ACTIVE SMAQMD BACT CLEARINGHOUSE

CATEGORY: **FURNACE/SMELTER**

BACT Size: Minor Source BACT **METAL MELTING FURNACE**

BACT Determination Number: 211	**BACT Determination Date:** 12/12/2018

Equipment Information

Permit Number: 25548

Equipment Description: METAL MELTING FURNACE

Unit Size/Rating/Capacity: <1.0 mmBTU/hr Burnout Oven, <1.0 mmBTU/hr Furnace

Equipment Location: FROSTAD ATELIER
855 NATIONAL DRIVE
SACRAMENTO, CA

EXPIRED

BACT Determination Information

ROCs	**Standard:**	No standard
	Technology Description:	
	Basis:	
NOx	**Standard:**	60 ppmvd @ 3% O2
	Technology Description:	
	Basis:	Achieved in Practice
SOx	**Standard:**	Natural Gas
	Technology Description:	
	Basis:	Achieved in Practice
PM10	**Standard:**	Natural Gas, clean charge, cover
	Technology Description:	
	Basis:	
PM2.5	**Standard:**	Natural Gas, clean charge, cover
	Technology Description:	
	Basis:	Achieved in Practice
CO	**Standard:**	No standard
	Technology Description:	
	Basis:	
LEAD	**Standard:**	No standard
	Technology Description:	
	Basis:	

Comments:

District Contact: Michelle Joe Phone No.: (916) 874 - 4853 email: mjoe@airquality.org

Printed: 12/12/2018

777 12th Street, Third Floor

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Sacramento, CA 95814

BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

DETERMINATION NO.:	211
DATE:	October 31, 2018
ENGINEER:	Michelle Joe

Category/General Equip Description:	Bronze Casting Process
Equipment Specific Description:	Burnout Oven, Crucible & Pot Furnace, and Bronze Melting & Casting of Pure Bronze Ingots
Equipment Size/Rating:	<1.0 mmBTU/hr Burnout Oven and <1.0 mmBTU/hr Furnace, with 240 lb/day Maximum Bronze Melting Capacity
Previous BACT Det. No.:	N/A

This BACT determination was determined under the project A/C 25548 (Sacramento Bronze Art Foundry DBA Frostad Atelier) for a bronze casting process, including a burnout oven and a crucible and pot furnace. The process starts with casting a wax figure using the provided mold, then making a ceramic/fiberglass investment mold around the wax figure. The burnout oven is then used to melt out the wax figure from the investment mold, while bronze ingots are placed in a crucible and melted in the pot furnace. Molten bronze is then cast (poured) into the investment mold. After the bronze has cooled, the investment mold is broken away. The bronze sculpture is then cleaned and detailed with various techniques such as sandblasting, welding, and applying patina. This source category includes the criteria emissions from the combustion of natural gas in the burnout oven and furnace and particulate matter emissions from the bronze melting and casting process.

BACT ANALYSIS

A. ACHIEVED IN PRACTICE (Rule 202, §205.1a):

The BACT/T-BACT clearinghouses for the following agencies and air pollution control districts were reviewed for control technologies currently employed for bronze casting processes, which include natural gas-fired burnout ovens, natural gas-fired furnaces, and melting and casting of bronze ingots:

District/Agency	Best Available Control Technology (BACT) Requirements
US EPA	**BACT:** Source: EPA RACT/BACT/LAER Clearinghouse There are no BACT standards published in the clearinghouse for this source category (see Attachment A for a summary of the determinations reviewed). **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category. **RULE REQUIREMENTS:** 40 CFR Part 60 – New Source Performance Standards (NSPS): There are currently no 40 CFR, Part 60 NSPS sections that apply to this source category. The following rules were reviewed and are discussed below to verify inapplicability: 40 CFR 60 Subpart M – Standards of Performance for Secondary Brass and Bronze Production Plants This subpart is applicable to reverberatory and electric furnaces of 1,000 kg (2,205 lb) or greater production capacity and blast (cupola) furnaces of 250 kg/h (550 lb/h) or greater production capacity used at secondary brass or bronze production plants. Furnaces from which molten brass or bronze are cast into the shape of finished products, such as foundry furnaces, are not considered to be affected facilities. Since this facility uses a furnace to cast molten bronze into the shape of finished products, this subpart is not applicable. 40 CFR Part 61 – National Emission Standards for Hazardous Air Pollutants (NESHAPS): There are currently no 40 CFR, Part 61 NESHAPs that apply to this source category. 40 CFR Part 63 – NESHAPS for Source Categories (MACT Standards): There are currently no 40 CFR, Part 63 NESHAPs that apply to this source category. The following rule was reviewed and is discussed below to verify inapplicability: 40 CFR 63 Subpart ZZZZZZ – National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Aluminum, Copper, and Other Nonferrous Foundries (adopted 6/15/2009): This subpart is applicable to aluminum, copper, or other nonferrous foundries at an area source of HAPs and which melt at least 600 TPY of aluminum, copper, and other nonferrous metals, including all associated alloys. Since this facility has the maximum potential to melt 511,000 lb/year (255.5 TPY) of bronze (a copper alloy), this subpart is not applicable to this facility.

District/Agency	Best Available Control Technology (BACT) Requirements
Air Resources Board (ARB)	**BACT:** Source: ARB BACT Clearinghouse There are no BACT standards published in the clearinghouse for this source category. (see Attachment B for a summary of the determinations reviewed). **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category. **RULE REQUIREMENTS:** ARB Airborne Toxic Control Measures (ATCM): There are currently no ATCMs that apply to this source category. The following rule was reviewed and is discussed below to verify inapplicability: Airborne Toxic Control Measure (ATCM) for Emissions of Toxic Metals from Non-Ferrous Metal Melting (adopted 1/14/1993): This ATCM applies to non-ferrous metal (lead, copper, zinc, cadmium, arsenic, aluminum, and their alloys) melting furnaces, in which metal in a container is brought to a liquid state, and includes but is not limited to: reverberatory, cupola, induction, direct arc furnaces, sweat furnaces, and refining kettles. The facility uses silicone bronze in their bronze casting process. Silicone bronze has less than 0.004 percent of cadmium and 0.002 percent of arsenic. Therefore, it qualifies for an exemption from the ATCM under §93107(c)(2) for metal or alloy purity exemption.

