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Heidelberg Materials

Received by
State of Indiana
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Via Email 7/1/2024 KB-3

Heidelberg Materials North America
Mitchell Cement Plant
200 Mill Creek Road
Mitchell, IN 47446
Phone (812) 849-2191

July 1, 2024

Via email: airpermitapps@idem.IN.gov
Indiana Department of Environmental Management
Permit Administration and Support Section, Office of Air Quality
100 North Senate Avenue
MC 61-53, IGCN 1003
Indianapolis, Indiana 46204-2251

Subject: Application for Prevention of Significant Deterioration and Significant Permit Modification
Heidelberg Materials US Cement LLC – Mitchell, Indiana (Source ID 093-00002)

To Whom It May Concern:

Please find enclosed an application for a Prevention of Significant Deterioration and Significant Permit Modification to the Part 70 Operating Permit (Title V) for the Heidelberg Materials US Cement LLC stationary portland cement manufacturing plant located at 180 North Meridian Road in Mitchell, Indiana (Mitchell Facility).

Per the requirements of 326 IAC 2-1.1-6(c) (Public Notice), a copy of this application was also sent to the Mitchell Community Public Library.

If there are any questions concerning this application, please do not hesitate to contact me at (812) 620-8714 or Emily Stewart of Trinity Consultants at (317) 451-8102.

Sincerely,

Michael Harding, CHMM
Environmental Manager

Enclosures

Cc: Tracy Crowther - Plant Manager

Heidelberg Materials

Heidelberg Materials North America
Mitchell Cement Plant
200 Mill Creek Road
Mitchell, IN 47446
Phone (812) 849-2191

July 1, 2024

Mitchell Community Public Library
804 West Main Street
Mitchell, Indiana 47446

Subject: Application for Prevention of Significant Deterioration and Significant Permit Modification
Heidelberg Materials US Cement LLC – Mitchell, Indiana (Source ID 093-00002)

Dear Librarian:

Enclosed is an application for a Prevention of Significant Deterioration and Significant Permit Modification for the Title V Operating Permit for the Heidelberg Materials US Cement LLC (Heidelberg) portland cement plant located at 180 N Meridian Road in Mitchell, Indiana.

Pursuant to 326 IAC 2-1.1-6(c), within ten (10) days of submission of a modification application, the applicant must submit a copy of the permit application for public review to a library in the county where the facility is located. The Indiana Department of Environmental Management (IDEM) will send a copy of the draft permit to the Mitchell Community Public Library and will notify all affected parties when the draft permit is available for review and comment.

If you have any questions regarding the information contained in this application, please feel free to contact me at (812) 620-8714 or Ms. Emily Stewart of Trinity Consultants at (317) 451-8102.

Sincerely,

Michael Harding, CHMM
Environmental Manager

Enclosures

Cc: Tracy Crowther - Plant Manager

PREVENTION OF SIGNFICANT DETERIORATION AND SIGNIFICANT PERMIT MODIFICATION APPLICATION

Heidelberg Materials US Cement LLC
Mitchell, Indiana

Prepared By:

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(317) 451-8100

June 2024

Project 231501.0071

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1. INTRODUCTION

The following constitutes an application for a prevention of significant deterioration (PSD) and significant permit modification for an existing major source with respect to the Title V and PSD air permitting programs. Heidelberg Materials US Cement LLC (Heidelberg) owns and operates a portland cement plant in Mitchell, Indiana (Mitchell Plant) which currently operates under Part 70 (Title V) Renewal No. T093-45783-00002 issued March 3, 2023, by the Indiana Department of Environmental Management (IDEM).

On June 27, 2019, a final PSD/Significant Source Modification (SSM) permit (No. 093-40198-00002) was issued for a project involving construction of a cement manufacturing kiln and associated emission units. A SSM permit (No. 093-44966-00002) was issued on August 5, 2022 to revise emission units associated with this project. [1] This project is known as the "Mitchell Modernization Project". Heidelberg has since finished construction on the project and began operation of the cement manufacturing kiln and associated emission units. Heidelberg conducted an "as-built" review of the project and has determined that some emission units differ from those permitted in the 2019 and 2022 PSD/SSM. Certain emission units permitted were not built, others were added, and some previously permitted emission units require descriptive changes in the permit to reflect the as-built design. As a result of this "as-built" review, Heidelberg submitted a SSM and SPM application on April 30, 2024 to revise the permit to reflect the as-built design.

To supplement the previously submitted "as-built" application, Heidelberg is submitting this application to propose revised Best Available Control Technology (BACT) limits for the pyroprocessing kiln system and two finish mill air heaters permitted as part of the Mitchell Modernization Project. Additionally, the emergency generators that were installed as part of the Mitchell Modernization project differ than the emergency general permitted; therefore, Heidelberg is requesting the correct generators be incorporated into the Title V permit as part of this application.

In the 2019 PSD/SSM, PSD review was triggered for nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOC), and greenhouse gases (GHGs). The proposed refinements to the emergency generators that are reflected in the current application impact the emissions of these pollutants. Due to this, and because Heidelberg is requesting revisions to the previously determined BACT limits, the current application requires reopening of PSD elements from the 2019 permit. As shown in this application, the revised project design will continue to result in emissions increases of NOx, CO, VOC, and GHGs that are greater than the PSD significant emission rates (SERs).

Emission units associated with the proposed project will be subject to applicable requirements of New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAP), and Indiana Administrative Code (IAC) Title 326 regulations.

Heidelberg is submitting this source and permit modification application to IDEM in accordance with all federal and state specific requirements. The application contains a project summary, emission calculations, regulatory analysis, BACT analysis, ambient air quality dispersion modeling, and the required forms.

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[1] Corresponding Significant Permit Modifications (No. 093-40210-00002 and 093-45027-00002) were issued on July 17, 2019 and August 23, 2022 to incorporate the Mitchell Modernization Project into the operating permit.

2. SOURCE AND PROJECT DESCRIPTION

2.1 Source Description

The Mitchell Plant currently operates under Title V Renewal No. T093-45783-00002 issued March 8, 2023. The facility, a portland cement plant, is classified as one of the 28 designated industrial source categories and consists of one pyroprocessing kiln system capable of firing coal, natural gas, coke, fuel oils, and other non-hazardous fuels. The plant also contains various raw material crushing, grinding, and handling equipment as well as product grinding, handling, storage, and loadout equipment. The Mitchell Plant is located in Mitchell, Lawrence County, Indiana which has been designated by the U.S. Environmental Protection Agency (EPA) as attainment or unclassifiable for all criteria pollutants.[2]

2.2 Facility Location

The Mitchell Plant is located at 180 North Meridian Road in Mitchell, Indiana, in Lawrence County. Figure 2-1 shows the plant property relative to the surrounding area.

Figure 2-1. Aerial Map of the Mitchell Plant

[2] 40 CFR 81.315

2.3 Project Description

2.3.1 Generator Update

To reflect the as-built construction and operation, Heidelberg is proposing updates to the emergency generator included in the previous PSD/SSM permit (No. 093-40198-00002) issued on June 27, 2019.

Section A.2(aa) of the permit lists one 750 kW natural gas-fired emergency generator. This proposed generator was not installed due to COVID-related procurement delays. Instead, two smaller emergency generators were installed at the Mitchell Plant. Heidelberg requests IDEM remove the emergency generator currently listed in Section A.2(aa) and replace it with the following:

> ***One (1) natural gas-fired spark ignition engine for emergency generator, identified as EGN1, constructed in 2023, with a maximum rated capacity of 80 kW. This emission unit is subject to the requirements of NSPS JJJJ and NESHAP ZZZZ.***
>
> ***One (1) diesel-fired compression ignition engine for emergency generator, identified as EGN2, constructed in 2023, with a maximum rated capacity of 400 kW. This emission unit is subject to the requirements of NSPS IIII and NESHAP ZZZZ.***

Emission calculations for the revised generators are included in Appendix B. A NOx, CO, VOC, and GHG BACT analysis for the revised generators is included in Section 5 of the application.

2.3.2 BACT Update

Following the construction and startup of the Mitchell Modernization project, Heidelberg has found that the previously selected CO and VOC BACT limits for the pyroprocessing kiln, identified as Kiln #4, and the finish mill air heaters, identified as E51HG01 and E52HG01, are unattainable. The BACT limits previously selected for the kiln focus on the combustion efficiency of the unit; however, since start-up of the kiln, Heidelberg has determined through process evaluation that CO and VOC emissions are primarily dependent on the concentration of organics in the raw materials used at the Mitchell Plant, particularly limestone. Combustion efficiency alone is not an appropriate measure of CO and VOC emissions from the kiln at the Mitchell Plant.

When selecting the BACT limits for the finish mill air heaters, E51HG01 and E52HG01, no BACT limits for finish mill air heaters were included in EPA's Reasonably Available Control Technology (RACT)/Best Available Control Technology (BACT)/Lowest Achievable Emission Reduction (LAER) Clearinghouse (RBLC) database. Therefore, the BACT limits for the minish mill air heaters were selected based on available BACT limits for natural gas-fired furnaces in other industries such as metals, fuels, and starch drying. Since start-up of the finish mill air heaters, Heidelberg has determined that the heaters do not operate in the same manner as a furnace in other industries and the emissions performance of the finish mill air heaters is not similar to that of the furnaces considered in the original BACT analysis. Equating emissions from finish mill air heaters employed in a cement plant to a furnace is not an appropriate assumption, as emissions from a furnace reflect only a result of combustion from heating air while the exhaust of a finish mill air heater at a cement plant includes both combustion pollutants from heating air in addition to the recirculated air that had previously contacted the raw materials being processed..

