# AZZ Galvcast Canada
# TOXIC SUBSTANCES REDUCTION PLAN, PM2.5
## October 27, 2017

GENERAL INFORMATION

Contact Name:                Duane Bickers, Plant Manager
(Highest Ranking Employee) duanebickers@azzgalv.com

| | |
|---|---|
| Company Legal Name | AZZ Canada Limited (860168426 NO0001) |
| Parent Company | AZZ incorporated |
| Parent Company Address: | 3100 W 7$^{th}$ St # 500 |
| | Fort Worth TX 76107 |
| Facility DBA Name | AZZ Galvcast Canada |
| Ministry Generators # | ON0085400 |
| NPRI ID | 5626 |
| Facility Physical Address | AZZ Galvcast Canada |
| | 49 Commerce Crescent |
| | Acton, ON   L7J 2X2 |
| | Canada |
| | |
| Contact Phone | 519-853-3540 |
| UTM | 576526.22 E  4832505.33 N |
| | |
| Process | Hot Dip Galvanizing Services |
| Production | 30578 tonnes of galvanized steel per year (CY 2016) |
| Full Time Employees | 110 |
| Primary SIC | 3479 |
| NAICS 2 digit code | 33 |
| NAICS 4 digit code | 3328 |
| NAICS 6 digit code | 332812 |

Licensed Planner:      Craig Maunder, M.Sc. CIH
Planner License Number: TSRP0275
75 Courtneypark Drive West, Unit 1
Mississauga, Ontario, Canada L5T 1X7
905-795-2800, cmaunder@ecoh.ca

Prepared By:

| | |
|---|---|
| Frank Gaudet, P.E. | & Craig Maunder, M.Sc. CIH |
| Environmental Engineer | Senior Project Manager |
| AZZ Inc. | ECOH Management Inc. |
| 3100 W 7$^{th}$ St., #500 | 75 Courtneypark Drive West, Unit 1 |
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**Contents**

**Appendix I**:   Planner Recommendations and Rationale
**Appendix II**:  Emission Factors

# 1 INTENTS, OBJECTIVES AND TARGETS

Particulate Matter, PM, is the only toxic substance created at the galvanizer and released as an air emission. PM includes lighter fractions known as PM 10 and PM 2.5. A master toxic substances reduction plan for zinc, hexavalent chromium, ammonia, hydrochloric acid and PM10 was prepared in 2014 (for the 2012 reporting year).

AZZ Galvast intends to reduce toxic substances, but to the extent that it is practically and economically feasible. The galvanizer cannot eliminate or reduce the creation of PM 2.5 because it is an byproduct of integral feedstocks/processes associated with galvanized steel production. PM 2.5 is not "used" at the facility; it is only created by processes at the facility.

The creation of PM 2.5 emissions directly correlates to plant production. The galvanizer provides a service to steel manufacturing customers and its production is dependent upon customer orders. The production fluctuates month-to-month and year-to-year depending on customer orders. The reduction objectives in this plan are expressed as a ratio of production; reduction targets expressed in terms of production are more meaningful than targets expressed as weights.

PM 2.5 is estimated to be generated at a rate of 0.26 kg/tonne of galvanized steel produced. Galvcast processed 40,545 tonnes of steel in CY 2014. Production declined slightly from 43,591 tonnes produced in 2012 when a Toxic Substances Plan was prepared for the 5 other toxic substances. Section 3 of this Plan details the evaluation of possible reduction options for creation of PM 2.5. In summary, Galvcast does not plan to reduce PM 2.5 because no options to reduce creation of PM 2.5 could be identified. While this plan also outlines options for reduction of air emissions (outside the scope of the Toxics Reduction Act), such reductions are not cost effective.

# 2 STAGES AND PROCESSES

AZZ Galvcast offers hot dip galvanizing services to outside customers who fabricate steel structures. The facility operates 4 Stages:

- Receiving and Storing,
- Pretreating,
- Galvanizing, and
- Cleaning and Shipping

The Receiving and Storing Stage is where chemicals are received at the galvanizer, placed into storage, and proportioned out to the production floor. The second stage, Pretreating, cleans and removes rust as the black steel is made ready for galvanizing. The third Galvanizing Stage coats the steel with zinc. The final Stage is Cleaning and Shipping. There are Processes within each of the Stages. For example, the Pretreating Stage includes a Pickling Process and a Fluxing Process. Refer to Figure 1 for a graphical representation of the Stages.

PM 2.5 is created in the Pretreating and Galvanizing stages.

All chemical processes are performed in open top tanks with chemical mixtures. A caustic cleaning solution removes grease and marks. An acid pickling tank removes rust. A flux tank preserves the steel and finally a kettle of molten zinc applies the coating. Each chemical process is necessary to provide a uniform high quality for the galvanized coating. The processes are performed in open top tanks containing either chemical mixtures or rinse waters. The heavy steel parts are attached to a chain and dipped into the chemical tanks using an overhead crane.

A natural gas fired boiler and heat exchange system heats the chemical mixtures in the caustic tanks and the preflux tanks in the Pretreating Stage. The combustion of natural gas creates PM 2.5 emissions.

AZZ Galvcast operates 3 galvanizing kettles with different lengths: 46 feet, 32 feet and 16 feet. The largest kettle is used for long steel pieces such as cell phone towers and structural beams. The smaller kettles can be used to galvanize smaller steel parts such as bolts and fittings. The galvanizing lines are housed in two adjacent buildings called Plant 1 and Plant 2. The largest kettle is located in Plant 1 and the two smaller kettles are in Plant 2. The Stages and Processes are identical for all 3 galvanizing lines.

All 3 kettles are heated by natural gas-fired furnaces that maintain the zinc bath in a molten state. The combustion of natural gas creates PM 2.5.