SMAQMD	**BACT:** Source: SMAQMD BACT Clearinghouse (categories searched: *"foundry," "casting," "melting," "burnout/burnoff/wax oven," "furnace"*) There are no BACT standards published in the clearinghouse for this source category. **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category. **RULE REQUIREMENTS:** There are currently no category-specific prohibitory series 400 rules that apply to this source category. The following rules were reviewed and discussed below to verify inapplicability: Rule 411 – NOx from Boilers, Process Heaters, and Steam Generators (amended 8/23/2007) This rule limits NOx and CO emissions from boilers, steam generators, and process heaters with a rated heat input capacity of 1 mmBTU/hr or greater. As per Section 111 of this rule, process heaters where the products of combustion come into direct contact with the material to be heated are exempt from this rule. For the burnout oven, since the wax and investment shells to be heated come into direct contact with the burnout oven's burner, this burnout oven is exempt from this rule. For the furnace, the flame is aimed in-between the crucible and refractory lining, thereby heating the crucible's contents without direct contact. However, since the furnace has a rated heat input capacity below 1 mmBTU/hr, this furnace is exempt from this rule. Rule 414 – Water Heaters, Boilers, and Process Heaters Rated Less Than 1,000,000 BTU Per Hour (amended 3/25/2010) This rule applies to any person who manufactures, distributes, offers for sale, sells, or installs any type of water heater, boiler or process heater, with a rated heat input capacity less than 1,000,000 BTU/hr, fired with gaseous or nongaseous fuels. As per Section 209 of this rule, process heaters are defined as any unit fired with any fuel which transfers heat from combustion gases to water or process streams, and does not include: any dryer in which the material being dried is in direct contact with the products of combustion, cement or lime kilns, glass melting furnaces or smelters. For the burnout oven, since the wax and investment shells to be heated come into direct contact with the burnout oven's burner, this burnout oven is not included in the definition of process heater and is exempt from this rule. For the furnace, the flame is aimed in-between the crucible and refractory lining, thereby heating the crucible's contents without direct contact. Although this metal melting furnace is not explicitly excluded from the definition of "process heater" in Section 209, past permitting precedence for other metal melting furnaces did not apply this rule and therefore this furnace will continue to be exempt from this rule. Rule 419 – NOx from Miscellaneous Combustion Units (amended 10/25/2018) This rule applies to any miscellaneous combustion unit with a total rated heat input capacity of 5 million Btu per hour or greater located at any area source of NOx (<25 TPY of NOx). Although the burnout oven and furnace are located at an area source of NOx, each are rated below 5 mmBTU/hr and therefore this rule does not apply.

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>South Coast AQMD</td><td>

BACT:
Source: SCAQMD BACT Guidelines for Non-Major Polluting Facilities (revised 2/2/2018)

<table>
<tr><th colspan="2">For Brass Melting Furnace, Crucible, ≤ 300 lbs/hr process rate (page 16)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>SOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>PM10</td><td>Natural Gas, Charge Clean Metal Only and Maintain Slag Cover Over Entire Melt Surface (1990)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
<tr><td>Inorganic</td><td>No standard</td></tr>
</table>

*Note: the following BACT was identified but **excluded** since it was outside the scope of this BACT determination source category for the following reasons. Although this source category is for bronze melting (occurring at 1742 °F), this BACT is specifically for metal aging (698 to 1040 °F), annealing (500 to 1400 °F), forging (787 to 1652°F), heat treating (350 to 1350 °F), and homogenizing (900 to 1000 °F). Furthermore, Appendix J-4 of SCAQMD's Rule 1147 Final Technology Assessment (February 2017) recognized this BACT for heat treating furnaces and summarized the results from emission testing to be in the range of 45 to 55 ppm NOx. By comparison, Table 2-1 of SCAQMD's tech assessment listed the emission test results from various metal melting pots/crucibles as an average NOx concentration of 54 ppm. Due to the differences in operating temperatures and the emission test results submitted (and therefore achieved in practice), the metal heat treating furnaces specified in this BACT cannot be compared to the metal melting pot/crucible in this source category.*

<table>
<tr><th colspan="2">For Metal Heating Furnace, Including Metal Aging, Annealing, Forging, Heat Treating, and Homogenizing (page 84)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Natural Gas with Low NOx Burner ≤ 50 ppmvd @ 3% O_2, dry (10-20-2000)</td></tr>
<tr><td>SOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>PM10</td><td>No standard</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
<tr><td>Inorganic</td><td>Natural Gas (1990)</td></tr>
</table>

</td></tr>
</table>

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>South Coast AQMD (continued)</td><td>
Note: the following categories were identified but excluded since they were outside the scope of this BACT determination source category due to unspecified process rates.
<table>
<tr><th colspan="2">For Aluminum Melting Furnace, Crucible or Pot (page 4)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Natural Gas (7-11-1997)</td></tr>
<tr><td>SOx</td><td>Natural Gas (7-11-1997)</td></tr>
<tr><td>PM10</td><td>Natural Gas with Ingots or Non-contaminated Scrap Charge, or Baghouse (10-20-2000)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
<tr><td>Inorganic</td><td>No standard</td></tr>
</table>
<table>
<tr><th colspan="2">For Lead Melting Furnace, Pot or Crucible, Non-Refining Operations (page 81)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>SOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>PM10</td><td>Natural Gas and Melt Only Sows, Pigs, Ingots, or Clean Scrap (1990)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
<tr><td>Inorganic</td><td>No standard</td></tr>
</table>
<table>
<tr><th colspan="2">For Zinc Melting Furnace – Crucible or Pot (page 128)</th></tr>
<tr><td>VOC</td><td>No standard</td></tr>
<tr><td>NOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>SOx</td><td>Natural Gas (1990)</td></tr>
<tr><td>PM10</td><td>Natural Gas with Ingot and/or Clean Scrap Charge Only, or Baghouse (1988/2000)</td></tr>
<tr><td>PM2.5</td><td>No standard</td></tr>
<tr><td>CO</td><td>No standard</td></tr>
<tr><td>Inorganic</td><td>No standard</td></tr>
</table>
<u>T-BACT:</u>
There are no T-BACT standards published in the clearinghouse for this source category.
</td></tr>
</table>