Therefore, to accurately reflect emissions from the raw materials and finish mill air heaters used at the Mitchell Plant, Heidelberg is proposing to revise the previously selected CO and VOC BACT limits for the kiln and finish mill air heaters. A revised CO and VOC BACT analysis for these units is included in Section 5 of this application. Heidelberg requests no changes to the previously selected BACT limits for all other pollutants and emission units permitted in the previous PSD/SSM permit (No. 093-40198-00002) issued on June 27, 2019.

3. REGULATORY REQUIREMENTS

3.1 Federal Regulations

3.1.1 Prevention of Significant Deterioration

Indiana has incorporated the requirements of the PSD permitting program into its State Implementation Plan (SIP) in 326 IAC 2-2. With respect to the PSD permitting program, Indiana SIP PSD requirements may apply to the proposed project for emissions of PM, PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, VOC, and CO_2e. The Mitchell Plant is located in Lawrence County which has been designated by the U.S. EPA as attainment or unclassifiable for all criteria pollutants. Therefore, NSR permitting in accordance with PSD regulations is applicable.

3.1.1.1 Major Stationary Source

A new stationary source or an existing stationary source is considered a major source with respect to PSD regulations if the potential to emit for any regulated NSR pollutant exceeds the applicability thresholds provided in the definition in 40 CFR §52.21(b)(1)(i) (as incorporated in 326 IAC 2-2-1(ww)(1)). Therefore, a major stationary source, is one that:

Belongs to one of the industrial categories listed in 40 CFR §52.21(b)(1)(i) and has the potential to emit more than 100 tons per year of any regulated NSR pollutant as defined in §52.21(b)(50), or
Does not belong to a listed category but has the potential to emit more than 250 tons per year of any regulated NSR pollutant.

Heidelberg is a portland cement plant which is a listed category and has the potential to emit greater than 100 tons per year of several pollutants (i.e., PM, PM_{10}, $PM_{2.5}$, NO_X, CO, SO_2, and VOC) that are subject to regulation under the Federal Clean Air Act (FCAA). Therefore, Heidelberg is a PSD major source and must evaluate whether PSD permitting requirements are applicable to the proposed project.

3.1.2 Major Modification

The proposed project is a physical and operational change that has the potential to increase emissions and, therefore, a modification. The facility must determine whether the project will be considered a major modification as defined in 326 IAC 2-2-1(dd). A major modification is a physical or operational change that meets both of the following criteria.

Results in a **significant emissions increase** of a pollutant, and
Results in a **significant net emissions** increase of that pollutant.

The 2019 SSM permit showed calculations of the net emissions increases of PM, PM_{10}, $PM_{2.5}$, and SO_2 to demonstrate that PSD applicability was not triggered for the Mitchell Modernization Project. Prior to submittal of the application for the initial Mitchell Modernization Project in July 2018, EPA issued a guidance memo that outlined a PSD applicability policy referred to as "Project Emissions Accounting". Since that time, EPA issued a "Project Emissions Accounting" rulemaking to clarify that sources can demonstrate that a significant emissions increase does not occur when accounting for both emissions increases and decreases associated with the project.[3] All of emissions decreases relied upon in the 2019 netting analysis are part of

[3] 85 FR 74890, November 24, 2020.

the Mitchell Modernization Project and no contemporaneous projects were identified in the 2019 netting analysis. Therefore, the emissions increase in a netting analysis and project emissions accounting analysis would be the same.

3.1.2.1 Significant Emissions Increase

To determine whether a significant emissions increase will occur due to the proposed project, the post-project emission rates must be calculated. The post-project emissions are comprised of the projected actual emission rate increases for existing sources remaining after the project and the PTE for new sources added by the project.

For this project there are two types of affected sources that contribute to the post-project emissions.

1. Existing emission sources that may experience an associated emissions increase due to the project, and
2. New sources added by the project.

For existing sources with associated increases, the projected actual emissions are the maximum annual emission rates expected following project completion and startup of regular operations less the current baseline emission levels. The baseline actual emissions (2-year average) for existing sources are determined for comparison to the post-project emission rates. For new sources added by the project, the projected actual emissions equal the PTE.

A significant emissions increase occurs if the difference between the post-project emission rates and the baseline actual emission rates exceeds the pollutant-specific significant emission rates (SER) in 326 IAC 2-2-1(ww)(1). The following table identifies the regulated NSR pollutants for emission units that will be impacted by this application and the associated SERs.

Table 3-1. PSD Significant Emission Rates

Pollutant	Significant Emission Rate (SER) (tpy)
PM	25
PM_{10}	15
$PM_{2.5}$	10
SO_2	40
NOx	40
CO	100
Greenhouse Gas Emissions (CO_2e)	75,000

3.1.2.2 Significant Net Emissions Increase

A significant net emissions increase occurs when the sum of the increase in emissions from the project and any other contemporaneous changes in actual emissions exceeds the SER. An increase or decrease in actual emissions is contemporaneous with the increase from the project only if it occurs between the date 5 years before starting construction on the current project and the date that the increase from the current project (startup) occurs.

For this project a number of existing emission sources were decommissioned resulting in decreases that are contemporaneous with the project. These contemporaneous changes are included in calculating the net emissions increase for the project. There are no other projects that occurred during the contemporaneous period.

PSD permitting is applicable to the project if a significant emissions increase occurs and the net emissions increase exceeds the SER for any regulated NSR pollutant. A summary of the post-project emission rates, comprised of emission increases from new sources, emission increases from existing units, and emission decreases from existing sources to be shut down, compared to the SERs is shown in Table 3-2. The detailed post-project PTE and baseline actual emissions are provided in Appendix C.

Table 3-2. PSD Applicability Summary (Tons/Year)

	PM	PM_{10}	$PM_{2.5}$	SO_2	NOx	VOC	CO	CO_2e
New Units PTE	257.00	262.10	207.18	563.64	2121.03	468.03	2846.70	2742597.67
Emission Increase due to Increased Utilization at Existing Units	10.80	7.92	5.33	0	0	0	0	0
Project Emissions Decreases	288.78	255.89	206.67	754.63	1012.90	48.82	324.48	0
Total Emissions Increase	-20.98	14.13	5.83	-190.99	1108.12	419.20	2522.22	2742597.67
PSD SER	25	15	10	40	40	40	100	75000
PSD Permitting Required?	No	No	No	No	Yes	Yes	Yes	Yes

Note that Heidelberg has an outstanding Significant Permit Modification (No. 093-47798-00002) that will impact the particulate emissions shown in Table 3-2. It is expected that particulate emissions included in the outstanding Significant Permit Modification and this application will be combined such that total particulate emissions will not exceed the pollutant-specific SERs.

The proposed project is considered a major modification because it will result in significant net emissions increases for NOx, CO, VOC, and GHGs. Therefore, pursuant to the requirements of 326 IAC 2-2-5, Heidelberg has performed a modeling analysis to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS). As documented in the air dispersion modeling protocol submitted for this project to IDEM on June 26, 2024, remodeling of NOx is not required as emission changes for that pollutant are minimal as a result of this project. A detailed discussion of the remodeled analysis for CO emissions will be included in a modeling report, which will be submitted separately from this application. Pursuant to 326 IAC 2-2-3(2), Heidelberg has performed a top-down BACT analysis for NOx, VOC, CO, and GHGs for the new emergency generators associated with this project. A detailed discussion of the BACT analysis is provided in Section 5 of this application.

All other pollutants in the above table are not subject to PSD review; therefore, Heidelberg will only address state level source and permit modification requirements for emissions of these pollutants.

3.1.3 New Source Performance Standards

New Source Performance Standards (NSPS) require new, modified, or reconstructed sources in applicable source categories to control emissions to the level achievable by the best demonstrated technology as specified in the applicable provisions. Any source subject to a NSPS is also subject to the general provisions of NSPS Subpart A, except as noted. NSPS applicability is reviewed for each unit that is physically modified or newly constructed as part of the project. An analysis of applicability for these rules is provided in the following subsections.

3.1.3.1 Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (40 CFR 60 Subpart JJJJ)

NSPS JJJJ for Stationary Spark Ignition Internal Combustion Engines (40 CFR 60, Subpart JJJJ) applies to manufacturers, owners, and operators of stationary spark ignition (SI) internal combustion engines (ICE) as specified in 40 CFR 60.4230(a). Pursuant to 40 CFR 60.4230(a)(4), owners and operators of stationary SI ICE that commence construction after June 12, 2006 are subject to the applicable requirements of NSPS JJJJ where the stationary SI ICE are manufactured on or after January 1, 2009 for emergency engines with a maximum engine power greater than 19 kilowatts (25 horsepower).

The natural gas-fired emergency generator engine, EGN1, installed at the Mitchell Plant was manufactured after January 1, 2009; therefore, it is subject to the requirements of NSPS JJJJ. An FED-01 form is included in Appendix A.

