,781.18 Tons	+	0.0071 Tons	+	0.0713 Tons		=	**3,781 Tons**
	Year		Year		Year			**Year**
	CO_2		**N_2O**		**CH_4**			
CO_2e	3,781.18 TPY X 1		0.0071 TPY X 298		0.0713 TPY X 25		=	**3,785 Tons**
	3,781.18	+	2.12	+	1.78			**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.

Figure 6 – Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners Fuel Burning Equipment Emission Calculations

Zinc Melting					
Throughput	1,645	ton/yr			
Pollutant	**Emission Factor**	**Units**	**Source**	**PTE**	
				lb/hr	**TPY**
PM	5	pounds of PM/ton of zinc used	AP-42 Table 12.14-2	0.94	4.11
Lead	3.00E-05	Mass fraction[1]	SDS	2.82E-05	1.23E-04
Cadmium	3.00E-05	Mass fraction[1]	SDS	2.82E-05	1.23E-04
[1]These values were taken from a Safety Data Sheet provided by Adanowa.					

Figure 7 – Galvanizing Kettle with six 1.23 MMBtu/hr HASCO Burners Zinc Melting Emission Calculations