District/Agency	Best Available Control Technology (BACT) Requirements
South Coast AQMD (continued)	**RULE REQUIREMENTS:** Regulation II, Rule 219 - Equipment Not Requiring a Written Permit Pursuant to Regulation II (amended 4/6/2018): For reference purposes for the following prohibitory rules, this rule identifies the equipment, processes, or operations that emit small amounts of air contaminants that shall not require written permits. The following applicable metallurgical processing equipment were identified as exempt from requiring a written permit: - Section (e)(1): Crucible-type or pot-type furnaces with a brimful capacity of less than 7400 cm^3 (452 in^3) of any molten metal and control equipment exclusively venting the equipment. - Section (e)(2): Crucible furnaces, pot furnaces, or induction furnaces with a capacity of 450 kg (992 lbs) or less each, and control equipment used to exclusively vent the equipment where no sweating or distilling is conducted and where only the following materials are poured or held in a molten state: (A) Aluminum or any alloy containing over 50 percent aluminum, (B) Magnesium or any alloy containing over 50 percent magnesium, (C) Tin or any alloy containing over 50 percent tin, (D) Zinc or any alloy containing over 50 percent zinc, (E) Copper or any alloy containing over 50 percent copper, (F) Precious metals, and (G) Ceramic materials, including glass and porcelain. Provided these materials do not contain alloying elements of arsenic, beryllium, cadmium, chromium and/or lead and such furnaces are exempt pursuant to paragraph (b)(2) [combustion equipment firing natural gas, for which the maximum heat input is 2 mmBTU/hr or less and for which there are no other emissions other than products of combustion]. - Section (e)(3): Molds used for the casting of metals and control equipment used to exclusively vent the equipment. - Section (e)(4): Inspection equipment used exclusively for metal, plastic, glass, or ceramic products and control equipment used to exclusively vent such equipment. - Section (e)(13): Ladles used in pouring molten metals. - Section (e)(17): Wax burnout kilns where the total internal volume is less than 0.2 m^3 (7.0 ft^3) or kilns used exclusively for firing ceramic ware, provided such furnaces are exempt pursuant to paragraph (b)(2). Regulation XI, Rule 1147 - NOx Reductions from Miscellaneous Sources (amended 7/7/2017): This rule applies to ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with nitrogen oxide emissions that require a District permit **and are not** specifically required to comply with a nitrogen oxide emission limit by other District Regulation XI rules.

<table>
<tr><th>District/Agency</th><th>Best Available Control Technology (BACT) Requirements</th></tr>
<tr><td>South Coast AQMD (continued)</td><td>
<table>
<tr><th colspan="4">SCAQMD Rule 1147 §(c)(1), Table 1 – NOx Emission Limit for Units ≥ 325,000 BTU/hr ppmvd @ 3% O_2 or lb/mmBTU heat input</th></tr>
<tr><td>Equipment Category</td><td colspan="3">Process Temperature</td></tr>
<tr><td>Gaseous fuel-fired equipment</td><td>≤ 800° F</td><td>> 800 ° F and < 1200° F</td><td>≥ 1200 ° F</td></tr>
<tr><td>Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner</td><td>60 ppm or 0.073 lb/mmBTU</td><td>60 ppm or 0.073 lb/mmBTU</td><td>60 ppm or 0.073 lb/mmBTU</td></tr>
<tr><td>Metal Heat Treating, Metal Melting Furnace, Metal Pot, or Tar Pot</td><td>60 ppm or 0.073 lb/mmBTU</td><td>60 ppm or 0.073 lb/mmBTU</td><td>60 ppm or 0.073 lb/mmBTU</td></tr>
</table>
Note: Rule 219 - Equipment Not Requiring a Written Permit Pursuant to Regulation II (amended 4/6/2018) exempts combustion equipment firing natural gas, for which the maximum heat input is 2 mmBTU/hr or less and for which there are no other emissions other than products of combustion (except for food ovens rated ≤ 2 mmBTU/hr), from the requirement to obtain a written permit. Therefore, in practice, the BACT, LAER and Rule 1147 standards only apply to process heaters or any combustion unit with no other emissions other than products of combustion with a heat input greater than 2 mmBTU/hr.
Regulation XIV, Rule 1407 – Control of Emissions of Arsenic, Cadmium and Nickel from Non-Ferrous Metal Melting Operations (adopted 7/8/1994):
The purpose of this rule is to reduce emissions of arsenic, cadmium, and nickel from non-ferrous metal (defined as any metal containing aluminum, arsenic, cadmium, copper, lead, zinc or their alloys) melting operations, which include but are not limited to, smelters (primary and secondary), foundries, die-casters, coating processes (galvanizing and tinning), and other miscellaneous processes such as dip soldering, brazing and aluminum powder production.
The rule requires that any person who owns or operates a non-ferrous metal melting facility shall be in compliance with all the emission, operation, and maintenance requirements specified in subdivisions (d) and (e), unless exempted under paragraphs (i)(1) and/or (i)(2). This facility does not melt scrap and uses silicone bronze, which has less than 0.004 percent of cadmium and 0.002 percent of arsenic. Therefore, it qualifies for an exemption from Rule 1407 under paragraph (i)(2) for metal or alloy purity exemption.
</td></tr>
</table>

San Joaquin Valley APCD

BACT:

Source: SJVUAPCD Searchable BACT Clearinghouse (categories searched: *"foundry," "casting," "melting," "burnout/burnoff/wax oven," "furnace"*)

*Note: the following categories were identified but **excluded** since they were outside the scope of this BACT determination source category due to process rates >240 lb/day or non-crucible type furnaces.*

BACT Guideline 8.2.6 A – Brass/Bronze Foundry with > 300 lb/hr brass/bronze process rate (7/18/2006)

Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	No Standard	No Standard
SOx	No Standard	No Standard
PM10	Brass Melting Furnace: use of an electric induction furnace and a collection system vented to a control device with a control efficiency of 99% for PM10 Sand Handling System with Shakeout and/or Muller in System: shakeout stations, return conveyors, elevators, screens, material bins, and Muller vented to a control device with a control efficiency of 99% for PM10 Cast Metal Parts Finishing Operations: grinders, saws and finishing mills served by capture devices vented to a control device with 99% control efficiency for PM10	No Standard
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

BACT Guideline 1.5.4 A – Metal Melting Crucible/Furnace, Brass Melting Crucible Furnace, Rated at 2,000 lb/day (6/18/1996)

