pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

April 21, 2023

BEFESA ZINC US INC.
Eric Stroom, DIR OF OPERATIONS - EAST
900 DELAWARE AVE
PALMERTON, PA 18071-2008

Re: RACT III Notification
Befesa Zinc US Inc
Palmerton Borough, Carbon County

Dear Eric Stroom:

The PA Department of Environmental Protection (Pa DEP) has reviewed the above referenced RACT III notification and has determined there is missing information that is required for facilities claiming that their existing RACT II permit conditions formulated under PA Code 25, Chapter 129.99, assures compliance with the RACT III conditions in Chapter 129.111 thru 129.115. Based upon our initial review of the notification, additional detailed information required under 129.114(i) is required before the Department may conclude that you have satisfactorily met these requirements.

Attached is the guidance document prepared by the Department titled, "Additional RACT Requirements for Major Sources of NOx and VOCs" for demonstrating that compliance with RACT II conditions provides assurance of compliance with RACT III conditions. Carefully review this document to determine which set of regulations pertain to your facility based upon the cost thresholds set forth. Prepare an update to your existing notification with this additional information required and submit it to the Department within 30 days of receiving this letter attached to the associated email sent to you.

If you believe that this missing information is not significant, instead of submitting a response, you have the option of asking DEP to render a decision based on the existing notification that you have already made available. If you choose this option, you should explain and justify how your current submission satisfies the RACT III regulations. Please keep in mind that if you fail to respond, your notification will be considered deficient and you will be subject to enforcement actions.

Should you have any questions regarding the above, please contact me at (570) 826-2524, or by email at nelko@pa.gov, to discuss your concerns or to schedule a meeting. The meeting must be scheduled within the 30-day period allotted for your reply, unless otherwise extended by DEP.

Sincerely,

Neal J Elko

Neal J Elko
Application Manager, New Source Review

Attachment: Additional RACT Requirements for Major Sources of NOx and VOCs

Joe Falko
Environmental Affairs Manager
Befesa Zinc US Inc.
900 Delaware Avenue
Palmerton, PA 18071
P: 610-826-8714
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BEFESA

May 19, 2023

Mr. Neal J. Elko
Application Manager
Air Quality New Source Review
PA DEP Northeast Regional Office
2 Public Square
Wilkes-Barre, PA 18701-1915

RE: Befesa Zinc US Inc.
Additional RACT III Information Request
Current TV Permit No.: 13-0001

Dear Mr. Elko,

We have reviewed your April 21, 2023, letter requesting additional information in regard to our RACT III assertions, and the following information is being provided to supplement our previous submittal:

1. **Current Operations**
   Since the submittal of the RACT II analysis Kiln #6 has been decommissioned and Kiln #1 has discontinued operation in the calcining mode. The three operating Kilns #1, #2 and #5 only operate in the Waelzing Mode. In the Waelzing process, zinc bearing materials are reduced in a rotary kiln using carbon (coke or coal) and supplemented with natural gas to form an elemental zinc vapor that is then later oxidized to form Crude Zinc Oxide (CZO). The CZO is then collected in a fabric filter that is classified as a product collector. A by-product from this recycling process is known as Iron Rich Material (IRM) that is also used in a number of applications. Because no other operating sources trigger the RACT III emission requirements only Kilns #1, #2 and #5 operating in the Waelzing Mode need to be analyzed for RACT III applicability. Currently the allowable case-by-case RACT II NO_x emissions rates from the Kilns are:

   a. Kiln #1 – 8.20 lbs/hr.
   b. Kiln #2 – 9.9 lbs/hr.
   c. Kiln #5 – 12.3 lbs/hr.

2. **RACT III Analysis**

In our RACT III submittal we re-evaluated the RACT II determinations and have concluded that there are no new technologies that can further reduce the NO_x emissions from the three operating kilns. To this extent the following technologies were evaluated:

a. **Combustion Controls**

In the Waelz Kiln, the burner is used to pre-heat the kiln during startup until a temperature of 650 - 700°C (1202°F - 1292°F) is achieved in the kiln. The burner is also used periodically in the Waelz Kilns during their operation in order to maintain a kiln discharge temperature at around 1050 -1100°C (1922°F - 2012°F). Heat input from the Waelz Kiln burners is not required to continuously maintain kiln temperatures since kiln temperature is inherently maintained from the heat balance resulting from the reaction of coke and zinc bearing feed materials within the kiln. There are two principal mechanisms for NOx formation in the kilns, including "fuel" NOx and "thermal" NOx. Fuel NOx, which results from the presence of nitrogen in fuel sources, can result from oxidation of gas used to fire the kilns, and oxidation of coke/coal fed to the kiln. Natural gas consumed at the burner contains little nitrogen, if any, therefore fuel NOx formation from natural gas consumption at the burner is negligible. Coke/coal contains nitrogen that when oxidized is a source for fuel NOx formation. Thermal NOx formation results from oxidation of atmospheric nitrogen contained in the gas-air mixture at temperatures above 1982°C (3599°F) at the burner flame. The factors influencing thermal NOx formation include temperature, air to fuel ratio, and residence time within the combustion zone. The cumulative time of burner use in each Waelz kiln for start-up and routine temperature maintenance (trimming) is less than 2000 hours per year, with most of the burner hours from trimming use. Trimming occurs for brief periods of time and uses about 30% of the maximum thermal capacity while start-ups typically occur over a period of 16 to 24 hours and use 50 - 100% burner thermal capacity.