All 3 kettles are fitted with hoods or enclosures to capture PM 2.5 emissions, which are routed to one (1) of three (3) baghouses for dust filtration. The 46-foot kettle uses an enclosure, and the two smaller kettles use fume hoods adjacent to the kettles.
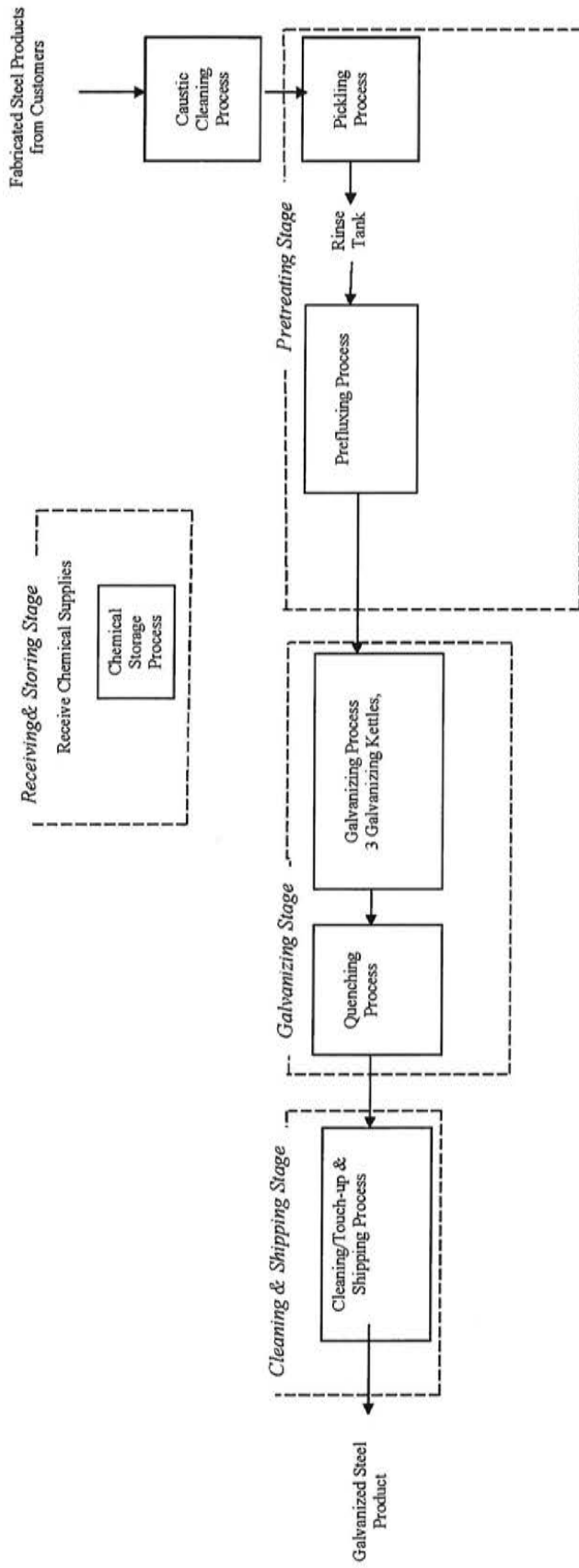
Figure 1. Galvanizing Stages and Processes

# 3  PM 2.5

PM 2.5 is created in the galvanizing stage. The galvanizing kettle creates a whitish-gray smoke as the preflux coating burns off when the steel product dips into the molten zinc of the kettle. Galvcast captures and filters some of the smoke, but there remains fugitive emissions and stack emissions.

PM 2.5 is also created by the combustion of natural gas in the furnaces that heat the kettles. The furnaces operate continuously and consumed approximately 2.4 million cubic meters of natural gas in CY 2014. Gas consumption remains consistent year-to-year and is not a function of production, because kettle furnaces operate continuously to maintain molten zinc.

Data presented in the sections below is for the 2014 reporting year, when PM 2.5 was first reported for the facility under the Toxics Reduction Act.

## 3.1  PM 2.5. Tracking and Quantification at the Process Level.

The air emissions are created when preflux burns off while entering the kettle. Some of the PM 2.5 is captured by baghouses and becomes a waste which is disposed of off-site. Remaining PM 2.5 emits to the air either as fugitive or stack emissions.

### 3.1.1  PM 2.5 Galvanizing Process:

PM 2.5 is created when the preflux solution, zinc ammonium chloride, burns off in the galvanizing kettle. PM 2.5 does not enter the Galvanizing Process since it is created there.

#### 3.1.1.1  PM 2.5 Created

PM 2.5 is created when the preflux-coated steel immerses in the molten zinc of the kettle. It is also created by natural gas combustion.

*The Quantification Method.* PM 2.5 creation is quantified using Emission Factors published by the US EPA. Samples of air emissions are not available. The emission factor is 0.26 kg of PM for each tonne of steel production. PM 2.5 is estimated to represent 82% of the total PM based upon published EPA data for melting, smelting and refining operations.

*The Best Available Method.* Air emission factors are based on studies and sampling at other similar galvanizers. The emission factors are accepted for use at galvanizers and are the best available method for quantifying emissions.

*Calculations.* The published emissions factor for galvanizing kettles is 0.26 kg of PM for every tonne of galvanized steel. The galvanizer created 8.644 tonnes of PM 2.5 in CY 2014 (40545 tonnes of steel x 0.26 kg/t x .82 = 8.644 tonnes of PM 2.5).

The published emissions factor for created by natural gas combustion is 122 kg of PM 2.5 per million cubic meters burned. The PM 2.5 emitted is 0.293 tonnes ((122 x 2.4) /1000 = 0.293 tonnes).

#### 3.1.1.2  PM 2.5 Leaves the Galvanizing Process (Off-Site Disposal and Air Emissions)

Air emissions from the kettles are normally captured by hoods/enclosures and baghouses. In CY 2014, all baghouses were under repair or not operable. As such, no PM 2.5 was captured by the baghouses, and there was no PM 2.5 disposed of as

a waste dust, or emitted as a stack emission from the baghouses (15% of any PM 2.5 captured within the baghouse is estimated (engineering estimate) to bypass the baghouse as stack emissions (see plan for PM 10)). All PM 2.5 generated in CY 2014 was released to the air as fugitive emissions.

*The Quantification Method.* Mass Balance.

*The Best Available Method.* As no dust controls were in place in CY 2014, any PM 2.5 generated at the facility would necessarily have escaped as a fugitive emission. Due to the simplicity of this situation, mass balance is the best quantification method available.