Pollutant	Achieved in Practice or in the SIP	Technologically Feasible
VOC	No Standard	No Standard
NOx	Natural Gas	Electric Furnace (Alternate Basic Equipment)
SOx	No Standard	No Standard
PM10	Clean Charge	Baghouse
PM2.5	No Standard	No Standard
CO	No Standard	No Standard

<table>
<tr><td>District/Agency</td><td>Best Available Control Technology (BACT) Requirements</td></tr>
<tr><td>San Joaquin Valley APCD (continued)</td><td>
<table>
<tr><td colspan="3">BACT Guideline 1.5.13 A – Aluminum Diecasting Furnace (3/7/2016)</td></tr>
<tr><td>Pollutant</td><td>Achieved in Practice or in the SIP</td><td>Technologically Feasible</td></tr>
<tr><td>VOC</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>NOx</td><td>Reverb Furnaces (non-sweating): 53 ppmvd @ 3% O_2 (0.0643 lb/mmBTU) with the use of low-NOx burners</td><td>Reverb Furnaces (non-sweating):
1. 6.0 ppmvd @ 3% O_2 (0.0073 lb/mmBTU) with use of low-NOx burners and Selective Catalytic Reduction
2. 12.0 ppmvd @ 3% O_2 (0.0146 lb/mmBTU) with the use of low-NOx burners and Regerative Selective Catalytic Reduction
3. 30 ppmvd @ 3% O_2 (0.0364 lb/mmBTU) with the use of low-NOx burners and Selective Non-Catalytic Reduction

Electric Furnace:
(Alternate Basic Equipment)</td></tr>
<tr><td>SOx</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>PM10</td><td>Reverb Furnaces (non-sweating): use of “clean charge” without the addition of any flux, and the use of natural gas fuel in the furnace</td><td>Reverb Furnaces (non-sweating): use of baghouse and natural gas fuel in the furnace</td></tr>
<tr><td>PM2.5</td><td>No Standard</td><td>No Standard</td></tr>
<tr><td>CO</td><td>No Standard</td><td>No Standard</td></tr>
</table>

T-BACT:
There are no T-BACT standards published in the clearinghouse for this source category.

RULE REQUIREMENTS:
Rule 4309 – Dryers, Dehydrators, and Ovens (adopted 12/15/2005):
This rule applies to any dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, that has a total rated heat input of ≥ 5.0 mmBTU/hr. Since the burnout oven and furnace are each rated below 5 mmBTU/hr, this rule does not apply.

Rule 7060 – Toxic Metals from Non-Ferrous Metal Melting (adopted 12/15/1994):
This rule incorporates the requirements of the Airborne Toxic Control Measure (ATCM) for Emissions of Toxic Metals from Non-Ferrous Metal Melting (see Air Resources Board (ARB) section above).
</td></tr>
</table>

District/Agency	Best Available Control Technology (BACT) Requirements
Bay Area AQMD	**BACT:** Source: BAAQMD BACT Guideline (categories searched: *"foundry," "casting," "melting," "burnout/burnoff/wax oven," "furnace"*) There are no BACT standards published in the clearinghouse for this source category. **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category. **RULE REQUIREMENTS:** Regulation 9, Rule 7 – Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, And Process Heaters (amended 5/4/2011) This rule applies to industrial, institutional and commercial boilers, steam generators and process heaters with a rated heat input of greater than 2 mmBTU/hr when fired exclusively with natural gas, LPG, or any combination thereof. As per Section 9-7-110.6, kilns, ovens, and furnaces used for drying, baking, heat treating, cooking, calcining, or vitrifying are exempt from this rule. Since the burnout oven and furnace each meet the exemption in Section 9-7-110.6, this rule does not apply. Regulation 11, Rule 15 – Airborne Toxic Control Measure for Emissions of Toxic Metals from Non-Ferrous Metal Melting (adopted 4/6/1994): This rule incorporates the requirements of the Airborne Toxic Control Measure (ATCM) for Emissions of Toxic Metals from Non-Ferrous Metal Melting (see Air Resources Board (ARB) section above).
San Diego County APCD	**BACT:** Source: NSR Requirements for BACT Guidelines (June 2011) (categories searched: *"foundry," "casting," "melting," "burnout/burnoff/wax oven," "furnace"*) There are no BACT standards published in the clearinghouse for this source category. **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category. **RULE REQUIREMENTS:** There are currently no category-specific prohibitory rules that apply to this source category. The following rules were reviewed and discussed below to verify inapplicability: Regulation 4, Rule 68 – Fuel-Burning Equipment – Oxides of Nitrogen (9/20/1994) This rule does not apply to fuel burning equipment which has a maximum input rating of < 50 mmBTU/hr. Since the burnout oven and furnace in this source category are each rated below 1 mmBTU/hr, this rule does not apply. Regulation 4, Rule 69.2.1 – Small Boilers, Process Heaters, and Steam Generators (effective 3/25/2010) This rule applies to gaseous and/or liquid fuel fired boilers, process heaters, and steam generators with a heat input rating from 0.6 mmBTU/hr to 2 mmBTU/hr. As per Section (b)(1)(ii), furnaces, kilns, and any combustion equipment where the material being heated is in direct contact with the products of combustion are exempt from this rule. Since the wax and investment shells to be heated come into direct contact with the burnout oven's burner, this burnout oven is exempt from this rule. Since the furnace is explicitly exempted, this furnace is exempt from this rule.

