west virginia department of environmental protection

Division of Air Quality
601 57th Street SE
Charleston, WV 25304
Phone 304/926-0475 • FAX: 304/926-0479

Earl Ray Tomblin, Governor
Randy C. Huffman, Cabinet Secretary
www.wvdep.org

ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2918
Plant ID No.:	011-00029
Applicant:	Richwood Investment Castings, Inc.
Facility Name:	Huntington Facility
Location:	Huntington
NAICS Code:	331511
Application Type:	Construction
Received Date:	January 18, 2012
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$1000.00
Date Received:	April 28, 2011
Completeness Date:	March 28, 2012
Due Date:	June 26, 2012
Newspaper:	*The Herald-Dispatch*
Applicant Ad Date:	January 25, 2012
UTMs:	Easting: 373.2 km Northing: 4,250.0 km Zone: 17
Description:	The facility installed a burnout furnace with afterburner in 2009, two-thermoset fiberglass molding machines in 2011, and proposed to add a second induction and burnout furnace in 2012.

DESCRIPTION OF PROCESS

This application is for an existing facility, which does not currently have a Rule 13 Permit, and for the modification to the facility to allow more flexibility in operations. The facility is currently owned by Richwood Investment Castings, Inc. (Richwood) and is located near Huntington, in Cable County, West Virginia. The facility was constructed and operated by Xcel-Premet, Inc. in 1976. The facility continues to operate as it was initially constructed with some minor changes to equipment such as replacing the autoclave boiler with a smaller boiler. Richwood purchased the facility in 2002 and has operated it since that time. This application is the result of a visit by Mr. Andy Grimm, Environmental Resource Specialist assigned to the

Compliance and Enforcement Section. A burnout furnace and fiberglass reinforced polyester molding machine was installed in 2009 and 2011 respectively.

The primary business of the facility is a foundry, which is to casts metal parts on a contractual basis. The site starts with taking wax and making molds in mold making machines. Each mold is made individually and then each mold is attached to a tree (a tree holds multiple molds). The tree with the molds attached is then alternately dipped into a binding solution and an aggregate (sand) material to form the outside of the cast. The dipped tree with the green casts on the outside is then air dried. Once the casting has air-dried unit it is firm enough to stand removal of the internal wax mold, then the tree is placed in the autoclave and the boiler quickly heats the autoclave (directly applied steam is placed in the autoclave) to remove the majority of the wax from the inside of the cast. Afterward, the tree is placed in the burn off furnace (cast curing oven) to remove the remainder of the wax and to cure the cast to the appropriate level and pre-heat the cast so molten metal can be poured into it.

Molten metal cannot be poured directly into a cold cast. If a cast has been through the burn off furnace and has cooled prior to being filled then the cast will be reheated in the furnace prior to use. After pouring the molten metal into the cast, they are allowed to sit and cool prior to further work on the part, which has been casted. After appropriate cooling the cast is taken to the finishing room and each individual part is cut from the tree and finished as required.

SITE INSPECTION

Compliance and Enforcement Staff members have visited the facility numerous times over the years. Mr. Andy Grimm, an Environmental Resource Specialist with the Compliance and Enforcement Section last visited the facility on February 10, 2011. As result of this last visit, Mr. Grimm was not able to determine if the facility was operating in compliance and issued Status 99 (undetermined). Mr. Grimm render this decision mainly because Richwood did not determine if a permit was necessary or not for the new burnout furnace and thermoset machine as required by 45 CSR §13-5.14.

On March 16, 2012, the writer conducted an announced site inspection of the proposed site. Mr. Geoff Stoll, General Manager, accompanied the writer during this inspection. The facility is located on Pleasant Valley Road as stated in the application. The primary business of the facility is investment castings of ferrous and non-ferrous metals. The existing operation centers on one burnout furnace and one electric induction furnace with two 400-amp power supplies. This type of induction furnace needs to be re-lined once every 24 hours, which explains how the furnace can melt ferrous and non-ferrous metals without cross contamination of the individual hot metal batches (heats).

The layout of the facility was as described in the application with the exception of the thermosetting fiberglass reinforced polyester (FRP) process. Richwood plans to expand the existing operating building by constructing an additional structure adjacent to the existing

building to locate the second burnout and melting furnaces. The existing casting room is not capable of accommodating a second burnout furnace and induction furnace.