*Calculations.* All PM 2.5 created at the galvanizing kettles (see Section 3.1.1.1) was released as an air emission. 8.644 tonnes created = 8.644 tonnes emitted to the air from the galvanizing kettles.

All PM 2.5 created though natural gas combustion (see Section 3.1.1.1) was released as an air emission. 0.293 tonnes of PM 2.5 created = 0.293 tonnes emitted to the air due to natural gas combustion.

PM 2.5 air emissions total 8.937 tonnes for CY 2014 (Natural Gas Stack Emissions + Fugitive Emissions = 0.293 tonnes + 8.644 tonnes = 8.937 tonnes).

### 3.1.1.3 Input/Output Balance for PM 2.5 in Galvanizing Process:

PM 2.5 Created = (Fugitive Air Emissions + Stack Emissions (natural gas) + Disposed as Waste)

8.644 tonnes + 0.293 tonnes = 8.644 tonnes + 0.293 tonnes + 0 tonnes

8.937 tonnes = 8.937 tonnes

The input/output balance for this process is equal due to all dust control measures being inactive during CY 2014.

## 3.2 Facility Wide Accounting Information

| FORM OF INVOLVEMENT | PM 2.5 (tonnes) |
|---|---|
| Received | 0 |
| Created | 8.937 |
| Released Air | 8.937 |
| Released Water | 0 |
| Released Land | 0 |
| Disposed On-site | 0 |
| Disposed Off-site | 0 |
| Recycled On-site | 0 |
| Recycled Off-site | 0 |
| Contained in Product | 0 |

### 3.2.1  PM 2.5 Cost Estimates

#### 3.2.1.1  Raw Material Costs
Not applicable.

#### 3.2.1.2  Production Costs
Baghouses and enclosures are costly at about $1 million. Estimate sunk capital cost at $100,000 per year for a 10-year life.

#### 3.2.1.3  Process Related Costs
Baghouse and enclosures utilize electricity. Estimate at $5,000 per year. ($0.00 expenditure in CY 2014, as baghouses were not operational)

#### 3.2.1.4  Sampling and Analysis Costs
Not applicable. No sampling is conducted.

#### 3.2.1.5  Labor Costs
The baghouses and enclosures require maintenance costs when operational. Estimate $18/hr x 300 man-hours per year on average = $5,400. ($0.00 expenditure in CY 2014, as baghouses were not operational and did not require preventative maintenance)

#### 3.2.1.6  Health and Safety Compliance Costs
No current health and safety costs are associated with PM-2.5 .

#### 3.2.1.7  Disposal Costs
PM 2.5 typically creates baghouse dust which is shipped off-site for disposal. Disposal costs are about $1 per kg. As no dust was shipped off-site in CY 2014, no costs were associated with baghouse dust disposal.

#### 3.2.1.8  Total Costs
PM 2.5 costs currently total approximately $100,000 per year.

This cost is shared with the PM 10 generated at the facility, as PM 10 includes PM 2.5.

## 3.3 Identification and Evaluation of PM 2.5 Reduction Options

There are seven reduction categories as suggested by the Ministry. The table below describes the possible reduction options in each of the categories. Options are not available for all categories.

### 3.3.1 Description and Analysis of PM 2.5 Options

| | |
|---|---|
| Raw Material or Feedstock Substitution | Zinc and ammonia are the primary contributors to PM 2.5 emissions. Their use or quantity used cannot be changed as they are essential to the galvanizing process. |
| Product Reformulation or Redesign | Product re-design would not affect PM 2.5 creation at the galvanizer |
| Equipment or Process Modification | Three options were identified which would reduce air emissions of PM 2.5, but would not affect PM 2.5 creation. While these are not valid options under the requirements of the Toxics Reduction Act, they have been kept in the sections below, as future implementation would still be beneficial to the environment, and the plan is a good place to record these options so they are not forgotten. |
| Spills/Leak Prevention | Not applicable to PM 2.5 which is an air emission |
| Reuse or Recycling of Toxic Substance | Not applicable to PM 2.5. No known reuse or recycling opportunities exist. |
| Improved Inventory Management or Purchasing Techniques | Not applicable to PM 2.5 which is created at the galvanizer |
| Training or Improved Operating Practices | Employees are already trained to minimize zinc ash formation and disturbance. No other training/operating practice improvements could be identified. |

#### 3.3.1.1 Options for Reduction of Emissions only (see above section)

**Repair and Re-activate Existing Baghouses, PM-1**

The existing baghouses could be repaired or re-built and re-activated to provide control of air emissions of PM 2.5. As per the 2012 toxic substance reduction plan for PM 10, the average PM 2.5 capture rate for the existing hoods and enclosures is estimated (engineering estimate) to be 50% (of all PM 2.5 released from kettles), of which 85% is captured by the baghouses and becomes waste dust for disposal, while 15% is released as stack emissions. Based upon the amount of PM 2.5 created at the kettles in CY 2014, 4.322 tonnes of PM 2.5 ($8.644 * 0.5 = 4.322$) would be captured by the enclosures and hoods, of which 3.674 tonnes ($4.322 * 0.85 = 3.674$) would become waste dust for disposal, and 0.649 tonnes ($4.322 * 0.15 = 0.649$) would be released as stack emissions. This would result in an expected overall decrease in air emissions of 3.674 tonnes, a 43% reduction ($1 - ((8.644 - 3.674)/8.644) * 100$).

**Repair 46' Kettle Baghouse & Improve Two Baghouses, PM-2.**
When operational, PM 2.5 capture efficiency is believed to be marginal on the 2 kettles with wall hoods, and capture could be improved with full enclosure hoods. Additional PM 2.5 could be captured with an (operational) enclosure and baghouse.

Information on PM 2.5 created at each individual kettle is not available. As PM 2.5 creation rates are determined based upon emissions factors that in turn are based upon tonnage of steel produced, it is very difficult to estimate the amount of PM 2.5 created by the two kettles that would undergo upgrades.