District/Agency	Best Available Control Technology (BACT) Requirements
Ventura County APCD	**BACT:** Source: ARB BACT Clearinghouse There are no BACT standards published in the clearinghouse for this source category from this district. **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category from this district. **RULE REQUIREMENTS:** There are currently no category-specific prohibitory rules that apply to this source category. The following rules were reviewed and discussed below to verify inapplicability: Rule 74.15.1 – Boilers, Steam Generators and Process Heaters (1 to 5 MMBTUs) (revised 6/23/15) This rule applies to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a rated heat input capacity ≥1 mmBTU/hr and <5 mmBTU/hr. Since the burnout oven and furnace in this source category are each rated below 1 mmBTU/hr, this rule does not apply. Rule 74.34 – NOx Reductions from Miscellaneous Sources (adopted 12/13/16) This rule reduces NOx and CO emissions and applies applies to dryers, furnaces, heaters, incinerators, kilns, ovens, and duct burners where the total rated heat input for the unit is 5 mmBTU/hr or greater. Since the burnout oven and furnace in this source category are each rated below 1 mmBTU/hr, this rule does not apply.
Yolo Solano AQMD	**BACT:** Source: ARB BACT Clearinghouse There are no BACT standards published in the clearinghouse for this source category from this district. **T-BACT:** There are no T-BACT standards published in the clearinghouse for this source category from this district. **RULE REQUIREMENTS:** There are currently no category-specific prohibitory rules that apply to this source category. The following rule was reviewed and is discussed below to verify inapplicability: Rule 2.27 – Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters (revised 8/14/1996) This rule applies to boilers, steam generators, and process heaters with rated heat inputs of greater than or equal to 5 mmBTU/hr, used in all industrial, institutional, and commercial operations. Since the burnout oven and furnace in this source category are each rated below 1 mmBTU/hr, this rule does not apply.

Summary of Achieved in Practice Control Technologies

The following control technologies have been identified and are ranked based on stringency:

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
VOC	1. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]
NOx	1. 60 ppmvd @ 3% O_2 [SCAQMD Rule 1147] 2. Natural gas fueled [SCAQMD Non-Major BACT Guidelines, page 16] 3. No standard [EPA, ARB, SMAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]
SOx	1. Natural gas fueled [SCAQMD Non-Major BACT Guidelines, page 16] 2. No standard [EPA, ARB, SMAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]
PM10	1. Natural gas fueled, clean metal charge only and maintain slag (A) cover over entire melt surface [SCAQMD Non-Major BACT Guidelines, page 16] 2. No standard [EPA, ARB, SMAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]
PM2.5	1. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]
CO	1. No standard [EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD]

(A) SCAQMD Rule 1420.2, Section (c)(20) defines slag as the inorganic material by-product discharged, in melted state, from a smelting furnace.

Discussion on Achieved in Practice Control Technologies:

The following control technologies have been identified as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED		
Pollutant	**Standard**	**Source**
VOC	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD
NOx	60 ppmvd @ 3% O_2	SCAQMD
SOx	Natural gas fueled	SCAQMD
PM10	Natural gas fueled, clean metal charge only and maintain slag cover over entire melt surface	SCAQMD
PM2.5	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD
CO	No standard	EPA, ARB, SMAQMD, SCAQMD, SJVAPCD, BAAQMD, SDCAPCD, VCAPCD, YSAQMD

B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.a.):

Technologically Feasible Alternatives:
Any alternative basic equipment, fuel, process, emission control device or technique, singly or in combination, determined to be technologically feasible by the Air Pollution Control Officer.

The table below shows the technologically feasible alternatives identified as capable of reducing emissions beyond the levels determined to be "Achieved in Practice" as per Rule 202, §205.1.a:

Pollutant	Technologically Feasible Alternatives
VOC	No other technologically feasible option identified
NOx	1. Selective Catalytic Reduction (SCR) 2. Selective Non-Catalytic Reduction (SNCR)
SOx	No other technologically feasible option identified
PM10	1. Baghouse 2. Electrostatic Precipitator (ESP) 3. Venturi Scrubber (Wet Scrubber)
PM2.5	(same as above for PM10)
CO	No other technologically feasible option identified

- **Technologically Feasible Alternatives for NOx:**
  The following technologically feasible alternatives were identified for NOx and discussed below for technological feasibility:
  - Selective Catalytic Reduction (SCR) – Not technologically feasible due to the exhaust gas temperature (1800 ºF to 2300 ºF for this source category) operating above the optimum temperature range of 480 ºF to 800 ºF (as per page 2-17, EPA Cost Control Manual, 7th Edition, Updated 12/8/17).
  - Selective Non-Catalytic Reduction (SNCR) – Not technologically feasible due to the exhaust gas temperature (1800 ºF to 2300 ºF for this source category) operating above the optimum temperature range of of 1550 ºF to 1950 ºF (as per page 1-7, EPA Cost Control Manual, 7th Edition, Updated 12/8/17).

- **Technologically Feasible Alternatives for PM10:**
  The following technologically feasible alternatives were identified for PM10 and discussed below for technological feasibility:
  - Baghouse – Technologically feasible, but EPA AP-42, Section 12.9.3 indicates that cooling systems may be needed to prevent hot exhaust gases from damaging or destroying the bag filters.
  - Electrostatic Precipitation (ESP) – Not technologically feasible since EPA AP-42, Section 12.9.3 indicates ESPs have a low collection efficiency for dense particulate such as the oxides of lead and zinc from this type of source.
  - Venturi Scrubber (Wet Scrubber) – Not technologically feasible since EPA AP-42, Section 12.9.3 indicates that wet scrubbers are useful for particles larger than 1 micrometer, and the metal oxide fumes generated are generally submicron in size.

After eliminating the technologically infeasible options of SCR, SNCR, ESP, and wet scrubber above, only a baghouse was identified as a technologically feasible alternative.

Cost Effectiveness Determination:
After identifying the technologically feasible alternatives, a cost analysis is performed to take into consideration economic impacts for all technologically feasible controls identified.

Maximum Cost per Ton of Air Pollutants Controlled:
A control technology is considered to be cost-effective if the cost of controlling one ton of that air pollutant is less than the limits specified below (except coating operations):

Pollutant	Maximum Cost ($/ton)
ROG	17,500
NOx	24,500
PM10	11,400
SOx	18,300
CO	TBD if BACT triggered

A. Baghouse for PM10:

As shown below, the cost effectiveness for the add-on baghouse to control PM10 was calculated to be $90,650 per ton (see Attachment C – Baghouse Cost Effectiveness Analysis). The cost analysis was processed in accordance with the EPA OAQPS Air Pollution Control Cost Manual (6th Edition). The sales tax rate was based on the District's standard rate of 8.5% and the electricity rate (11.24 cents/kWh) was based on an industrial application, as approved by the District on 10/17/16. The life of the equipment was based on the EPA cost manual recommendation. The interest rate was based on the previous 6-month average interest rate on United States Treasury Securities (based on the life of the equipment) and addition of two percentage points and rounding up the next higher integer rate. The labor (Occupation Code 27-1013: Fine Artists, Including Painters, Sculptors, and Illustrators) and maintenance (Occupation Code 49-9099: Installation, Maintenance, and Repair Workers) rates were based on data from the Bureau of Labor Statistics. Only the addition of a baghouse will be used to determine if the additional control is cost effective; the enclosure of the equipment, associated ducting, and addition of dilution air to cool the exhaust stream would only add to the cost of the system.