The application hints that the FRP process used at the facility is comparable to the open molding systems used to manufacture FRP products. As observed by the writer, Richwood uses a closed mold technique with a combination of heat and pressure to cure the resin into the desired product. The facility is located a complex terrain area of Cabell County with several nearby residences.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Combustion Sources

Emissions from the facility stem from several different sources including fuel combustion in the boiler and burnout furnaces; metal castings and cast making; finishing (surface cleaning); and fiberglass reinforced polyester molding process. The boiler for the autoclave and the burnout furnaces with afterburner are natural gas fired. Thus, the applicant used the emission factor (EF) from Chapter 1.4 of AP-42 to quantify the combustion emissions from these three sources. Presented in the following table are the emission rates from these sources.

Table #1 – Combustion Emissions (Boiler & Burnout Furnaces)

Source		Boiler	Burnout Furnace #1	Burnout Furnace #2
Maximum Total Heat Input	MM Btu/hr	1.68	1.44	1.44
Pollutant	EF ($lb/10^6$ SCF of NG)	pounds/hour	pounds/hour	pounds/hour
Particulate Matter ($PM/PM_{10}/PM_{2.5}$)	7.6	0.013	0.01	0.01
Sulfur Dioxide (SO_2)	0.6	0.001	0.001	0.001
Oxides of Nitrogen (NO_x)	100	0.17	0.14	0.14
Carbon Monoxide (CO)	84	0.141	0.121	0.121
Volatile Organic Compounds (VOCs)	5.5	0.01	0.01	0.01
Total HAPs	1.89	0.003	0.003	0.003

EF – emission factor

When annualized, the only pollutants of significant emission rates are oxides of nitrogen and carbon monoxide, which 2.07 and 1.75 tons per year respectively. The main purpose of the two-burnout furnaces is to burn off residual wax on the casting molds, which cause or create an undesired void (air space) in the final product. The furnace manufacturer designed the furnaces

to burn off 7.8 of wax per batch with a maximum of four batches per hour. The furnaces are equipped with natural gas fired afterburners with a destruction efficiency of 99% for volatile organic compounds. The VOC emission rate after controls (afterburner) for each furnace would be 0.32 pounds per hour based on the manufacturer's design, which includes VOCs from combustion. This VOC emission rate equates to an annual basis of 1.4 tons per year from each furnace.

Metal Melting, Pouring, Cooling and Other Related Activities

The applicant identified potential sources or activities from Chapter 12.10 of AP-42, which are the induction furnaces, pouring/cooling, and core making. Activities that are listed in Chapter 12.10., but considered not appropriate for this particular facility are scrap and charge pre-heating/handling, magnesium treatment, and shakeout. These specific activities are not performed at the facility or not necessary do to the nature of this particular process. Richwood does not have the capability to pre-heat metal charges or uses scrap metals in its melting process. The facility purchases ingots already alloyed to meet the customer's specifications. Thus, no metallurgical mixing or other additive to include magnesium is conducted at the facility.

Richwood only uses the "lost wax" process to produce its molds. Some of the activities noted in Chapter 12.10 are unique to operations that use green sand as the primary means to make its molds. Thus, Richwood does not have the shakeout process, which is needed to recover the sand for future castings. Richwood breaks their molds up to retrieve the casted part/component. The discarded ceramic molds are being separated and sent to a third party recycler to be reused. A facility using sand castings would normally shakeout/clean the casting sand to be reused in their mold making process.

The particulate matter emissions were broken down into three sources: induction furnaces (2S and 2AS), pouring/cooling (3S), and core making/baking (1S). The hourly particulate matter emissions from these three sources were 1.65 pounds per hour with an hourly metal melting rate of 534 pounds per hour. Assuming maximum annual operating schedule possible, the annual particulate matter rate would be 7.24 tons per year, which corresponds to an annual metal production rate of 2,336 tons per year. The applicant assumed that all of the particulate matter is classifiable as particulate matter less than 10 and 2.5 microns. This is a reasonable assumption given that the emission factors for this application from Chapter 12.10. were rated "E"(poor).