For the purposes of estimate reductions associated with this option, we have made simplifying assumptions that the existing enclosure on the 46' kettle is made operational, is capable of capturing 75% of PM 2.5 created at the kettle, and the baghouse attached to that enclosure is 85% effective in capturing PM 2.5. On that basis, installing enclosures capable of capturing 75% of PM 2.5 created at the two other kettles, with baghouses that are 85% effective, would be expected to result in total removal from the air (as waste dust) of 5.511 tonnes/yr of PM 2.5 currently created ($(8.644 \times .75) \times .85$), reducing air emissions by 5.511 tonnes/yr, an improvement of 64% ($1 - ((8.644 - 5.511)/8.644) * 100$).

### 3.3.2 Estimate of PM 2.5 Reductions

This table summarizes the effectiveness of the 2 options.

| | | |
|---|---|---|
| Raw Material or Feedstock Substitution | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Product Reformulation or Redesign | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Equipment or Process Modification | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | PM-1: Reduce Air Emissions by 3.674 tonnes (43%)<br><br>PM-2: Reduce Air Emissions by 5.511 tonnes (64%) |
| | Disposed | **PM-1:** Amount of Baghouse Dust Disposal will **increase** by 3.674 tonnes (100%, as currently 0 tonnes are disposed of).<br><br>**PM-2:** If the improvements are captured the Baghouse Dust Disposal will **increase** by 5.511 tonnes (100%, as currently 0 tonnes are disposed of). |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Spills/Leak Prevention | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Reuse or Recycling of Toxic Substance | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Improved Inventory Management or Purchasing Techniques | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |
| Training or Improved Operating Practices | Used | 0 kg, 0% |
| | Created | 0 kg, 0% |
| | Transformed | 0 kg, 0% |
| | Discharged | 0 kg, 0% |
| | Disposed | 0 kg, 0% |
| | Recycled | 0 kg, 0% |
| | In Product | 0 kg, 0% |

### 3.3.3 Technical Feasibility of (Invalid) PM 2.5 Options

| Equipment or Process Modification | PM-1: Air emission reductions are possible by repairing and reactivating the baghouses. |
| --- | --- |
| | PM-2: Enclosure hoods can be added on 2 kettles, and the baghouse at the 46' kettle can be repaired or rebuilt. |

### 3.3.4 Economic Feasibility of (Invalid) PM 2.5 Options

As indicated in Section 8.3.1, this information is being kept, even though the actual options are not valid under the Toxics Reduction Act.

<table>
<tr><td rowspan="2">Equipment or Process Modification</td><td colspan="2">PM-1:<br><br>ANNUALIZED CAPITAL COSTS:</td></tr>
<tr><td colspan="2">

|  | Current | If Option Implemented |
| --- | --- | --- |
| Equipment | $0 | $194,200 |

Repairing and reactivating the baghouses could be costly if the enclosures and baghouses must be substantially rebuilt or even replaced. Replacement cost for one system is $971,000 based on a May 15, 2014 proposal from Southern Environmental. If the equipment has a life of 10 years then the system will cost $194,000 per year.

**ANNUAL COSTS**

|  | Current | If Option Implemented |
| --- | --- | --- |
| Raw Material | $0 | $0 |
| Production Costs | $0 | $0 |
| Process Costs (Utilities & Supplies) | $0 | $5,000 |
| Labor Costs | $0 | $5,400 |
| Health and Safety Costs | $0 | $0 |
| Disposal Costs* | $0 | $3,674 |
| TOTAL | $0 | $14,074 |

*This relates to a removal cost of $1 per kg of PM 2.5.

**ANNUAL SAVINGS/LOSS**
= Current Annual Costs – Annual Costs if Option Implemented
= $0.00 - $14,074.00
= -$14,074.00

**PAYBACK PERIOD**
Capital costs invested would never be recovered, as this option would result in a net loss each year. There are no costs, such as air emission fees or disposal fees, that will be off-set by the removal of additional PM 2.5.
</td></tr>
</table>

| | |
|---|---|
| | Environmental and health effects are insignificant due to the low amount of emissions. PM 2.5 emissions are less than 25 kg per day and do not cause environmental or health effects that represent a cost. The option is not economically feasible. |
| Equipment or Process Modification | PM-2:<br><br>**ANNUALIZED CAPITAL COSTS:**<br><br>**ANNUAL COSTS**<br><br>*This relates to a removal cost of $1 per kg of PM 2.5.<br><br>**ANNUAL SAVINGS/LOSS =**<br>= Current Annual Costs − Annual Costs if Option Implemented<br>= $0.00 - $18,191.00<br>= -$18,191.00<br><br>**PAYBACK PERIOD**<br>Capital costs invested would never be recovered, as this option would result in a net loss each year. There are no costs, such as air emission fees or disposal fees that will be off-set by the removal of additional PM 2.5.<br><br>Environmental and health effects are insignificant due to the low amount of emissions. PM 2.5 emissions are less than 25 kg per day and do not cause environmental or health effects that represent a cost. The option is not economically feasible. |

**ANNUALIZED CAPITAL COSTS:**

| | Current | If Option Implemented |
|---|---|---|
| Equipment | $0 | $291,300 |

Baghouses including enclosures cost $971,000 based on a May 15, 2014 proposal from Southern Environmental. If the equipment has a life of 10 years then the system will cost $291,300 per year.

**ANNUAL COSTS**

| | Current | If Option Implemented |
|---|---|---|
| Raw Material | $0 | $0 |
| Production Costs | $0 | $0 |
| Process Costs (Utilities & Supplies) | $0 | $7,500 |
| Labor Costs | $0 | $8,100 |
| Health and Safety Costs | $0 | $0 |
| Disposal Costs | $0 | $5,511 |
| TOTAL | $10,582 | $18,191 |

## 3.3.5   Technically and Economically Feasible Options

No options are feasible.