3.1.3.2 Subpart IIII– Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII)

NSPS Subpart IIII applies to owners or operators of stationary compression ignition (CI) internal combustion engines (ICE) manufactured after April 1, 2006 that are not fire pump engines. The proposed project consists of one EPA-certified ICE-driven diesel-fired emergency generator, EGN2. The engine has been manufactured after the dates specified above; therefore, the engine is subject to the provisions of Subpart IIII. An FED-01 form is included in Appendix A.

3.1.3.3 National Emission Standards for Hazardous Air Pollutants

National Emissions Standards for Hazardous Air Pollutants (NESHAPs) apply to sources in specifically regulated industrial source classifications (Clean Air Act Section 112(d)) or on a case-by-case basis (Clean Air Act Section 112(g)) for facilities not regulated as a specific industrial source type. Pollutant specific NESHAP may also be applicable. NESHAP are primarily developed for particular industrial source categories. Therefore, the potential applicability of a particular NESHAP to a facility can be readily ascertained based on the industrial source category covered.

3.1.3.4 Subpart ZZZZ – National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR 63, Subpart ZZZZ)

The NESHAP for Reciprocating Internal Combustion Engines (RICE), 40 CFR 63 Subpart ZZZZ (RICE MACT), regulates all existing, reconstructed, and new stationary RICE for virtually all fuels at major and area sources of HAP. The emergency generator engines (EGN1 and EGN2) are (1) located at a major source of HAP, (2) have a site-specific rating greater than 500 hp, (3) qualify as emergency RICE, and (4) have been constructed after June 12, 2006; therefore, the generator engines are subject to the RICE MACT and will comply with the regulation by also complying with NSPS IIII and NSPS JJJJ. An FED-01 form for the emergency generators is included in Appendix A.

3.2 State Regulations

The following section outlines the key state air quality regulations that apply to the proposed modification at the Mitchell Plant.

3.2.1 Preventive Maintenance Plans (326 IAC 1-6-3)

Preventive Maintenance Plans (PMPs) are required for any non-insignificant source that requires a permit. PMPs will be developed as outlined in the modified permit.

3.2.2 Source Modification (326 IAC 2-7-10.5)

Pursuant to 326 IAC 2-7-10.5(a), a Title V source proposing to construct new emission units, modify existing emission units, or otherwise modify the source as described in 326 IAC 2-7-10.5, must submit an application for source modification approval unless the proposed project is exempt under 326 IAC 2-1.1-3. As shown in the detailed calculations in Appendix B, the project PTE for all pollutants does not exceed the thresholds as outlined in 326 IAC 2-1.1-3(e); therefore, a source modification is not required.

3.2.3 Significant Permit Modification (326 IAC 2-7-12)

A permit modification is required for any revision to a Title V permit that cannot be accomplished under the provisions for administrative permit amendments contained in 326 IAC 2-7-11. Heidelberg is requesting the Mitchell Plant's current Title V permit be modified to incorporate the proposed changes. This revision does not qualify for an administrative permit amendment under 326 IAC 2-7-11; therefore, a permit modification is required.

Pursuant to 326 IAC2-7-12(b)(1), a minor permit modification may only be used if certain criteria are satisfied. Because the proposed project will involve significant changes to existing monitoring, reporting, and recordkeeping requirements in a Part 70 permit, this application must be processed as a significant modification. Therefore, Heidelberg requests the proposed modification be incorporated into the Mitchell Plant's Title V permit through a significant permit modification.

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4. BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS METHODOLOGY

4.1 Methodology

As the Kiln 4 project results in net emission increases of NO_X, CO, VOC, and GHG in excess of the NSR major modification thresholds, an analysis to ensure the implementation of BACT is required for the new units being proposed as part of this project which have the potential to emit these pollutants. A technical review has been performed to investigate and identify emission controls that have recently been determined by various permitting authorities across the U.S. to satisfy BACT requirements.

The requirement to conduct a BACT analysis is set forth in the PSD regulations:

> *A major modification shall apply best available control technology for each regulated NSR pollutant for which it would result in a significant net emissions increase at the source. This requirement applies to each proposed emissions unit at which a net emissions increase in the pollutant would occur as a result of a physical change or change in the method of operation in the unit.*[4]

PSD BACT is defined as:

> *...an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and Technologies, including fuel cleaning or treatment or innovative fuel combustion Technologies for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61.*[5]
> [primary BACT definition]
>
> *If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.*
> [allowance for secondary BACT standard under certain conditions]

U.S. EPA's memo of December 1, 1987, instituted the policy of the "top-down" BACT analysis, in which all available control technologies are ranked in descending order according to their effectiveness.[6] The most stringent option is considered BACT unless it can be shown that the limit cannot be achieved, based on technical considerations or on energy, environmental, or economic impacts.

[4] 40 CFR 52.21(j)(3)
[5] 40 CFR 52.21(b)(12)
[6] U.S. EPA, Office of Air and Radiation, Memorandum from J.C. Potter to the Regional Administrators, Washington, D.C., December 1, 1987.

U.S. EPA issued the New Source Review Workshop Manual in October of 1990 and the PSD and Title V Permitting Guidance for Greenhouse Gases in March 2011, which both contain detailed guidance on establishing BACT limit through the "top down" analysis.[7] The five key steps to the analysis are as follows:

4.1.1 Step 1 – Identify Potential Control Technologies

Available control technologies with the practical potential for application to the emission unit are identified. The application of demonstrated control technologies in other similar source categories to the emission unit in question can also be considered. While identified technologies may be eliminated in subsequent steps in the analysis based on technical and economic infeasibility or environmental, energy, economic or other impacts, control technologies with potential application to the emission unit under review are identified in this step. Under Step 1 of a criteria pollutant BACT analysis, the following resources are typically consulted when identifying potential technologies:

1. EPA's Reasonably Available Control Technology (RACT)/Best Available Control Technology (BACT)/Lowest Achievable Emission Reduction (LAER) Clearinghouse (RBLC) database;
2. Determinations of BACT by regulatory agencies for other similar sources or air permits and permit files from federal or state agencies;
3. Engineering experience with similar control applications;
4. Information provided by air pollution control equipment vendors with significant market share in the industry; and/or
5. Review of literature from industrial technical or trade organizations.

Searches of the RBLC database were performed in April 2023 to identify the emission control technologies and emission levels that were determined by permitting authorities as BACT within the past ten years for comparable emission sources.

4.1.2 Step 2 – Eliminate Technically Infeasible Options

The second step in the BACT analysis is to eliminate any technically infeasible control technologies. Each control technology for each pollutant is considered, and those that are clearly technically infeasible are eliminated. U.S. EPA states the following with regard to technical feasibility: [8]

> *A demonstration of technical infeasibility should be clearly documented and should show, based on physical, chemical, and engineering principles, that technical difficulties would preclude the successful use of the control option on the emissions unit under review.*

4.1.3 Step 3 – Rank the Remaining Control Technologies by Control Effectiveness

All remaining technically feasible control options are ranked based on their overall control effectiveness for the pollutant of interest.

[7] U.S. EPA, New Source Review Workshop Manual (Draft): Prevention of Significant Deterioration and Nonattainment Area Permitting, October 1990.

[8] U.S. EPA, New Source Review Workshop Manual (Draft): Prevention of Significant Deterioration and Nonattainment Area Permitting, October 1990.

4.1.4 Step 4 – Evaluate the Most Effective Controls and Document the Results

The remaining control technologies are evaluated on the basis of economic, energy, and environmental considerations.
After identifying and ranking available and technically feasible control technologies, the economic, environmental, and energy impacts are evaluated to select the best control option. If adverse collateral impacts do not disqualify the top-ranked option from consideration it is selected as the basis for the BACT limit. Alternatively, in the judgment of the permitting agency, if unreasonable adverse economic, environmental, or energy impacts are associated with the top control option, the next most stringent option is evaluated. This process continues until a control technology is identified.

In the case when the optimal control isn't chosen, a cost analysis to support the economic unreasonableness would be done according to the following procedures.

Economic analyses compare total costs (capital and annual) for potential control technologies. Capital costs include the initial cost of the components intrinsic to the complete control system. Annual operating costs include the financial requirements to operate the control system on an annual basis and include overhead, maintenance, outages, raw materials, and utilities.

The capital cost estimating technique used is based on a factored method of determining direct and indirect installation costs. That is, installation costs are expressed as a function of known equipment costs. This method is consistent with the latest EPA's Office of Air Quality Planning and Standards (OAQPS) guidance manual on estimating control technology costs.[9]

Total capital investment (TCI) represents the delivered cost of the control equipment, auxiliary equipment, and instrumentation (purchased equipment costs). Auxiliary equipment consists of all the structural, mechanical, and electrical components required for the efficient operation of the device. Auxiliary equipment costs are estimated as a percentage of the equipment cost. Direct installation costs consist of the direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting and facilities. Indirect installation costs include engineering and supervision of contractors, construction and field expenses, construction fees, and contingencies. Other indirect costs include equipment startup, performance testing, working capital, and interest during construction.

Annual costs are comprised of direct and indirect operating costs. Direct annual costs include labor, maintenance, replacement parts, raw materials, utilities, and waste disposal. Indirect operating costs include plant overhead, taxes, insurance, general administration, and capital charges. Replacement part costs, such as the cost of replacement of catalysts for the oxidation catalysts, can be included where applicable. With the exception of overhead, indirect operating costs are calculated as a percentage of the total capital costs. The indirect capital costs are based on the capital recovery factor (CRF) defined as:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where i is the annual interest rate and n is the equipment life in years.