The following basic parameters were used in the analysis.

PM10 Control Level	=	99%
PM10 Baseline Level	=	0.0893 ton PM10/year
Equipment Life	=	20 years
Direct Cost	=	$3,344
Indirect Cost	=	$2,033
Direct Annual Cost	=	$9,564
Indirect Annual Cost	=	$6,858
Total Annual Cost	=	$16,426
PM10 Removed	=	0.0884 tons
Cost of PM10 Removal	**=**	**$185,776 per ton reduced**

Since this exceeds the $11,400 per ton cost effectiveness threshold for PM10, the add-on baghouse is considered not cost effective and is eliminated.

Using the PM10 BACT standard for PM2.5:
Since both PM10 and PM2.5 trigger BACT at > 0 lb/day and PM2.5 is a subset of PM10, BACT for PM2.5 will be triggered whenever BACT is triggered for PM10. Therefore, BACT for PM2.5 will be set to be the same as for PM10.

SELECTION OF BACT:

Based on the above analysis, the following has been determined to be BACT for bronze casting processes:

BACT FOR BRONZE CASTING PROCESS (<1.0 MMBTU/HR BURNOUT OVEN AND <1.0 MMBTU/HR FURNACE, WITH 240 LB/DAY MAXIMUM BRONZE MELTING CAPACITY)		
Pollutant	**Standard**	**Source**
VOC	No standard	N/A
NOx	60 ppmvd @ 3% O_2	[SCAQMD Rule 1147]
SOx	Natural gas fueled	[SCAQMD Non-Major Source BACT Guidelines, page 16]
PM10	Natural gas fueled, clean metal charge only and maintain slag cover over entire melt surface	[SCAQMD Non-Major Source BACT Guidelines, page 16]
PM2.5	(same as above for PM10)	(same as above for PM10)
CO	No standard	N/A

C. SELECTION OF T-BACT:

There are no Federal NSPS's, NESHAP's nor State ATCM's applicable for this source category. None of the sources surveyed have any toxic T-BACT determinations published. Therefore, T-BACT standards will be considered as meeting the BACT standards identified above.

REVIEWED BY: _____ **DATE:** 12-13-18

APPROVED BY: _____ **DATE:** 12/12/18

Attachment A

Review of BACT Determinations Published by EPA

List of applicable[A] BACT determinations published in EPA's RBLC Clearinghouse for **Process Code 19.600 (Misc. Boilers, Furnaces, Heaters), Process Code 19.900 (Other Misc. Combustion), Process Code 82.420 (Secondary Copper Production), Process Code 82.999 (Other Non-Ferrous Metals Industry Sources), and keywords "foundry," "casting," "metal melting," "oven," and "furnace":**

Process Code 19.600 – Misc. Boilers, Furnaces, Heaters								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Mag Pellet LLC iron ore concentrate pelletizing plant – space heaters and lab furnaces, natural gas-fired, 1.00 mmBTU/hr each (23.028 mmBTU/hr total)	IN-0185	04/24/2014	BACT-PSD	N/A	0.0500 lb/mmBTU (41.2 ppm), use of low-NOx burners, natural gas only, and good combustion practices	0.0005 lb/mmBTU, use of natural gas and good combustion practices	0.0072 lb/mmBTU, use of natural gas and good combustion practices	N/A
Process Code 19.900 – Other Misc. Combustion								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Volkswagen Group of America automobile assembly plant – natural gas-fired, 2.05 mmBTU/hr undercoating drying oven, 3.4 mmBTU/hr basecoat drying oven, and 1.02 mmBTU/hr spot repair drying oven	TN-0160	10/10/2008	BACT-PSD	N/A	0.0500 lb/mmBTU (41.2 ppm), use of low-NOx burners or equivalent control	N/A	N/A	N/A

Process Code 82.420 – Secondary Copper Production, Process Code 82.999 – Other Non-Ferrous Metals Industry Sources, and keyword searches "foundry," "casting," "metal melting," "oven," and "furnace"								
Description and Capacity	**RBLC ID**	**Date**	**Case-By-Case Basis**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Waupaca Foundry, Inc. gray and ductile iron foundry – casting lines with pouring/mold cooling and shakeout, 43.00 ton/hour iron throughput	IN-0288	6/25/2018	BACT-PSD	1.4000 lb/ton	0.0100 lb/ton	0.0200 lb/ton	N/A	5.0000 lb/ton for pouring/mold cooling and 1.0 lb/ton for shakeout
Huron Casting Inc. & Blue Diamond Steel Casting steel foundry – electric induction furnaces, two 8-ton capacity melt furnaces, one electric arc ladle reheat station, and a vacuum degassing unit controlled by a 50,000 CFM baghouse with exhaust recirculated behind furnace hoods	MI-0430	3/30/2017	BACT-PSD				0.0050 gr/dscf PM, 2.1400 lb/hr PM10, 0.5000 lb/hr PM2.5, 90.000% control efficiency, using 50,000 CFM baghouse	
Intat Precision, Inc. gray and ductile iron foundry – casting line with pouring, cooling, and shakeout, 15.00 ton/hour and 79,000 tons/12-consecutive month period of iron throughput	IN-0257	8/25/2016	BACT-PSD	1.2000 lb/ton of metal for 3 hours, use of mold vent off-gas ignition system	N/A	N/A	N/A	N/A