## 3.4 Implementation of Options for Reduction of PM 2.5

No options are selected for implementation

## 3.5 Estimate of Reductions by Implementation of Options

No options are selected for implementation

## 3.6 Planner Recommendations and Rationale

See Appendix I.
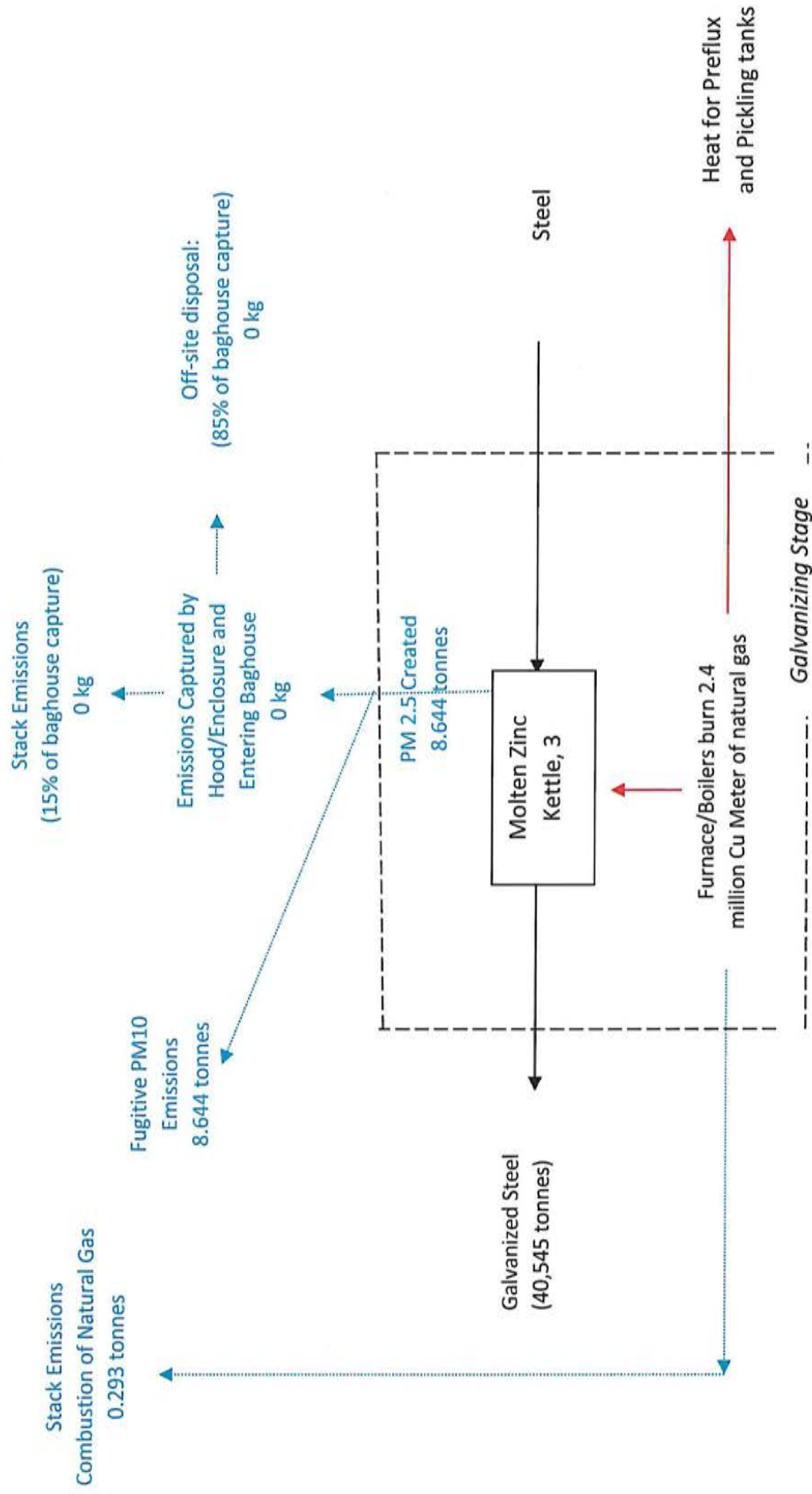
Figure 2. Process Flow Diagram for PM 2.5 (Data from CY 2014)

Stack Emissions
(15% of baghouse capture)
0 kg

Off-site disposal:
(85% of baghouse capture)
0 kg

Emissions Captured by
Hood/Enclosure and
Entering Baghouse
0 kg

Steel

PM 2.5 Created
8.644 tonnes

Fugitive PM10
Emissions
8.644 tonnes

Molten Zinc
Kettle, 3

Furnace/Boilers burn 2.4
million Cu Meter of natural gas

Heat for Preflux
and Pickling tanks

Galvanizing Stage

Galvanized Steel
(40,545 tonnes)

Stack Emissions
Combustion of Natural Gas
0.293 tonnes

15

## 4 PLAN CONFIRMATION STATEMENTS

As of Oct 30, 2017, I, Duane Bickers, confirm that I have read the toxic substance reduction plan for the PM 2.5 and I am familiar with its contents, and to my knowledge the plan is factually accurate and complies with the Toxics Reduction Act, 2009, and Ontario Regulation 455/09 (General) made under that Act.

Name:              Duane Bickers

Title:               Plant Manager, AZZ Galvcast

Signature _D.B._        Date: Oct 30/17

As of October 27, 2017, I, Craig Maunder, confirm that I am familiar with the processes at AZZ Galvcast that use or create PM 2.5, that I agree with the estimates referred to in subparagraphs 7 iii, iv, and v of subsection 4 (1) of the Toxics Reduction Act, 2009 that are set out in the plan dated October 27, 2017 and that the plan complies with that Act and Ontario Regulation 455/09 (General), made under that Act, with the exception of meeting the regulatory deadline of Dec 31, 2014.

Name:        Craig Maunder, M.Sc. CIH
Title:         Senior Project Manager, ECOH Management Inc.