[9] EPA, *OAQPS Control Cost Manual*, 6th edition, EPA 452/B-02-001, July 2002. Some sections updated more recently: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution#cost%20manual

The equipment life is based on the normal life of the control equipment and varies on an equipment type basis. The same interest rate applies to all control equipment cost calculations.

The primary focus of the environmental impact analysis is the reduction in ambient concentrations of the pollutant being controlled. Increases and decreases in other criteria or non-criteria pollutants may occur with some technologies and should also be identified. Non-air impacts, such as solid waste disposal and increased water consumption, may be an issue as well.

4.1.5 Step 5– Select BACT

In the final step, the BACT emission limit is determined for each emission unit under review based on evaluations from the previous step.

Although the first four steps of the top-down BACT process involve technical, economic, and other environmental impact evaluations of potential control options (i.e., defining the appropriate technology), the selection of BACT in the fifth step involves an evaluation of emission rates achievable with the selected control technology. BACT is an emission limit unless technological or economic limitations of the measurement methodology would make the imposition of an emissions standard infeasible, in which case a work practice or operating standard can be imposed.

U.S. EPA has consistently interpreted the statutory and regulatory BACT definitions as containing two core requirements that the agency believes must be met by any BACT determination, irrespective of whether or not it is conducted in a "top-down" manner. First, the BACT analysis must include consideration of the most stringent available technologies (i.e., those which provide the "maximum degree of emissions reduction"). Second, any decision to require a lesser degree of emissions reduction must be justified by an objective analysis of "energy, environmental, and economic impacts" contained in the record of the permit decision.[10] In addition, the minimum control efficiency to be considered in a BACT analysis must result in an emission rate less than or equal to the NSPS or NESHAP emission limits applicable to the source (if such exist).

4.2 BACT Requirement

The BACT requirement applies to each new or modified emission unit from which there are emissions increases of pollutants subject to PSD review. The Kiln 4 System is subject to PSD permitting for NOx, CO, VOC, and GHG and is subject to BACT for these pollutants. The finish mill air heater and emergency generator engines are subject to BACT for each pollutant requiring PSD permitting that is emitted by the particular piece of equipment. Table 4-1 identifies the pollutants considered in the BACT analysis for each emission unit. Refer to Sections 5 and 6 of this application for a detailed discussion of each emission unit.

The following sections present the top-down BACT analysis for each pollutant.

[10] Draft BACT Guidelines, March 15, 1990.

Table 4-1. Pollutants Evaluated in the BACT Analysis for Each Emissions Unit

Equipment	CO (Yes/No)	VOC (Yes/No)	NO_X (Yes/No)	GHG (Yes/No)	PM (Yes/No)	$PM_{10}/PM_{2.5}$ (Yes/No)	SO_2 (Yes/No)	H_2SO_4 (Yes/No)
Kiln 4 System	**Yes**	**Yes**	No	No	No	No	No	No
Finish Mill Air Heaters (E51HG01 and E52HG02)	**Yes**	**Yes**	No	No	No	No	No	No
Natural Gas-Fired Emergency Generator (EGN1)	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No
Diesel-Fired Emergency Generator (EGN2)	**Yes**	**Yes**	**Yes**	**Yes**	No	No	No	No

4.3 Proposed BACT Limits Summary

Based on BACT assessment, Heidelberg proposes the BACT limits in Table 4-2 below.

Table 4-2. Proposed Primary BACT Limits Summary

Unit	Pollutant	Limit		Averaging Period	Proposed BACT
Kiln 4 System	CO	2.0	lb/ton clinker	12-month rolling average	Good Combustion Practices, Raw Material Properties
	VOC	0.28	lb/ton clinker	12-month rolling average	Good Combustion Practices, Raw Material Properties
Finish Mill Air Heaters (E51HG01 and E52HG01)	CO	0.2	lb/MMBtu	3-hour	Good Combustion Practices, Raw Material Properties
	VOC	0.3	lb/MMBtu	3-hour	Good Combustion Practices, Raw Material Properties
Natural Gas-Fired Emergency Generator (EGN1)	NOx	2.0	g/hp-hr	3-hour	Purchase Certified Engine
	CO	4.0	g/hp-hr	3-hour	Purchase Certified Engine
	VOC	1.0 86	g/hp-hr ppmvd at 15% O_2	3-hour	Good Combustion Practices
	GHG	25.0	tons of CO_2e	12 consecutive months	Use of Pipeline Natural Gas and Good Design and Operating Practice
Diesel-Fired Emergency Generator (EGN2)	VOC + NOx	4.80	g/hp-hr	3-hour	Good Combustion Practices
	CO	2.61	g/hp-hr	3-hour	Good Combustion Practices
	GHG	179.74	tons of CO_2e	12 consecutive months	Good Design and Operating Practice

5. BACT EVALUATION

5.1 Kiln System BACT Analysis

5.1.1 CO BACT Evaluation

CO emissions from a modern preheater/precalciner kiln system are a combination of CO generated during the combustion of fuel and CO generated from partial oxidation of organics in the raw material that occurs primarily at the top of preheater towers. The following analysis will include two technologies that will have an effect on carbon monoxide generated during the combustion of fuel (Excess Air and Good Combustion Practices). These two technologies will have no effect on the CO coming from the partial oxidation of the organics in the raw materials. The two technologies that would have an impact on both raw material generated CO and CO from fuel combustion (Thermal Oxidation and Catalytic Incineration) are add-on tailpipe (applied to the stack) technologies.

5.1.1.1 Identification of Potential Control Technologies (Step 1)

The first step in the BACT analysis is to identify all control technologies for each pollutant. Potentially available control options for reducing CO emissions from the kiln system are listed below:

- ► Thermal Oxidation
- ► Catalytic Incineration
- ► Excess Air
- ► Good Combustion Practices

U.S. EPA's RACT/BACT/LAER Clearinghouse lists good combustion practices as the only control for emissions of CO from kilns. The Clearinghouse provides a listing of recent RACT, BACT, and LAER determinations in the United States. We have supplemented this list with potential other control technologies for emissions of CO, which are explored further in the following sections.

5.1.1.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Thermal Oxidation

A Thermal Oxidizer (TO) can be used for CO control in certain industries, although they are more typically employed to control VOC emissions. Thermal oxidation is performed with devices that use an open flame or combustion within an enclosed chamber to oxidize pollutants. Thermal oxidizers typically operate at temperatures that range from 1,200°F to 2,000°F, with a residence time of up to 2 seconds. By raising the temperature, the residence time for complete combustion can be reduced, or, alternatively, by increasing the residence time, the temperature can be reduced.

The three types of thermal oxidizers most commonly used in industrial plants are regenerative, recuperative, and open-flame (flare). The most energy-efficient is the regenerative thermal oxidizer (RTO), which can recover up to 95 percent of the heat used during oxidation under ideal conditions, thereby reducing fuel costs. In practice, at a cement manufacturing operation, maximum heat recovery would not be expected due to fouling of the heat transfer media in the RTO.

The recuperative thermal oxidizer is less thermally efficient than the RTO. Heat from the treated gas is transferred to the untreated gas using a gas-to-gas heat exchanger. The open-flame is the least energy-efficient thermal oxidizer since it does not recover any heat. It is uncommon to use either of these two oxidizers as tail pipe controls in large-scale processes such as cement kiln systems. All three technologies require the combustion of additional fuel to treat the kiln gas. Since the RTO is the most energy efficient and is applicable to large-scale processes, the BACT analysis will consider only the regenerative thermal oxidizer.

The exhaust gas to be treated enters the RTO system through a forced-draft fan. The inlet heat transfer bed of ceramic media preheats the gas stream prior to the combustion phase. In the combustion chamber that is equipped with a natural gas burner, up to 99.5 percent of CO is oxidized to CO_2. The purified exhaust gas preheats a second heat transfer bed and exits through the diverter valve. The control efficiency that can be achieved by the RTO depends on the inlet pollutant concentration. A 99.5 percent control efficiency will be considered for this analysis.

From a review of U.S. EPA's RACT/BACT/LAER Clearinghouse, the control of CO using thermal oxidation has never been approved or used as a BACT technology for a cement kiln.

The addition of another source of combustion emissions to the kiln could also result in an increase in criteria pollutant emissions and would result in increased energy consumption. Although RTOs are technically feasible, site-specific engineering assessments would need to be completed to fully verify the technical feasibility of an RTO at the Mitchell Plant. For purposes of this BACT screening analysis, we have carried this technology forward and will conduct an economic feasibility analysis under Steps 3 and 4.

Catalytic Incineration

In a catalytic incineration (CI) system, the combustion gases pass over a catalyst (usually platinum) where the CO is converted into CO_2. CI systems use less fuel than RTO systems because the catalyst lowers the combustion temperature of the exhaust gas. The primary environmental hazard expected from this process is poisoning of the catalyst by cement kiln dust, chlorine, and SO_2 generated from the kiln pyroprocessing system. CI systems have been applied successfully to many industrial processes to treat flue gas streams that contain low concentrations of PM, such as exhaust streams from painting operations. However, no attempt has ever been made to apply a CI system to a cement kiln.