Grinding and Surface Cleaning

Richwood uses two types of machines to surface clean the parts/components that have been cast. One style is a barrel blast machine, which is designed and built as a fully integrated blast cleaning system. This barrel machine has an integrated dust collector to reclaim the abrasive media. The other system is a small bench size abrasive cabinet that requires an operator to control the nozzle of the abrasive blast. Like the barrel machine, the cabinet has an integrated dust collector to re-claim the abrasive media. Richwood estimated that the maximum hourly consumption of media would be 500 pounds per hour. Using the emission factor from Chapter 13.2.6 for abrasive blasting of unspecified metal parts, control with a fabric filter, the particulate

matter emissions were estimated to be 0.36 pounds per hour. On a maximum operating schedule, the annual particulate matter emissions would be 1.5 tons per year.

Grinding emissions in the application were estimated at 2.81 tons per year. This estimate was not based on the amount of grinding or number of grinders in continuous operation. Instead, this rate is the allowable PM from Rule 7 for processing 534 pounds of metal castings per hour.

The proposed PM and PM_{10} emission rates from grinding is not representative of the actual emission generated from such activities. Further, the grinding of metal using hand-held equipment is listed as a "de minims source" in 45CSR13 (See Table 45-13B). Therefore, no estimated PM emission from grinding is deemed necessary for this permitting action.

Compression Formed FRP Products

The facility has two compression machines (composite molding presses). The applicant provided emission estimates based on the Unified Emission Factors (UEF) developed by the American Composites Manufacturing Association. These UEF are for open molding processes or fabrication shops using either hand or spray layup techniques to create fiberglass reinforced polyester products.

The emission estimates for this process as provide in the application is not valid. In March 2007, EPA re-published Chapter 4.4 for the polyester resin plastic products source sector in AP-42. For Closed Molding, the emission factor from Table 4.4-2. is 1-3 percent of starting monomer by weight emitted. For 20 lb of bulk molding compound (BMC) processed per hour, the predicted styrene emission rate is 0.06 pounds per hour. The selected BMC has another monomer besides styrene, which is vinyl toluene. The release of vinyl toluene is predicted to be 0.03 pounds per hour. With these estimates, the project release of VOCs from this process is 0.09 pounds per hour. On an annual basis, VOCs from the FRP production lines would be 0.4 tons per year.

In summary, the metal casting facility at maximum capacity and with controls has the potential to emit a little less than nine tons per year of particulate matter. VOC emissions for the facility will be 3.25 tons per year with oxides of nitrogen and carbon monoxide around 2 tons per year for each. The annual emissions for the facility were based on the maximum operating schedule possible, which is operating 8,760 hours per year.

REGULATORY APPLICABILITY

The following state regulations apply:

45CSR2 To Prevent and Control Particulate Air Pollution From Combustion of Fuel In Indirect Heat Exchangers

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45CSR10 To Prevent and Control Air Pollution From Emissions of Sulfur Oxides

These two rules establish emission limitations for smoke and particulate matter (Rule 2), and sulfur dioxide (Rule 10), which are discharged from fuel burning units. The existing unit at the facility is one 1.7 MMBtu/hr boiler fired only with natural gas. The agency recognizes that natural gas is a clean burning fuel and assumes "Type b" fuel burning units to be capable of complying with PM and visible emission limitations of Rule 2 and the sulfur dioxide limit of Rule 10. In addition, 45CSR§2-11.1 and 45CSR§10-10.1 exempts the boiler from most of the applicable requirements of these two rules except for the visible emission standard of 45CSR§2-3.1. The agency recognizes burning of natural gas in boilers should not generate visible emissions and deemed it unnecessary to develop a monitoring plan to verify compliance with the visible emission standard.

The facility's burnout furnaces are classified as part of a manufacturing process under Rule 10. However, the facility's overall potential to emit of sulfur dioxide is 60 pounds per year (0.03 tpy). According to 45CSR§10-4.1.e., the manufacturing process at this facility is exempt from the sulfur dioxide standard for manufacturing process source operations, which apply to manufacturing processes with a potential to emit of less than 500 pounds of SO_2 per year.

45CSR6 - To Prevent and Control Air Pollution From Combustion of Refuse

The purpose of this rule is to prevent and control air pollution from combustion of refuse. The permittee has one burnout furnace and proposes to install and operate a second furnace. This rule defines incineration as the destruction of combustible refuse by burning in a furnace designed for that purpose. These burnout furnaces are designed to burnout the waxy residual from the ceramic molds through incineration. Thus, it meets this definition.