Signature _____ Date: _____ Oct 27, 2017 _____

**Appendix I**: Planner Recommendations and Rationale

**Appendix II**: Emission Factors

October 27, 2017

AZZ Incorporated
One Museum Place
3100 West 7th Street, Suite 500
76107 Fort Worth, TX
United States

**Attention:**   **Frank Gaudet, Environmental Engineer**

**Re:**   **Recommendations for Improvement to PM2.5 Toxic Substance Reduction Plan**
AZZ Galvcast
49 Commerce Crescent, Acton, Ontario, Canada
ECOH Project No.: 18413

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As per section 18.2 of Ontario Regulation 455/09 (General) – made under the Toxics Reduction Act, a Toxic Substance Reduction Plan must include recommendations in specifically prescribed categories. These recommendations must be provided by a licensed Toxic Substance Reduction Planner. The purpose of these recommendations is to suggest areas of potential improvement to all aspects of the plan, including the potential for reducing the use and creation of the toxic substance at the facility, and improving the business rationale for implementing reduction options within the plan. To assist AZZ Incorporated in meeting these requirements, Mr. Craig Maunder of ECOH (Planner License No.: TRSP0275) is pleased to provide the following recommendations for improvement to the Toxic Substance Reduction Plans for PM-2.5 for the AZZ Galvcast facility, located at 49 Commerce Crescent in Acton, Ontario, Canada. The plan for PM-2.5 was certified by Mr. Maunder on October 27, 2017.

**Recommendations by Category**

A. **Expertise relied on in preparing the plan**

- Consider making a senior employee at the Galvcast facility responsible for the first draft of the mandatory plan review and revision due by December 31, 2018, with that draft then reviewed by the AZZ Environmental Engineer at AZZ's head office. Galvcast employees will be more familiar with up-to-date, day-to-day operations at the facility. With the current plan established as a template to work from, the learning curve should not be excessively steep. Such an approach should reduce the time commitment of the AZZ Environmental Engineer, and help to ensure maximum data accuracy.

- Consider making the same senior employee responsible for the toxic substance accounting information due annually to the Ministry of the Environment on by June 1 of each year (for information collected the previous year), and responsible for annual reports to the federal government under the National Pollutant Release Inventory (NRPI). This will help to ensure

(required) consistency between the plans and annual reports, and to avoid scenarios in which a plan is not created for a substance that is reported under the Toxics Reduction Act.

- Consider referring to *EPA Air Pollution Control Cost Manual - Sixth Edition, Section 6, Chapter 1 – Baghouses and Filters* (EPA/452/B-02-001) for guidance in more accurately determining cost estimates for production costs, process-related costs, and required hours of labour for maintenance and operations of baghouses when evaluating whether to repair the baghouses.

- Since the hot-dip galvanizing process does not vary greatly from galvanizer to galvanizer or country to country, consider reviewing published emissions factors for PM 2.5 at hot-dip galvanizing facilities developed by countries other than the US (e.g. Australia, U.K., E.U.), and using an average of the published values as a potentially more accurate PM 2.5 emissions factor.

B. **Identification and description of stages and processes, including description of how, when, where & why toxic substances are used or created at the facility**

- Consider defining any acronyms used (e.g. NPRI) as everyone who reads the plan may not be familiar with them.

- As only page excerpts of reference publications are provided within the report, consider including footnote references for data such as emissions factors, in a recognized format with additional details to assist readers to find the specific source material referenced (e.g. APA style, MLA style, etc.).

C. **Process flow diagrams**

- Consider including the 3 galvanizing kettles on-site as separate processes (boxes on the flow diagram) within the galvanizing stage. As the kettles have different types of controls in place, this this will enable AZZ staff or consultants who do not visit the facility on a regular basis to better understand the process flow, ensure any future changes to operations are more obvious, and provide more granular clarity as to where emissions controls could/should be improved to greatest effect in the future.

- Consider identifying enclosures/ventilation hoods separately from baghouses with respect to capture efficiency, for the same reasons provided in the bullet above.

D. **Data and methods used in toxic substance accounting**

- Consider developing and assigning a measure of data quality to the data quantification methods used in the plan (e.g. data quality 1=wild guess, 2=estimate, 3=reasonably confident, 4=very accurate). By showing the level of confidence in the accounting method used, less reliable methods will be highlighted for future improvement. Note that there are no rules as to how such a metric should be developed, and the example given is for demonstration purposes only.

- ECOH understands air emissions modelling was recently conducted for the AZZ Galvcast facility, and the consulting firm that conducted the work provided estimates for the capture efficiency of the hoods and enclosures for the galvanizing kettles. For the purposes of evaluating

the value in repairing the existing baghouses, consider reviewing and/or requesting the rationale for these estimates from the consulting firm to determine if these are more accurate than the engineering estimates that have been used in the past (e.g. for PM 10 toxic substances plan issued in 2014).

- Consider conducting real-time particulate sampling (e.g. with a TSI DustTrak DRX or equivalent) at the perimeter of kettles and (if baghouses are repaired in the future) at baghouse exhaust points during regular operations to verify PM2.5 (and PM10) levels. Costs should be relatively low, and information obtained can help to support use of emissions factors as an estimate of PM 2.5 creation at the kettles, provide data regarding the accuracy of enclosure and baghouse efficiency estimates, and help to reduce the I/O imbalance. As an additional benefit, results can be used to verify that particulates are not a health and safety hazard at the facility, demonstrating proactive health and safety leadership and potentially improving employee morale. Building the data into existing air modelling information could also alleviate potential regulatory risk associated with reporting air emissions to the National Pollutant Release Inventory (NPRI) that are lower than actual emissions.

## E. Analysis of input/output balances

- Limited recommendations can be provided, as the I/O balance is based upon very simple math, with very few processes involved.

- Consider writing I/O balances as (Inputs minus Outputs = #), thus producing a numerical measure of how balanced (or not) the equation is that can be easily tracked to demonstrate any improvements.

## F. Direct and indirect costs associated with the prescribed toxic substances

- Consider including cost of replacement bags for the baghouses.

- Consider referring to *EPA Air Pollution Control Cost Manual - Sixth Edition, Section 6, Chapter 1 – Baghouses and Filters* (EPA/452/B-02-001) for refining cost estimates for production costs, process-related costs, and labour costs.

## G. Reduction options identified in the plans

- Reduction option PM-2 relies on the installation of enclosures with 75% efficiency and baghouse with 85% efficiency. Given it is quite likely that the existing enclosures/hoods and baghouses are not this efficient, consider using a more conservative estimate to avoid disappointment should this reduction option be selected for implementation in the future.

## H. Reduction estimates prepared for each identified reduction option for each prescribed toxic substance

- The reduction estimates in the plan are highly dependent upon the accuracy of the published emissions factor, and the estimated efficiencies of the hoods/enclosures and baghouses. Consider following the suggestions provided in Section D of this appendix to refine these estimates.