A CI system on a cement kiln would likely require pretreatment with a cleaning device, such as a baghouse. Due to the sensitive nature of the catalyst bed, a CI system is much more susceptible to plugging, fouling, and corrosion. In the event of even a small leak or a minor bag failure in the particulate matter control device (PMCD) ahead of the catalytic oxidizer, the catalytic oxidizer would be flooded with harmful quantities of PM from the in-line kiln/raw mill. This situation likely would result in catastrophic fouling of the catalyst and require its subsequent replacement. For these reasons, CI systems are considered technically infeasible and are eliminated as an option for the purposes of BACT.

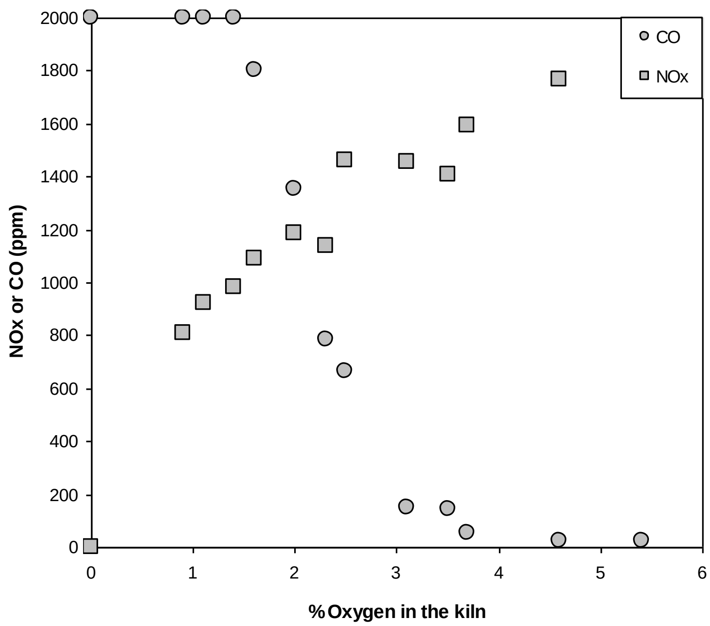
Total Excess Air – Combustion Zone

Excess air above the stoichiometric ratio of oxygen to fuel in combustion reactions reduces CO emissions by oxidizing CO to CO_2. Cement kilns require a large amount of excess air for proper operation. Oxidizing conditions in the burning zone of the kiln are necessary for producing quality clinker, because high levels of O_2 and low levels of CO tend to stabilize alkali and calcium sulfates. [11] However, adding excess air above the

11 Miller, F. M., Young, G. L., and von Seebach, M. "Formation and Techniques for Control of Sulfur Dioxide and Other Sulfur Compounds in Portland Cement Kilns." Portland Cement Association, Skokie, IL, 2001.

amount necessary for proper operation to either the kiln or the precalciner causes a large increase in the NO_x emissions from the kiln. Figure 5-1 shows the relation between percent oxygen in the kiln and concentrations of CO and NOx in the kiln. It can be seen from this figure that as the percent oxygen increases in the kiln, concentration of CO decreases, while concentration of NOx increases significantly.

Figure 5-1. Effect of Excess Oxygen on Concentrations of CO and NOx in Cement Kilns[12]



Hence, balancing the excess air in the kiln is an important consideration to a properly operated kiln (further explained in the Good Combustion Practices section below). Total excess air technology is not listed as a control option for cement kilns in the RACT/BACT/LAER Clearinghouse. Because this method is not a demonstrated technology for cement kiln control for CO and due to concerns listed above, excess air is considered technically infeasible for CO control. Finally, the rate of clinker production decreases with increase in excess air thus lowering the operating efficiency of the plant.[13]

Good Combustion Practices

A properly designed and operated portland cement kiln system minimizes CO formation from fuel combustion. GCP, however, has little to no effectiveness in controlling the generation of CO that emanates from raw materials used in the process. The kiln operator desires to minimize combustion CO formation because excess CO indicates unutilized thermal energy potential which results in increased operating costs. The RBLC indicates that GCP is the predominant BACT technology used for the control of CO emissions.

5.1.1.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling CO emissions from the kiln system:

12 Hansen E., "The use of carbon monoxide and other gases for process control", *IEEE Transactions on Industrial Applications, v IA-22*, n 2, pp 338-344, 1986.

13 Hansen, E., "Changing process priorities when firing alternate fuels", *45th IEEE-IAS/PCA Cement Industry Technical Conference, May 2002*.

Control Technology	Pollution Control Efficiency (%)
Regenerative Thermal Oxidation	99.5%
Good Combustion Practices	Base Case

5.1.1.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations.

Regenerative Thermal Oxidation

There are two (2) cement plants in the U.S. that have installed RTOs: the TXI plant in Midlothian, Texas, and the Holcim plant in Dundee, Michigan. The Holcim plant installed the RTO as a result of a consent order regarding odors from the volatile organic matter emissions as a result of kiln feed with high organic material content. The RTO/scrubber combination at Holcim did not operate continuously because of operational problems and was shut down (the plant was also shut down in 2008). Both of these installations relied on natural gas for supplemental fuel. The TXI plant voluntarily installed the RTO to reduce CO emissions resulting from a modification to minor levels. Otherwise, the TXI RTO would have been deemed economically infeasible.

The RTO installed at the Holcim plant in Dundee, Michigan was installed for control of odor and visible emissions (condensable hydrocarbon). The system was installed on two wet cement kilns but has been discontinued due to high maintenance and system failure. The RTO experience at the Dundee Plant further illustrates that the RTO is not readily available for application on cement kilns.

For the purpose of this BACT evaluation, a price quote for a three RTO system capable of 99.5 percent destruction efficiency was used.

<u>Environmental Analysis for RTO</u>

An RTO requires combustion of natural gas to provide the temperatures necessary for efficient CO oxidation. Based on the cost estimate, an oxidizer used to control the combustion sources of this installation would require supplemental heat input. This additional heat would be added by the combustion of natural gas and would result in the formation of additional pollutants such as NO_x.

<u>Energy Analysis for RTO</u>

The RTO cost estimate for the Mitchell Plant's kiln system is based on the treatment of at least 330,898 standard cubic feet per minute (scfm) of kiln exhaust gas. This level of control has energy requirements for the RTO's main fan in excess of 890 kW of electricity. The energy needed from approximately 10,000 standard cubic feet per hour (scfh) of natural gas to oxidize the CO would be approximately 10 MMBtu per hour[14]. Based on this information, the annual electricity cost is estimated at approximately $550,000, while the annual natural gas cost required for CO oxidation is approximately $590,000.

<u>Economic Analysis for RTO</u>

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[14] Natural gas heat content ~ 1 MMBtu per 1,000 scf; natural gas requirement for Mitchell RTO ~ 20,000 scfh.

An economic analysis was performed for an RTO system to be installed on the kiln system exhaust at the Mitchell Plant, and was submitted as part of the application for SSM No. 093-40198-00002. The analysis assumes that all CO from the kiln system would be treated in a three RTO system (two running at all times).

A total of 1,962 tons of CO would be removed through the installation and operation of an RTO system, while approximately 4.5 tons of other criteria pollutants would be generated. Based on the economic, energy, and environmental impacts, the cost effectiveness of an RTO system is estimated to be approximately $5,798 per ton of pollutants removed. The addition of an RTO system will impose approximately $56 million in capital costs and over $3.4 million in annual operating costs to the Mitchell Plant.

The costs associated with an RTO system are excessive and will result in an undue economic burden to Heidelberg. Therefore, the RTO system is not considered an economically feasible BACT.

Good Combustion Practices
A properly designed and operated kiln functions as a thermal oxidizer. CO formation is minimized with the kiln temperature and excess oxygen availability is adequate for complete combustion.

There are no incremental costs associated with optimal operation of a properly designed kiln. Hence proper design kiln and operation is the most effective control operation for CO. This is supported by the RACT/BACT/LAER determinations for CO BACT on cement kilns.

Table 5-1. Recent Permit Limitations and Determinations of BACT for CO (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	CO Limit	Control
Preheater/ Precalciner	KS-0031	Ash Grove Cement Company	7/14/2017	331 tons/hr raw material mix	5000 lb/hr per 8-hour block average	Fabric filters as specified in the PSD permit.
Preheater/ Precalciner	MO-0088	Continental Cement Company, LLC	1/18/2017	-	6 lb/ton clinker on a 30-day rolling average	GCP
Preheater/ Precalciner	NY-0115	Lafarge Ravena Plant	12/9/2014	-	2.5 lb/ton clinker on a 30-day rolling average	-
Preheater/ Precalciner	TX-0821	Alamo Cement Company	6/13/2017	1,277,500 ton/yr clinker	1.67 lb/ton clinker on an hourly average	GCP
Preheater/ Precalciner	TX-0822	Capitol Aggregates, Inc.	6/30/2017	1,606,000 ton/yr clinker	3 lb/ton clinker, annual average	GCP, preheater on kiln
Preheater/ Precalciner	TX-0831	GCC Permian, LLC	12/6/2017	3,300 ton/day clinker	1.5 lb/ton clinker on a 30-day rolling average	GCP
Preheater/ Precalciner	TX-0866	Texas Lehigh Cement Company	10/24/2019	1,314,000 ton/yr clinker	3 lb/ton clinker	GCP and clean fuel
Preheater/ Precalciner	TX-0907	Holcim US Inc	4/6/2021	-	5.33 lb/ton clinker, annual average	GCP; operation of the kiln and existing TO at appropriate oxygen range and temperature to promote complete combustion and minimize CO formation.