The kiln burners at Palmerton are operated in a fuel rich mode which produces a shorter and more luminous flame resulting in a reduced rate of potential NOx generation during fuel combustion.

Burners at the facility are maintained and operated in accordance with manufacturer's recommendations. In addition, good operating practices for Waelzing Kiln operations are practiced by Befesa at this location.

b. **Selective Non-Catalytic Reduction (SNCR)**

Selective non-catalytic reduction (SNCR) involves the direct injection of ammonia (NH_3) or urea ($CO(NH_2)_2$) in the flue gas stream where temperatures are approximately 1500° F to 1900° F. The ammonia or urea reacts with the NO_x in the flue gas to produce N_2 and water vapor. The NO_x reduction reactions in an SNCR system are driven by the thermal decomposition of ammonia or urea and the subsequent reduction of NO_x. SNCR systems do not employ a catalyst to promote these reactions. Typical reactions in the SNCR application are as follows:

Ammonia: $4NH_3 + 4NO + O_2 > 4N_2 + 6H_2O$
Urea: $CO(NH_2)_2 + 2NO + ½\ O_2 > 2N_2 + CO_2 + H_2O$

Flue gas temperatures at the point of reagent injection can greatly affect NOx removal efficiencies and the quantity of NH_3 that will pass through the SNCR un-reacted. This is known as ammonia slip. At temperatures below the desired operating range, the NO_x reduction reactions diminish and un-reacted NH_3 emissions increase. Above the desired temperature range, NH_3 is oxidized to NO_x resulting in the low NO_x reduction efficiencies.
Mixing of the reactant and flue gas within the reaction zone is also an important factor in SNCR performance. The SNCR system must be designed to deliver the reagent in the proper temperature window and allow sufficient residence time of the reagent and the flue gas in the temperature window. In addition to temperature, mixing, residence time, and other factors influence the performance of a SNCR system. Although you may be able to find the right temperatures prior to the product collector any ammonia slip would have a detrimental impact on the CZO collected in the product collectors. For this reason, the use of SNCR is not technically feasible. After an evaluation this is still the case and we have determined that SNCR remains not technically feasible for RACT III.

c. **Selective Catalytic Reduction**

Selective Catalytic Reduction (SCR) involves injecting ammonia into the flue gas in the presence of a catalyst to reduce NO_x to N_2 and water. The overall SCR reactions are shown as follows:

$4NH_3 + 4NO + O_2 > 4N_2 + 6H_2O$
$8NH_3 + 6NO_2 > 7N_2 + 12H_2O$
Urea: $CO(NH_2)_2 + 2NO + ½\ O_2 > 2N_2 + CO_2 + H_2O$

The performance of an SCR system is influenced by several factors, including flue gas temperature, SCR inlet NO_x concentration, catalyst surface area, volume and age of catalyst, and the acceptable amount of slip. The function of the catalyst is to lower the activation energy of the NO_x decomposition reaction and thus allow for the reduction at a lower

temperature than required for SNCR. The optimal temperature range depends upon the type of catalyst used but is typically between 550°F and 950°F. Below this range sulfate can form from the sulfur in the flue gas, resulting in catalyst deactivation. If used above the optimum temperature, the catalyst will deteriorate quickly and not achieve desired controls. The only possible location for SCR control would be following the product collectors since ammonia slip prior to the collector would contaminate the product. The exhaust temperatures following the product collectors are significantly lower (approximately 300°F) than what would be required for effective NOx control. Likewise, a stack re-heat system is not feasible and would emit more emissions than it would control. To this extent we have determined and reaffirm that the use of SCR is not technically feasible.

d. **Other Control Technologies**
After a review of current available technologies, we have determined that no additional controls have been developed since the RACT II evaluation. Additionally, a review of the RACT/BACT/LAER Clearing House (RBLC) does not identify any post combustion controls being used on rotary kilns. An internet review on potential NO_x controls for rotary kilns suggest that combustion practices as applied by Befesa in Palmerton are the best methods to minimize NO_x emissions.

3. **Determinations** – Based on the above evaluation we have looked at 25 PA Code 129.114(i) and made the following determinations.

   a. The only available control technology is the use of low NO_x burners which are already being employed on the three operating Waelzing Kilns. All other available control technologies, specifically SNCR and SCR have been determined not to be technically feasible. A review of literature has not identified any additional technologies that can be applied at this location.
   b. Regarding control costs, because add on controls are not technically feasible and have been determined not to be technically feasible an economic analysis is not required.

Table – Technically Feasibility of Potential NO_x Control Technologies

Control Technology	In Service on Existing Waelzing Kilns	In Service on Rotary Kilns	Technically Feasible for Befesa Palmerton
Low NO_x burners operated in accordance with manufacturers recommendation and good operating practices	Yes	Yes	Yes
SNCR	No	No	No
SCR	No	No	No

Table – Summary of Technically Feasible NO_x Control Technologies

Control Technology	Technically Feasible
Low NO_x Burners	Yes
Manufacturers Recommendations	Yes
Use of Good Operating Practices	Yes

Based on a review of all applicable requirements we have determined that the RACT II limitations should carry over and be considered to satisfy the RACT III requirements.

Table – Proposed RACT III Emission Limitations

Source	Source ID	NO_x emission limitation in Lbs/hr.
Waelzing Kiln #1	149	8.2
Waelzing Kiln #2	150	9.9
Waelzing Kiln #3	152	12.3

We believe that this satisfies the questions raised in your April 23rd letter. If you have any questions regarding this submittal, feel free to contact me.

Sincerely,

Joe Falko