Commercial Metals Company scrap steel mill – casting operations	OK-0173	1/19/2016	BACT-PSD	N/A	N/A	N/A	52.6600 TPY lube/vegetable oil 12-month rolling total	N/A
Structural Metals Inc steel minimill – natural gas-fired casting operations, ladle preheaters and ladle resin dryers, 1,300,000 TPY steel throughput	TX-0705	7/24/2014	BACT-PSD	Good combustion practices	Good combustion practices	Use of low-sulfur vegetable-based oil for mold oil combustion; use of natural gas for ladle preheaters	N/A	Good combustion practices
Intat Precision, Inc. gray and ductile iron foundry – casting operations with pouring, cooling and shakeout , 15.00 tons/hour iron throughput	IN-0170	6/10/2013	Other Case-By-Case Basis	0.8000 lb/ton of iron, use of mold vent off-gas ignition system	N/A	N/A	N/A	N/A
Ardmore Foundry Inc gray iron foundry – casting and poring operations, electric, 736.00 TPY iron throughput	OK-0141	10/7/2011	BACT-PSD	N/A	N/A	N/A	N/A	227.5000 lb/hr
SDI Lafarga, LLC copper rod facility – reverberatory furnace, natural gas-fired, 97.20 mmBTU/hr, 275 tons/day copper throughput	IN-0125	9/30/2011	Other Case-By-Case Basis	1.0000 lb/ton of copper, 98.000% control efficiency, use of regenerative thermal oxidizer	N/A	N/A	N/A	N/A

Thyssenkrupp Wapupaca, Inc. gray and ductile iron foundry – casting lines, 200 tons/hour iron throughput	IN-0136	5/10/2011	Other Case-By-Case Basis	1.4 lb/ton of iron, 50.000% control efficiency, use of mold vent off-gas ignition system	0.01 lb/ton of iron	0.02 lb/ton of iron	N/A	6.0 lb/ton of iron, 50.000% control efficiency, use of mold vent off-gas ignition system
Nucor Steel minimill – electric arc furnace, continuous steel casting, 6 natural gas-fired preheaters, 657,000 TPY steel throughput	OH-0341	12/23/2010	BACT-PSD	0.1300 lb/ton of steel, use of scrap management plan	0.4300 lb/ton of steel	0.5000 lb/ton of steel, use of natural gas	0.0052 gr/dscf for PM10, 0.0049 gr/dscf for PM2.5, use of building enclosure equipped with a canopy hood/baghouse system capable of achieving 100% capture of meltshop emissions	2.2300 lb/ton of steel, use of direct evacuation (DEC) system to capture CO which is oxidized at air gap between DEC elbow and DEC duct
General Motors LLC Defiance Casting Operations iron foundry and aluminum engine casting plant – precision sand core modules, electric, 75 castings/hour per module and 305,856 castings/year per module	OH-0334	12/20/2010	BACT-PSD (for VOC and SOx), Other Case-By-Case Basis (for PM10)	0.9000 lb/ton of sand, 99.000% control efficiency of dimethyl isopropyl amine, use of packed tower scrubber, catalyst	N/A	0.1600 lb/ton of sand, 99.000% control efficiency, use of packed tower wet scrubber	0.0462 lb/ton of sand, use of baghouse and cyclone	N/A

Rochester Metal Products Corp. gray and ductile iron foundry – casting and pouring operations, 60 tons/hour of sand and 10 tons/hour of metal throughput	IN-0147 (shakeout and cooling)	2/1/2010	Other Case-By-Case Basis	N/A	N/A	N/A	4.6000 lb/hr for 3 hours, use of 2 baghouses	N/A
	IN-0147 (cooling, shot blast, and grinding)	2/1/2010	Other Case-By-Case Basis	N/A	N/A	N/A	0.4200 lb/hr for 3 hours, use of baghouse	N/A
	IN-0147 (cooling and grinding)	2/1/2010	Other Case-By-Case Basis	N/A	N/A	N/A	0.8400 lb/hr for 3 hours, use of baghouse	N/A
	IN-0147 (pouring, cooling, and shakeout)	2/1/2010	Other Case-By-Case Basis	N/A	N/A	N/A	N/A	6.0000 lb/ton of metal
	IN-0147 (pouring, cooling, and shakeout)	2/1/2010	Other Case-By-Case Basis	N/A	N/A	N/A	N/A	6.0000 lb/ton of metal
Thyssenkrupp Waupaca, Inc. gray and ductile iron foundry – casting lines with pouring, mold cooling, and shakeout	IN-0143	4/17/2009	Other Case-By-Case Basis	1.9000 lb/ton of iron, use of mold vent off-gas ignition	N/A	N/A	N/A	N/A

Harrison Steel Castings Company steel and ductile iron casting plant – airset mold line pouring and castings cooling operations, 47.2 tons/hour of sand and 15.73 tons/hour of steel or iron throughput	IN-0165	7/29/2008	BACT-PSD	1.8000 lb/ton of metal poured	N/A	N/A	N/A	N/A
Brush Wellman Engineered Materials copper rolling and drawing – electric arc furnace, 1800 lbs/year and 6500 TPY copper alloy throughput	OH-0322	4/15/2008	BACT-PSD	0.6100 lb/hr	1.6200 lb/hr	2.6900 lb/hr	0.7100 lb/hr, use of baghouse and secondary filters	86.5000 lb/hr, use of 4th hole combustion control system

(A) "Applicable" criteria included: metal foundry, metal casting, metal melting, oven, furnace, rated < 1 mmBTU/hr, natural gas-fired, application for metal melting and casting.

= Excluded from the scope of this determination according to the following criteria: burner rated > 1 mmBTU/hr, metal melting throughput >240 lb/hour or >30 TPY, melting scrap metal, or case-by-case basis other than BACT.

Attachment B

Review of BACT Determinations Published by CARB

List of applicable[A] BACT determinations published in CARB's BACT Clearinghouse for the following source categories: **"SIC: 3369 (nonferrous foundries, except aluminum and copper)," "burnoff furnace," "dryer or oven, direct or indirect," "heater – other process," "metal heating furnace"):**

Source category: "burnoff furnace"								
Description and Capacity	**SIC**	**A/C Date**	**District**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Galt Steel Foundry, Inc., stainless and carbon steel foundry, two electric furnaces, 4.12 mmBTU/hr heat treat oven, 1000 lbs/hour steel melting capacity	331	3/19/2014	SMAQMD	N/A	N/A	N/A	Operation in negative airspace to capture any fugitive emissions. Source test showed that the baghouse had enough draw to make the entire operation negative.	N/A
Source category: "metal heating furnace"								
Description and Capacity	**SIC**	**A/C Date**	**District**	**VOC**	**NOx**	**SOx**	**PM10/2.5**	**CO**
Vista Metals aluminum billet heating furnace, natural gas-fired, 8 mmBTU/hr	3341	6/20/2001	SCAQMD	N/A	40 ppmvd @ 3% O_2 *(not yet BACT – considered AIP)*	N/A	0.1 gr/dscf	2000 ppmvd @ 3% O_2
Commonwealth Aluminum Concast scrap aluminum reverberatory furnace, natural gas-fired, 31.5 mmBTU/hr	3355	3/8/2000	SCAQMD	324 lb/month	60 ppmvd @ 3% O_2, use of regenerative, low-NOx North American Mfg. Co. burner	14 lb/month	583 lb/month	770 lb/month