## I. Technical and economic feasibility analyses

- While not relevant to the current plan (it is not worth the effort for the options currently identified), consider conducting the technical analysis for any future reduction option(s) identified to a greater level of detail, using a more systematic/structured approach. This will help to avoid the implementation of reduction options that are discovered not to be technically feasible, but only after much effort has been put into implementation or purchases related to the option have been made. Items to consider include availability/reliability of new technologies, impact on production rate, impact on product quality relative to customer requirements, employee training or experience requirements, compatibility with existing processes, space considerations, time required to implement the change, occupational health and safety considerations, etc.

## J. Additional Technically and Economically Feasible Options

- Consider the use of a galvanizing kettle top-flux (eg. Zaclon fluxes) to reduce zinc oxide formation and air emissions, thus reducing the amount of zinc required to be purchased to re-stock the galvanizing kettle. Use of a top-flux would also reduce the amount of PM 2.5 created because less zinc oxide ash would be produced and disturbed during manual removal of the ash. Incidentally, the use of the kettle flux would also reduce the creation of ammonia fumes as steel is immersed in the kettle.

## K. Implementation steps and timelines, and likelihood to achieve these

- N/A (No options were selected for implementation)

Thank you for the opportunity to be of service to AZZ Incorporated. We trust that you will find the above recommendations useful. Should you have any questions, please do not hesitate to contact the undersigned at (905) 795-2800.

Sincerely,

**ECOH**
Environmental Consulting
Occupational Health

**Craig Maunder, M.Sc. CIH**
**Senior Project Manager,**
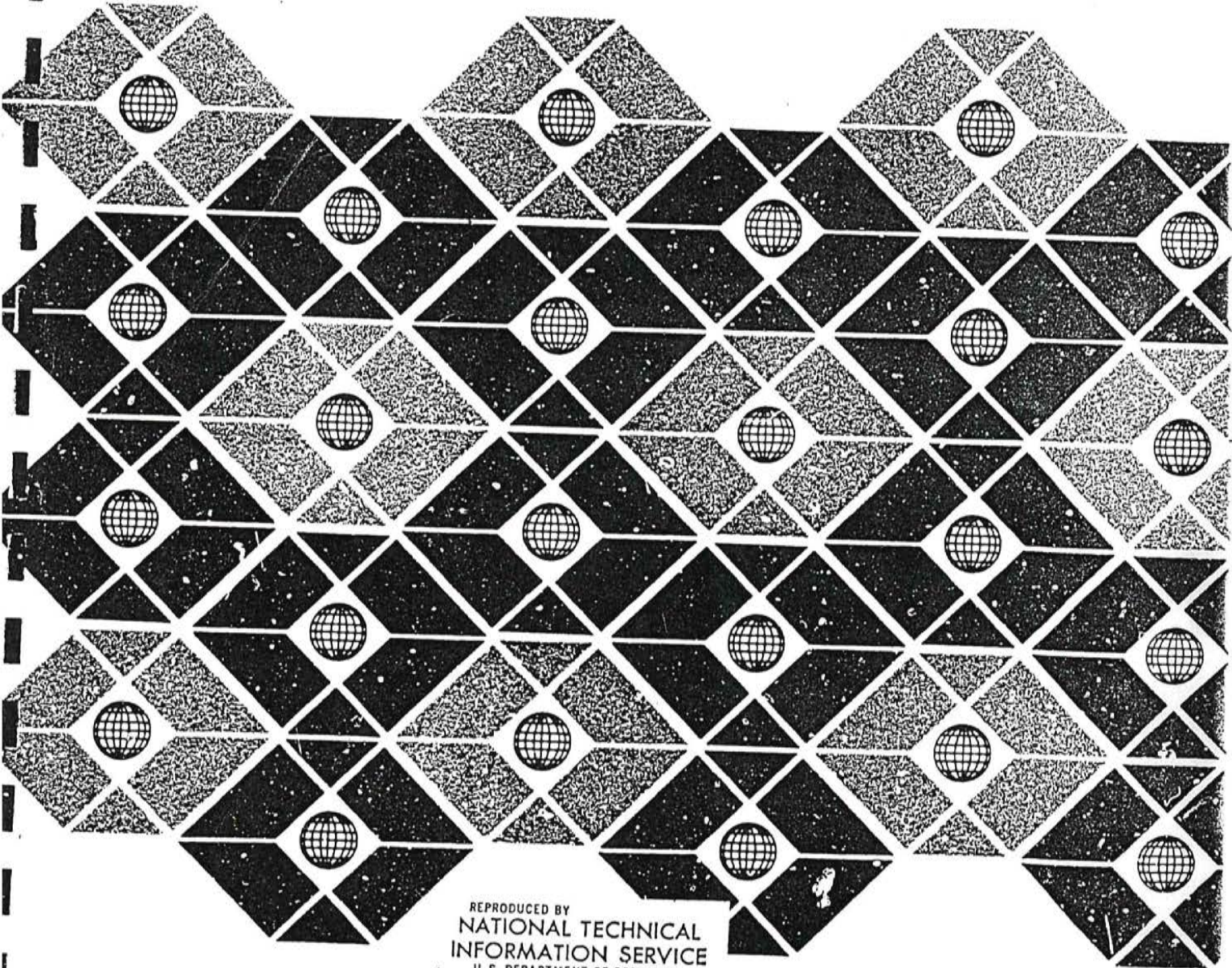**Licensed Toxic Substance Reduction Planner**

118011

PB 251 910

# EMISSIONS FROM HOT-DIP GALVANIZING PROCESSES

March 1976

EPA - 905/4-76-002

## TECHNICAL REPORT DATA
*(Please read Instructions on the reverse before completing)*

| 1. REPORT NO. EPA-905/4-76-002 | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|

**4. TITLE AND SUBTITLE**
Emissions From Hot-Dip Galvanizing Processes

**5. REPORT DATE** March, 1976

**6. PERFORMING ORGANIZATION CODE**

**7. AUTHOR(S)**
Peter J. Drivas

**8. PERFORMING ORGANIZATION REPORT NO.**

**9. PERFORMING ORGANIZATION NAME AND ADDRESS**
Pacific Environmental Services, Inc.
1930 14th Street
Santa Monica, California 90404