Per section 4.1, these burnout furnaces must meet the particulate matter limit by weight. The will have an allowable particulate matter emission rate of 0.09 pounds per hour (based on maximum design-incineration rate of 31 lb of wax per hour). This allowable rate is higher than the estimate hourly potential of 0.01 lb/hr. Thus, the unit should be more than capable of meeting this PM standard.

The burnout furnaces are subject to the 20% opacity (visible emission) limitation in section 4.3 of this rule. The opacity and the allowable limits should be met since each furnace is equipped with an afterburner, which is designed to reduce the particulate matter/volatile organic compounds entrained in the exhaust stream into products of complete combustion. The retention time of the afterburner was calculated to be 0.81 to 0.94 seconds with a furnace temperature of 2000^0F and the secondary chamber temperature of 1800^0F. Thus, this particular crematory should be capable of meeting the applicable limitations of this rule.

45CSR7 To Prevent And Control Particulate Matter Air Pollution From Manufacturing Process And Associated Operations.

The Richwood facility has been classified as a manufacturing process since the inception of Rule 7. Each source operation is subject to the process weight standard of

45CSR§7-4. and visible emission limitation of 45CSR§7-3. The particulate matter from the burnout furnaces are covered under 45CSR6. The main process source of particulate matter is from the melting, pouring and cooling activities of the melt shop. Under 45CSR§7-4.1., the melt shop would have an allowable of 1.92 pounds per hour for processing 534 pounds of melt per hour as a Type" c" source. The estimated PM potential from metal is 1.64 pounds per hour. Thus, no additional controls would be require to achieve compliance with this rule.

45CSR13 - Permits for Construction, Modification, Relocation and Operation of Stationary sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The potential-to-emit from the existing operation and proposed additional burnout furnace and induction metal are below 6 pounds per hour and 10 tons per year for all of the criteria pollutants, which is less than the permit trigger level as defined in 45CSR§13-2.24.b. By the emission based trigger level, the facility would not be obligated to obtain a permit. However, Rule 6 requires all incinerators be required to obtain a construction or modification permit regardless of size. Richwood Investment Castings, Inc. has proposed to install a burnout furnace, which is subject to Rule 6. Therefore, the facility is required to obtain a permit as required in 45CSR§6-6.1. and 45CSR§13-2.24.a. The facility has met the applicable requirements of this rule by publishing a Class I Legal Advertisement in *The Herald-Dispatch* on January 25, 2012, paid the $1,000.00 application fee, and submitted a complete permit application.

Even with the proposed additional equipment to be installed, Richwood's facility will not be classified as a major source of hazardous air pollutants or Title V. In addition, none of the emission units is subject to any of the New Source Performance Standards of 40 CFR Part 60 (NSPS). The facility may be subject to one of the Area Source regulations under Part 63. However, each one of these regulations has a provision to exempt the affected source or facility from obtaining an operating permit under either 40 CFR Part 70 or 40 CFR Part 71 (Title V Permit). Thus, the facility is not subject to Title V and will not be required to obtain an operating permit under 45CSR30. Therefore, Richwood's Metal Casting Facility will remain classified as a "9H – Gray Iron Facility" source as defined in 45CSR22.

45CSR21 Regulation To Prevent And Control Air Pollution From The Emission Of Volatile Organic Compounds

The purpose of this rule is to control emissions of volatile organic compounds through applying reasonably available control technology for specific VOC sources located in Putnam, Kanawha, Cabell, Wayne, and Wood counties of West Virginia. This facility is located in Cabell County and has the potential to emit VOCs. Each burnout furnace has the maximum potential to burn-off 136 tons of wax per year without the afterburner. With the afterburner, this potential is reduced down to 1.4 tons per furnace. Assuming that waxes used at the facility are 100% VOCs, the maximum potential to emit of VOCs from the burnout furnaces would be less than 3 tons per year. None of the specific source operations sections of this rule applied to the "lost wax" or to the thermal setting of FRP processes.