International Extrusion Corporation aluminum melting furnace, natural gas-fired, 8.8 mmBTU/hr, 40 ton/batch capacity	3354	1/22/2001	SCAQMD	N/A	40 ppmvd @ 3% O_2, use of low-NOx burner *(not yet BACT – considered AIP; suggest starting with 50 ppmvd @ 3% O_2)*	N/A	N/A	N/A
Superior Industries International aluminum melting furnace, natural gas-fired, 12.6 mmBTU/hr	3714	10/30/2001	SCAQMD	N/A	43 ppmvd @ 3% O_2, use of new furnace *(not yet BACT – considered AIP)*	N/A	0.1 gr/dscf	2000 ppmvd @ 3% O_2
Custom Alloy Sales aluminum-zinc alloy melting reverberatory furnace, natural gas-fired, 6 mmBTU/hr	3341	10/16/2001	SCAQMD	N/A	39 ppmvd @ 3% O_2, use of low-NOx burner *(not yet BACT – considered AIP)*	N/A	N/A	N/A
International Extrusion Corp. aluminum reverberatory furnace, 12.8 mmBTU/hr	Not Specified	2/15/2002	SCAQMD	N/A	37 ppmvd @ 3% O_2, use of low-NOx burner	N/A	N/A	N/A

(A) "Applicable" criteria included: metal foundry, metal casting, metal melting, oven, furnace, rated < 1 mmBTU/hr, natural gas-fired, application for metal melting and casting.

= Excluded from the scope of this determination according to the following criteria: burner rated > 1 mmBTU/hr, metal melting throughput >240 lb/hour or >30 TPY, case-by-case basis other than BACT.

Attachment C

Baghouse Cost Effectiveness Analysis

COST EFFECTIVENESS ANALYSIS FOR BAGHOUSE

This cost effectiveness analysis was performed using EPA's OAQPS Control Cost Manual
EPA publication No. 452/B-02-001, Chapter 1, Baghouses and Filters (12/98)

PM10 Baghouse Cost Effective Requirements		
Maximum Proposed Daily Process Rate	240	lb/hr bronze melted
PM10 Emission Factor	6.2	lb/ton of metal
Hourly Operation	1	hr/day
Quarterly Operation	60	days/quarter
Annual Operation	240	days/year
PM emissions from bronze casting	0.0893	tons/year
Baghouse Control Efficiency	99%	
Controlled PM Emissions	0.0884	tons/year
CRF (5% interest and 20 year life)	0.080242587	

Particulate Matter Control (Bag House) Cost Analysis		
Gas-to-Cloth ratio for shaker/reverse-air baghouse	2	Table 1.1 (for lead oxide dust)
A	9	Table 1.4 (for metal oxides)
B	1	Table 1.4 (for nuisance venting)
L	0.1	
D	10	
V	6.750301922	equation 1.11
acfm of system	175	acfm
Bag Size	25.92476633	ft^2
Cost of Baghouse common housing design	$ 2,492.70	
Cost of insulation	$ 1,098.81	
Cost of bag (Pulse jet, BBR - fiberglass, Table 1.8), bottom bag removal	$ 43.81	
Baghouse cages	$ 1.93	
Cage cost	$ 12.23	$/cage
Total cage costs	$ 23.62	
Equipment Costs (A)	$ 3,658.95	

Instrumentation	$ 365.89	0.10*A
California Sales taxes	$ 311.01	0.085*A
Freight	$ 182.95	0.05*A
Purchase Equipment Cost (**PEC**)	$ 4,518.80	

Direct Installation Costs		
Foundation & Supports	$ 180.75	0.04*PEC
Handling & erection	$ 2,259.40	0.50*PEC
Electrical	$ 361.50	0.08*PEC
Piping	$ 45.19	0.01*PEC
Insulation for ductwork	$ 316.32	0.07*PEC
Painting	$ 180.75	0.04*PEC
Total direct installation costs	$ 3,343.91	

Indirect Costs (installation)			
Engineering	$	451.88	0.10*PEC
Construction and field expense	$	903.76	0.20*PEC
Contractor fees	$	451.88	0.10*PEC
Starup-up	$	45.19	0.01*PEC
Performance test	$	45.19	0.01*PEC
Contingencies	$	135.56	0.03*PEC
Total indirect installation costs	$	2,033.46	

Total Capital Investment (TCI) (PEC+DC+IC)	$9,896.18

Direct Annual Costs		
Operating Labor (for SOC: 27-1013)	$3,595.80	(.5 hr/shift) (1 shift/8 hrs)(2080 hrs/yr)*$27.66
Supervisor	$539.37	15% of operating Labor
Maintenance Labor (for SOC: 49-9099)	$2,655.90	(.5 hr/shift) (1 shift/8 hrs)(2080 hrs/yr)*$20.43
Material	$2,655.90	100% of maintenance labor
Bag replacement labor	$0.19	$/ft2 of bag area
CRF for bags (5% interest and 2 year life)	0.54	
Replacement Parts, Bags	$28.68	equation 1.13
Electricity	$74.05	(0.000181)(900 acfm)(10 in H2O)(2080 hr/yr)($0.1124 kW/h)
Compressed Air	$10.92	(2scfm/1000acfm)*900cfm*($0.25/1000 scf)*(60min/hr)*(2080hr/year)
Waste Disposal	$3.09	$35/ton
Total Annual DC	$9,564.45	

Indirect Annual Costs		
Overhead	$5,668.18	60% of total labor and material
Admin charges	$197.92	2% of TCI
Property Tax	$98.96	1% of TCI
Insurance	$98.96	1% of TCI
Capital Recovery	$794.09	
Total Annual IC	$6,858.12	

Total Annual Costs (DAC + DIC)	$16,422.57

TAC/tons controlled	**$185,775.67**	**per ton reduced**