5.1.1.5 Selection of BACT (Step 5)

CO BACT limits for cement kilns are highly project specific as they are influenced by raw materials and other project operational specifications. The raw material mix used in the new kiln at the Mitchell Plant uses both limestone and clay quarried onsite, whereas the old kilns used only limestone quarried onsite. Differences in raw materials can result in variability from one source to another and result in differences in the CO emission rates from the existing kilns at the Mitchell Plant.

The kiln system at the Mitchell Plant is currently subject to a 1.4 lb/ton of clinker on a rolling 12-month average CO limit, achieved through good combustion practices. This limit was selected prior to the kiln's operation and was proposed solely based on the kiln's combustion efficiency. Since operation has begun, engineering and process evaluations show that CO is forming in the upper stages of the preheater tower rather than post-combustion locations (kiln/calciner), a formation that did not occur in the old cement kiln lines due to employment of different kiln technology and drastically different temperature profiles. This means that the concentration of natural organic matter in the raw materials is primarily responsible for CO emissions. As stated above, the CO emission rate from cement kilns is highly dependent on the raw material mix. Heidelberg therefore proposes that the CO BACT limit be increased to 2.0 lb/ton of clinker on a rolling 12-month basis to accurately reflect the CO emission as a result of the raw materials found at the Mitchell Plant. Internal testing at the Mitchell Plant indicates that Heidelberg will be able to comply with a 2.0 lb/ton of clinker limit based on the organic composition of the raw materials found at the Mitchell Plant and the proper management of those raw materials.

A review of plants identified in the RACT/BACT/LAER Clearinghouse indicate that the proposed CO BACT emission limit is within the range of recently issued air permits for preheater/precalciner kilns. The GCC Permian, LLC plant in Odessa, Texas and the Alamo Cement Company plant in San Antonio, Texas have CO BACT limits less than 2.0 lb/ton of clinker. These plants were permitted in 2017 and have yet to be constructed. The CO BACT determinations have never been demonstrated. Therefore, these CO limits should be excluded from this BACT analysis.

The Lonestar plant in Maryneal, Texas, which is not included in the RACT/BACT/LAER Clearinghouse results as the plant was permitted prior to 2014, has a CO BACT limit of 2.0 lb/ton of clinker with control based on good combustion practices, proper equipment design, and raw material properties. Heidelberg believes that the approach of taking the raw material properties into account, as was done when establishing the BACT limit for the Lonestar plant, is most reflective of actual CO emissions expected from Kiln 4 at the Mitchell Plant, and therefore proposes the same be done for the Mitchell Plant.

The proposed BACT limit for CO is consistent with BACT levels for existing kilns. There are no CO emission standards listed for portland cement kilns in 40 CFR 60 Subpart F or 40 CFR Subpart LLL PC MACT.

5.1.2 VOC BACT Evaluation

VOC emissions from cement kilns are primarily the result of organic compounds in the raw materials flashing off and partially combusting as the raw materials are heating up in the countercurrent flow at the top of the preheater tower of the preheater precalciner kiln system.

5.1.2.1 Identification of Potential Control Technologies (Step 1)

The first step in the BACT analysis is to identify all control technologies for each pollutant. Potentially available control options for reducing VOC emissions from the kiln system are listed below:

- Thermal Oxidation

- Catalytic Incineration
- Selective Quarrying
- Good Combustion Practices

5.1.2.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Thermal Oxidation

Thermal oxidation is performed with devices that use an open flame or combustion within an enclosed chamber to oxidize pollutants. Thermal oxidizers typically operate at temperatures that range from 1,200°F to 2,000°F, with a residence time of up to 2 seconds. By raising the temperature, the residence time for complete combustion can be reduced, or, alternatively, by increasing the residence time, the temperature can be reduced.

The three types of thermal oxidizers most commonly used in industrial plants are regenerative, recuperative, and open-flame (flare). The most energy-efficient is the regenerative thermal oxidizer (RTO), which can recover up to 95 percent of the heat used during oxidation under ideal conditions, thereby reducing fuel costs. In practice at a cement manufacturing operation, a maximum of 75 percent heat recovery is expected due to fouling of the heat transfer media in the RTO. The recuperative thermal oxidizer is less thermally efficient than the RTO. Heat from the treated gas is transferred to the untreated gas using a gas-to-gas heat exchanger. The open-flame is the least energy-efficient thermal oxidizer since it does not recover any heat. It is uncommon to use either of these two oxidizers as tail pipe controls in large-scale processes such as cement kiln systems. All three technologies require the combustion of additional fuel to treat the kiln gas. Since the RTO is the most energy efficient and is applicable to large-scale processes, the BACT analysis will consider only the regenerative thermal oxidizer.

The exhaust gas to be treated enters the RTO system through a forced-draft fan. The inlet heat transfer bed of ceramic media preheats the gas stream prior to the combustion phase. In the combustion chamber that is equipped with a natural gas burner, up to 99.5 percent of VOC is oxidized to CO2. The purified exhaust gas preheats a second heat transfer bed and exits through the diverter valve. The control efficiency that can be achieved by the RTO depends on the inlet pollutant concentration. A 99.5 percent control efficiency may be high, but will be considered for this analysis.

The addition of another source of combustion emissions to the kiln could also result in an increase in criteria pollutant emissions and would result in increased energy consumption. Although RTOs are technically feasible, site-specific engineering assessments would need to be completed to fully verify the technical feasibility of an RTO at the Mitchell Plant. For purposes of this BACT screening analysis, we have carried this technology forward and will conduct an economic feasibility analysis under Steps 3 and 4.

Catalytic Incineration

In a catalytic incineration (CI) system, the combustion gases pass over a catalyst (usually platinum) where the VOC is converted into CO2. CI systems use less fuel than RTO systems because the catalyst lowers the combustion temperature of the exhaust gas. The primary environmental hazards expected from this process is poisoning of the catalyst by cement kiln dust, chlorine, and SO2 generated from the kiln pyroprocessing system. CI systems have been applied successfully to many industrial processes to treat flue gas streams that contain low concentrations of PM, such as exhaust streams from painting operations. However, no attempt has ever been made to apply a CI system to a cement kiln.

A CI system on a cement kiln would likely require pretreatment with a cleaning device, such as a baghouse. Due to the sensitive nature of the catalyst bed, a CI system is much more susceptible to plugging, fouling, and corrosion. In the event of even a small leak or a minor bag failure in the particulate matter control device (PMCD) ahead of the catalytic oxidizer, the catalytic oxidizer would be flooded with harmful quantities of PM from the in-line kiln/raw mill. This situation likely would result in catastrophic fouling of the catalyst and require its subsequent replacement. For these reasons, CI systems are considered technically infeasible and are eliminated as an option for the purposes of BACT.

Selective Quarrying
Raw material selective quarrying has been considered technically feasible as a VOC emissions control technology when the quarry has specific rock formations with higher organic content than the bulk of the material. In certain cases, deposits of higher organic concentration material can be discarded and replaced with acceptable alternative raw materials bearing lower concentrations of organic constituents. This would reduce the primary source of VOC emissions in the system. However, the types of geological formations required to gain benefit from selective quarrying do not exist in the Mitchell quarry. The spatial distribution within the deposit is both lateral and vertical, and cannot be mitigated by selective mining or material substitution. Therefore, selective quarrying is not considered technically feasible for the Mitchell Plant.

Good Combustion Practices
A properly designed and operated portland cement kiln system minimizes VOC formation from fuel combustion. GCP, however, has little to no effectiveness in controlling the volatilization of VOC that emanates from raw materials used in the process. The kiln operator desires to minimize VOC formation from combustion because excess VOC indicates unutilized energy potential which results in increased operating costs. The RBLC indicates that GCP is the predominant BACT technology used for the control of VOC emissions.

5.1.2.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling VOC emissions from the kiln system:

Control Technology	Pollution Control Efficiency (%)
Regenerative Thermal Oxidation	99.5%
Good Combustion Practices	Base Case

5.1.2.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations.

Regenerative Thermal Oxidation
There are two (2) cement plants in the U.S. that have installed RTOs: the TXI plant in Midlothian, Texas, and the Holcim plant in Dundee, Michigan. These plants are not listed in the EPA's RACT/BACT/LAER Clearinghouse (RBLC). The Holcim plant installed the RTO as a result of a consent order regarding odors from the volatile organic matter emissions as a result of kiln feed with high organic material content. The RTO/scrubber combination at Holcim did not operate continuously because of operational problems and was shut down (the plant was also shut down in 2008.) Both of these installations relied on natural gas for supplemental fuel. The TXI plant voluntarily installed the RTO to reduce CO emissions resulting from a modification to minor levels. Otherwise, the TXI RTO would have been deemed economically infeasible.

For the purpose of this BACT evaluation, a price quote for a three RTO system capable of 99.5% destruction efficiency was used.

Environmental Analysis for RTO

An RTO requires combustion of natural gas to provide the temperatures necessary for efficient VOC destruction. Based on the cost estimate, an oxidizer used to control the combustion sources of this installation would require supplemental heat input. This additional heat would be added by the combustion of natural gas and would result in the formation of additional pollutants such as NOx.