**10. PROGRAM ELEMENT NO.**

**11. CONTRACT/GRANT NO.**
68-01-3156
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U.S. Environmental Protection Agency, Region V
230 South Dearborn Street
Chicago, Illinois 60604

**13. TYPE OF REPORT AND PERIOD COVERED**
Final

**14. SPONSORING AGENCY CODE**

**15. SUPPLEMENTARY NOTES**

*(handwritten)* .26 kg/m ton × 2.2 lb/kg = .572 lb/m tonn × $\frac{1\ kto}{1.1023t}$ = 0.519 = 0.52 lb/ton of galv. steel

**16. ABSTRACT**
A literature review and source tests were performed in order to accurately characterize emissions from hot-dip galvanizing processes. Particulate emission data from seventeen source tests on hot-dip galvanizing plants were considered relevant in developing an emission factor for galvanizing kettles. There was no significant difference between kettle emissions and emissions from control devices. Considering both kettle and control device emissions as one data base, two types of emission factors were calculated:

(1) An emission factor based on process weight, equal to 0.26 kg/metric ton galvanized product ($\sigma = 0.28$), or assuming 8% zinc by weight in the galvanized product, 3.3 kg/metric ton zinc used ($\sigma = 3.5$).

(2) An emission factor based on the hours of kettle operation, equal to 0.51 kg/hr per kettle ($\sigma = 0.44$).

Using the derived emission factors, the total amount of particulate emissions produced by hot-dip galvanizing operations in the United States is estimated to be approximately 1,600 metric tons per year.

*(handwritten)* = 0.52 lb of PM per ton of galvanized steel

*(handwritten)* 0.51 kg/hr × 2.2 lb/kg = 1.122 lb/hr

**PRICES SUBJECT TO CHANGE**

**17. KEY WORDS AND DOCUMENT ANALYSIS**

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Air pollution control<br>Emissions<br>Exhaust gases<br>Hot-dip coatings<br>Zinc coatings | | 13 B<br>13 H<br>11 F |

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Table B.2.2 (cont.).

Category:     8
Process:      Melting, Smelting, Refining
Material:     Metals, except Aluminum

Category 8 covers the melting, smelting, and refining of metals (including glass) other than aluminum. All primary and secondary production processes for these materials which involve a physical or chemical change are included in this category. Materials handling and transfer are not included. Particulate emissions are a result of high temperature melting, smelting, and refining.

REFERENCES: 1-2



PARTICLE DIAMETER, µm
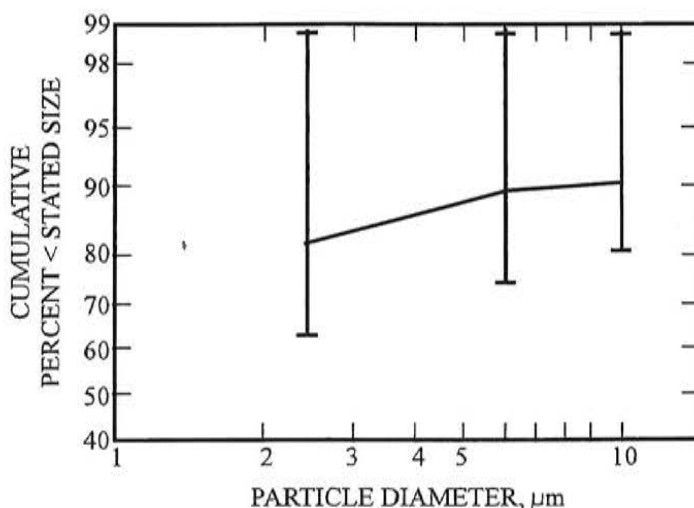
| Particle Size, µm | Cumulative % ≤ Stated Size (Uncontrolled) | Minimum Value | Maximum Value | Standard Deviation |
|---|---|---|---|---|
| 1.0[a] | 72 | | | |
| 2.0[a] | 80 | | | |
| 2.5 | 82 | 63 | 99 | 12 |
| 3.0[a] | 84 | | | |
| 4.0[a] | 86 | | | |
| 5.0[a] | 88 | | | |
| 6.0 | 89 | 75 | 99 | 9 |
| 10.0 | 92 | 80 | 99 | 7 |

[a] Value calculated from data reported at 2.5, 6.0, and 10.0 µm. No statistical parameters are given for the calculated value.

## TABLE 1.4-2.  EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

| Pollutant | Emission Factor $(lb/10^6 \text{ scf})$ | Emission Factor Rating |
|---|---|---|
| $CO_2$[b] | 120,000 | A |
| Lead | 0.0005 | D |
| $N_2O$ (Uncontrolled) | 2.2 | E |
| $N_2O$ (Controlled-low-$NO_X$ burner) | 0.64 | E |
| PM (Total)[c] | 7.6 ×16 = 122 | D |
| PM (Condensable)[c] | 5.7 | D |
| PM (Filterable)[c] | 1.9 | B |
| $SO_2$[d] | 0.6 | A |
| TOC | 11 | B |
| Methane | 2.3 | B |
| VOC | 5.5 | C |

[a] Reference 11.  Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6 \text{ m}^3$, multiply by 16.  To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020.  The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value.  TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to $CO_2$.  $CO_2[lb/10^6 \text{ scf}] = (3.67) (CON) (C)(D)$, where CON = fractional conversion of fuel carbon to $CO_2$, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2 \times 10^4 \text{ lb}/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate $PM_{10}$, $PM_{2.5}$ or $PM_1$ emissions.  Total PM is the sum of the filterable PM and condensible PM.  Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent).  Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to $SO_2$. Assumes sulfur content is natural gas of 2,000 grains/$10^6$ scf.  The $SO_2$ emission factor in this table can be converted to other natural gas sulfur contents by multiplying the $SO_2$ emission factor by the ratio of the site-specific sulfur content (grains/$10^6$ scf) to 2,000 grains/$10^6$ scf.