40 CFR 63, Subpart ZZZZZ, National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries Area Sources.

The DAQ has not taken delegation of this regulation under 45CSR34. However, the facility is classified as a small foundry since its maximum annual melt capacity is less than 2,400 tons of steel or iron per year with the additional second induction furnace. Under this regulation, small foundries are subject to management practices for metallic scrap, mercury switches, and binder formulations provisions. Because of the operation of the facility, these management practices requirements are moot for this facility. One, Richwood only melts ingots of specific metals or alloys and does not melt scrap metal for casting. Because only ingots are melted, the potential for mercury switches from automobile scrap is not possible. Finally, Richwood only uses the "lost wax" or "investment" process to create its casting molds, which differ from the furfuryl alcohol warm box mold method. In addition, the writer reviewed the MSDS for the casting binders used at the facility and did not find any MSDS that indicted that methanol is an ingredient in any of them. The facility will need to perform the applicable recordkeeping and reporting requirements of 40 CFR §63.10899.

40 CFR 63 National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers (Subpart JJJJJJ)

This regulation establishes emission limitations for area sources (minor sources of HAPs) that operate boilers. Natural gas fired boilers are not an affected source under this regulation. Thus, the natural gas boiler at the facility is not subject to this regulation.

40 CFR 63, Subpart ZZZZZZ, National Emission Standards for Hazardous Air Pollutants: Area Source for Aluminum, Copper, and Other Nonferrous Foundries

The facility does melt aluminum, copper, and other nonferrous metals in its induction furnace. This regulation defines an existing affected source as one that has annual metal melt production rate or capacity greater than 600 tons of nonferrous metals per year. For 2009, Richwood melted 40.6 tons of non-ferrous metals. Since Richwood acquired the facility, 2011 was the company's most productive year of casting non-ferrous metals, which was 80 tons. Assuming that the second melt can double the facility melt capacity, the facility's non-ferrous melt capacity would be 80 tons per year. Still, this would not trigger the "Standards and Compliance Requirements" of this regulation for the facility.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

Only trace amounts of non-criteria regulated pollutants will be emitted from this facility. These are acetaldehyde, arsenic, antimony, beryllium, cadmium, chromium, copper, formaldehyde, hydrogen chloride, lead, and mercury. Only the metals, (i.e. cadmium, chromium, mercury, etc.) would be not controlled by the afterburner (secondary chamber).

AIR QUALITY IMPACTS ANALYSIS

Air dispersion modeling study or analysis was not required, because the proposed modification does not meet the definition as a major modification of defined in 45CSR14.

MONITORING OF OPERATIONS

For the purposes of ensuring compliance with the proposed emissions limits and applicable rules, the facility should be required to monitor and keep records of the following:

Maintain the temperature of the afterburner at 1800^0F on a continuous basis for each batch of molds being burnout. This does not apply to using the furnace to pre-heat molds that have already been burnout.

Amount and type of metal casted for each month.

Quarterly check to determine if visible emissions are being emitted from the casting area.

Monitoring the afterburner chamber temperature is an indicator that the temperature in the chamber is sufficient to ensure complete combustion of products of incomplete combustion such as particulate matter, carbon monoxide, and volatile organic compounds. As noted earlier this evaluation the residence time for the afterburner was calculated to be 0.81 to 0.94 seconds for the existing furnace and the proposed one respectively. According to EPA guidance published in "Control Technologies for Hazardous Air Pollutants Handbook, it is anticipated that thermal incinerator systems can achieve a 99% destruction efficiency for non-halogenated streams with a combustion temperature of 1800^0F with a residence time of 0.75 seconds. Thus, these furnaces should be capable of achieving this destruction efficiency and then as a result of the formation of visible particulate matter should be nearly eliminated. To verify this, the writer proposes to require the source to conduct a simplified Method 22 once a year for one batch.

Richwood has proposed an annual metal casting limit of 2,336 tons for the facility per year. This annual operation schedule coincides with the annual emission limits respectively. Stipulating such, a limit will need to be monitored by recording the amount and type of metal casted each month. This monitoring coupled with a quarterly visible emission check to verify compliance with the requirements of Rule 7 for the metal melting operation should be enough to determine compliance with applicable requirements of Rule 7. The permit will set a facility limit on non-ferrous metal of 176 tons per year, which based on 2011non-ferrous metal production rate multiplied by 2.1 to account for the additional furnace plus 10%. These limitation and recordkeeping requirements have been established as permit conditions.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application and the conditions set forth in the draft permit indicates the facility should meet all applicable state rules and federal regulations when operated. Therefore, this writer recommends that Richwood Investment Castings, Inc. should be granted a Rule 13 modification Permit for their Metal Casting Facility near Huntington.

Edward S. Andrews, P.E.
Engineer

Date: May 16, 2012