Energy Analysis for RTO

The RTO cost estimate for the Mitchell Plant's kiln system is based on the treatment of at least 330,898 standard cubic feet per minute (scfm) of kiln exhaust gas. This level of control has energy requirements for the RTO's main fan in excess of 890 kW of electricity. The energy needed from approximately 10,000 standard cubic feet per hour (scfh) of natural gas to oxidize the VOC would be approximately 10 MMBtu per hour[15]. Based on this information, the annual electricity cost is estimated at approximately $550,000, while the annual natural gas cost required for VOC oxidation is approximately $590,000.

Economic Analysis for RTO

An economic analysis was performed for an RTO system to be installed on the kiln system exhaust at the Mitchell Plant, and was submitted as part of the application for SSM No. 093-40198-00002. The analysis assumes that all VOC from the kiln system would be treated in a three RTO system (two running at all times).

A total of 168 tons of VOC would be removed through the installation and operation of an RTO system, while approximately 4.5 tons of other criteria pollutants would be generated. Based on the economic, energy, and environmental impacts, the cost effectiveness of an RTO system is estimated to be approximately $67,642 per ton of pollutants removed. The addition of an RTO system will impose approximately $56 million in capital costs and over $3.4 million in annual operating costs to the Mitchell Plant.

The costs associated with an RTO system are excessive and will result in an undue economic burden to Heidelberg. Therefore, the RTO system is not considered an economically feasible BACT.

Good Combustion Practices

A properly designed and operated kiln functions as a thermal oxidizer. VOC formation is minimized with the kiln temperature and excess oxygen availability is adequate for complete combustion.

There are no incremental costs associated with optimal operation of a properly designed kiln. Hence proper design kiln and operation is the most effective control operation for VOC. This is supported by the RACT/BACT/LAER determinations for VOC BACT on cement kilns.

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[15] Natural gas heat content ~ 1 MMBtu per 1,000 scf; natural gas requirement for Mitchell RTO ~ 20,000 scfh.

Table 5-2. Recent Permit Limitations and Determinations of BACT for VOC (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	VOC Limit	Control
Preheater/ Precalciner	AL-0325	Argos Cement, LLC - Roberta Plant	10/2/2017	-	0.16 lb/ton clinker on a 30-day rolling average	-
Preheater/ Precalciner	TX-0821	Alamo Cement Company	6/13/2017	1,277,500 ton/yr clinker	0.08 lb/ton clinker on an 12-month average, and 0.1 lb/ton clinker on an hourly average	GCP, preheater on kiln
Preheater/ Precalciner	TX-0822	Capitol Aggregates, Inc.	6/30/2017	1,606,000 ton/yr clinker	0.5 lb/ton clinker on a 30-day rolling average	GCP, preheater on kiln
Preheater/ Precalciner	TX-0866	Texas Lehigh Cement Company	10/24/2019	1,314,000 ton/yr clinker	0.5 lb/ton clinker on an hourly average	GCP and clean fuel

5.1.2.5 Selection of BACT (Step 5)

Through the use of the prescribed top-down BACT analysis, GCP is the remaining feasible control technology for VOC and must be selected as BACT. The VOC emission rate is dependent on the raw material used and thus will vary over time, but ultimately will need to be compliant with the PC MACT THC limit of 24 ppmv (at 7% oxygen on a 30-day rolling average). Consequently, Heidelberg is currently subject to an existing BACT emission rate of 0.12 lb VOC/ton of clinker on a 12-month rolling average calculated based on the PC MACT THC limit, the kiln's design airflow, and excluding methane/ethane.

This limit was selected prior to the kiln's operation and was proposed based on the kiln's combustion efficiency. Since operation has begun, engineering and process evaluations show that VOC is forming in the upper stages of the preheater tower rather than post-combustion locations (kiln/calciner). This means that the concentration of organic matter in the raw materials is primarily responsible for VOC emissions. As stated above, the VOC emission rate from cement kilns is highly dependent on the raw materials used. Heidelberg therefore proposes that the VOC BACT limit be increased to 0.28 lb/ton of clinker on a rolling 12-month basis to accurately reflect the VOC emission as a result of the carbonaceous materials found in the Mitchell Plant's quarry. Internal testing at the Mitchell Plant indicates that Heidelberg will be able to comply with a 0.28 lb/ton of clinker limit based on the organics in the raw materials used at the Mitchell Plant and proper raw material management.

A review of plants identified in the RACT/BACT/LAER Clearinghouse indicate that the proposed VOC BACT emission limit is within the range of recently issued air permits for preheater/precalciner kilns. The Suwannee American Cement plant in Brandford, Florida and the Alamo Cement Company plant in San Antonio, Texas have VOC BACT limits less than 0.28 lb/ton of clinker. These plants were permitted in 2015 and 2017, respectively, and have yet to begin construction. The VOC BACT determinations have never been demonstrated and as the permit has been issued for well over 5 years for each plant, it is assumed there is no intent to construct these plants. Therefore, these VOC emission limits should be excluded from this BACT analysis.

The Lonestar plant in Maryneal, Texas, which is not included in the RACT/BACT/LAER Clearinghouse results as the plant was permitted prior to 2014, has a VOC BACT limit of 0.3 lb/ton of clinker with control based on good combustion practices and raw material properties. Heidelberg believes that the approach of taking the raw material properties into account, as was done when establishing the BACT limit for the Lonestar plant, is most reflective of actual VOC emissions and lends consideration to the impacts caused by raw materials found onsite, and therefore proposes the same be done for the Mitchell Plant.

The proposed BACT limit for VOC is consistent with BACT levels for existing kilns. Heidelberg will continue to comply with the 12 ppmvd organic HAP limit per footnote (4) to Table 1 in 40 CFR 63.1343, which is an alternative to the 24 ppmvd THC limit per the PC MACT.

5.2 Finish Mill Air Heaters BACT Analysis

5.2.1 CO BACT Evaluation

5.2.1.1 Identification of Potential Control Technologies (Step 1)

Candidate control options identified from literature review include those classified as pollution reduction techniques. CO reduction options include:

- Regenerative Thermal Oxidizer (RTO)

- Oxidation Catalyst
- Good Combustion Practices

5.2.1.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Regenerative Thermal Oxidizer

The thermal oxidizer has a stabilized flame maintained by a combination of auxiliary fuel, waste gas compounds, and supplemental air added when necessary. This technology is typically applied for destruction of organic vapors, nevertheless it is also considered as a technology for controlling CO emissions. Upon passing through the flame, the gas containing CO is heated from its inlet temperature to its ignition temperature. (It is the temperature at which the combustion reaction rate (and consequently the energy production rate) exceeds the rate of heat losses, thereby raising the temperature of the gases to some higher value). Thus, any CO/air mixture will ignite if its temperature is raised to a sufficiently high level. The CO-containing mixture ignites at some temperature between the preheat temperature and the reaction temperature. The ignition occurs at some point during the heating of a waste stream. The mixture continues to react as it flows through the combustion chamber.

Most thermal units are designed to provide no more than 1 second of residence time to the waste gas with typical temperatures of 1,200 °F to 2,000 °F. Once the unit is designed and built, the residence time is not easily changed, so that the required reaction temperature becomes a function of the particular gaseous species and the level of control. Regenerative Thermal Oxidizers consist of direct contact heat exchangers constructed of a ceramic material that can tolerate the high temperatures needed to achieve ignition of the waste stream.

The inlet gas first passes through a hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. The hot gases then react (releasing energy) in the combustion chamber and while passing through another ceramic bed, thereby heating it to the combustion chamber outlet temperature. The process flows are then switched, feeding the inlet stream to the hot bed. This cyclic process affords high energy recovery (up to 95%). The higher capital costs associated with these high-performance heat exchangers and combustion chambers may be offset by the auxiliary fuel savings to make such a system economical.

The use of an RTO is not a technologically feasible control option for the finish mill air heaters. Thermal oxidation is not normally used to control CO in the exhaust streams of natural gas combustion. The combustion products have a low heating value that makes the use of a thermal oxidizer impractical.

Oxidation Catalyst

Catalytic oxidation is also a widely used control technology to control pollutants where the waste gas is passed through a flame area and then through a catalyst bed for complete combustion of the waste in the gas. This technology is typically applied for destruction of organic vapors; nevertheless it is considered a technology for controlling CO emissions. A catalyst is an element or compound that speeds up a reaction at lower temperatures (compared to thermal oxidation) without the catalyst undergoing change itself. Catalytic oxidizers operate at 650°F to 1000°F and require approximately 1.5 to 2.0 ft3 of catalyst per 1000 scf of gas flow.

Emissions from some emission units may contain significant amounts of particulates. These particulates can poison the catalyst resulting in the failure of catalytic oxidation. For some fuels, such as coal and residual oil, contaminants would likely be present in such concentrations so as to foul catalysts quickly thereby making such systems infeasible due to the need to constantly replace catalyst materials. In addition, the use of oxidation catalysts on units with high sulfur fuels can also result in the creation of sulfuric acid mist through the conversion of SO_2 to SO_3 and subsequent combination with moisture in the exhaust gas.

The use of an oxidation catalyst to control carbon monoxide emissions is feasible for natural gas-fired combustion units because the fuel is low in sulfur with relatively low concentrations of other contaminants, such as metals. The use of catalytic oxidation is a technically feasible control option for the finish mill air heater.

Good Combustion Practices
Because CO is essentially a by-product of incomplete or inefficient combustion, combustion control constitutes the primary mode of reduction of CO emissions. This type of control is appropriate for any type of fuel combustion source. Combustion process controls involve combustion chamber designs and operating practices that improve the oxidation process and minimize incomplete combustion. CO emissions result from the incomplete combustion of carbon and organic compounds. Factors affecting CO emissions include firing temperatures, residence time in the combustion zone and combustion chamber mixing characteristics. Combustion control is a technically feasible control option for the finish mill air heater.

5.2.1.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling CO emissions from the finish mill air heaters:

Control Technology	Pollution Control Efficiency (%)
Oxidation Catalyst	75%
Good Combustion Practices	Base Case

5.2.1.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations.

A review of CO BACT analysis for natural gas-fired process heaters in the RBLC shows add-on control technology is not practical. CO emissions are controlled exclusively by good combustion practices and limits on the operation of the combustion unit. The use of a thermal or catalytic oxidizer for CO control would require significant supplemental fuel resulting in additional CO emissions.

Table 5-3. Recent Permit Limitations and Determinations of BACT for CO (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	CO Limit	Control
Boilers and Heaters (natural gas and diesel fired)	AK-0084	Donlin Gold LLC	6/30/2017	29.29 MMBtu/hr	0.0384 lb/MMBtu (ULSD), 3-hr average	GCP
Kiln Heater	AL-0313	Lhoist North America of Alabama, LLC	5/4/2016	6.2 MMBtu/hr	-	GCP
Small heaters and dryers sn-05 through sn-11, sn-16, and sn-17	AR-0155	Big River Steel LLC	11/7/2018	-	0.0824 lb/MMBtu	Combustion of natural gas and GCP
Small heaters and dryers sn-16 through sn-19b	AR-0159	Big River Steel LLC	4/5/2019	-	0.0824 lb/MMBtu	Combustion of natural gas and GCP
Small heaters and dryers sn-10 through sn-13	AR-0159	Big River Steel LLC	4/5/2019	-	0.0824 lb/MMBtu	Combustion of natural gas and GCP
Cold mill space heaters	AR-0159	Big River Steel LLC	4/5/2019	-	0.0824 lb/MMBtu	Combustion of natural gas and GCP
Ladle Preheaters	AR-0180	HYBAR LLC	4/28/2023	12.1 MMBtu/hr	0.0824 lb/MMBtu	Combustion of natural gas and GCP
Fuel Heater	IL-0129	CPV Three Rivers Energy Center	7/30/2018	12.8 MMBtu/hr	0.08 lb/hr	GCP
Fuel Heater	IL-0130	Jackson Energy Center	12/31/2018	13 MMBtu/hr	0.08 lb/MMBtu	GCP
FGFUELHTR (Two fuel pre-heaters identified as EUFUELHTR1 & EUFUELHTR2)	MI-0423	Indeck Niles, LLC	1/4/2017	27 MMBtu/hr	2.22 lb/hr, hourly, each	GCP
EUFUELHTR (Fuel pre-heater)	MI-0424	Holland Board of Public Works - East 5th street	12/5/2016	3.7 MMBtu/hr	0.41 lb/hr	GCP
EUFUELHTR1: Natural gas fired fuel heater	MI-0435	DTE Electric Company	7/16/2018	20.8 MMBtu/hr	0.77 lb/hr, hourly	GCP
Ladle preheater	MI-0438	Gerdau Macsteel Inc.	10/29/2018	30 MMBtu/hr	0.084 lb/MMBtu, hourly	Combustion of natural gas and GCP

FGFUELHEATERS	MI-0440	Michigan State University	5/22/2019	25 MMBtu/hr	0.08 lb/MMBtu, hourly, each	GCP
FGFUELHTR (2 fuel pre-heaters)	MI-0445	Indeck Niles, LLC	11/26/2019	27 MMBtu/hr	1.11 lb/hr, hourly, each	GCP
Fuel Gas Heaters (2 identical, P007 and P008)	OH-0374	Guernsey Power Station LLC	10/23/2017	15 MMBtu/hr	0.83 lb/hr	Combustion control
Ladle Preheaters and Dryers (P021-023, P025-026)	OH-0381	Northstar Bluescope Steel, LLC	9/27/2019	16 MMBtu/hr	0.32 lb/hr	Combustion of natural gas and GCP
Ladle Preheaters (P002, P003 and P004)	OH-0383	Petmin U SA Incorporated	7/17/2020	15 MMBtu/hr	0.521 lb/hr	Combustion of natural gas and GCP
Ladle Preheater #2	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.082 lb/MMBtu, 1-hr	-
Ladle Preheater #3	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.082 lb/MMBtu, 1-hr	-
Ladle Preheater #1	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.082 lb/MMBtu	-
Natural Gas-Fired Space and Unit Heater (P30)	WI-0299	WPL-Riverside Energy Center	8/20/2020	15.5 MMBtu/hr	0.082 lb/MMBtu	Only combust natural gas in each heater
Natural Gas-Fired Heater (P04)	WI-0300	Nemadji Trail Energy Center	9/1/2020	10 MMBtu/hr	0.08 lb/MMBtu	Only combust pipeline quality natural gas and operate and maintain the process according to manufacturer's recommendations
Natural Gas-Fired Heater (P05)	WI-0300	Nemadji Trail Energy Center	9/1/2020	10 MMBtu/hr	0.08 lb/MMBtu	Only combust pipeline quality natural gas and operate and maintain the process according to manufacturer's recommendations

5.2.1.5 Selection of BACT (Step 5)

Heidelberg is currently subject to an existing BACT emission rate of 0.05 lb CO/MMbtu to be demonstrated through good combustion practices. This BACT determination was made based on furnaces in other industries (i.e., metals, fuels, and starch drying). Determining the BACT limit based on a comparison to furnaces and other industries is not appropriate for finish mill air heaters since the finish mill air heaters are not similar to the furnaces found in the RBLC search results. The primary difference is in the composition of the exhaust gas, where discharges of a furnace reflect only combustion pollutants from the heating of air, but the exhaust of a finish mill air heater employed in a cement plant includes both combustion pollutants from the heating of air plus recirculated air that had previously contacted the raw materials being processed.

There are no comparable finish mill air heaters at cement plants listed in the RBLC; however, similar heaters used in other industries are provided in Table 5-3, which consider emissions from combustion only. One finish mill air heater not found in the RBLC search results for another portland cement facility is the finish mill air heater at the Continental Cement Company's facility in Hannibal, Missouri. This facility was recently issued a permit on April 30, 2024 including a CO BACT limit of 0.05 lb/MMbtu for their finish mill air heater. However, the selected BACT for the Continental Cement Company's facility was based on the original CO BACT limit for the Mitchell Plant, as the Mitchell Plant is the only other portland cement facility with finish mill air heaters found in the RBLC. As the Continental Cement Company's facility has not yet been constructed or demonstrated compliance with the 0.05 lb/MMbtu CO limit, and was selected because of the Mitchell Plant's CO BACT limit based on furnaces in other industries, the CO emission limit for this facility should be excluded from this BACT analysis. Should the plant ultimately be constructed, it is likely Continental Cement Company finds itself in the same position as the Mitchell Plant with respect to the finish mill air heater – unable to demonstrate compliance with the furnace-based BACT standard.

As with CO emissions from the kiln, CO emissions from the finish mill air heaters are dependent on the concentration of organic matter in the raw materials. Therefore, an emission limit relative to the raw materials used at the Mitchell Plant is the most appropriate for the finish mill air heaters. Based on internal stack testing completed at the Mitchell Plant, Heidelberg proposes the CO BACT limit for the finish mill air heaters be updated to 0.2 lb/MMbtu.

5.2.2 VOC BACT Evaluation

5.2.2.1 Identification of Potential Control Technologies (Step 1)

Candidate control options identified from literature review include those classified as pollution reduction techniques. VOC reduction options include:

- Regenerative Thermal Oxidizer (RTO)
- Oxidation Catalyst
- Good Combustion Practices

5.2.2.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Regenerative Thermal Oxidizer

Thermal oxidation is performed with devices that use an open flame or combustion within an enclosed chamber to oxidize pollutants. The thermal oxidizer has a stabilized flame maintained by a combination of auxiliary fuel, waste gas compounds, and supplemental air added when necessary. This technology is typically applied for destruction of organic vapors and is considered a technology for controlling VOC emissions. Upon passing through the flame, the gas containing VOC is heated from its inlet temperature to its ignition temperature. (It is the temperature at which the combustion reaction rate (and consequently the energy production rate) exceeds the rate of heat losses, thereby raising the temperature of the gases to some higher value). Thus, any VOC/air mixture will ignite if its temperature is raised to a sufficiently high level. The VOC-containing mixture ignites at some temperature between the preheat temperature and the reaction temperature. The ignition occurs at some point during the heating of a waste stream. The mixture continues to react as it flows through the combustion chamber.

Most thermal units are designed to provide no more than 1 second of residence time to the waste gas with typical temperatures of 1,200 °F to 2,000 °F. Once the unit is designed and built, the residence time is not easily changed, so that the required reaction temperature becomes a function of the particular gaseous species and the level of control. Regenerative Thermal Oxidizers consists of direct contact heat exchangers constructed of a ceramic material that can tolerate the high temperatures needed to achieve ignition of the waste stream.

The inlet gas first passes through a hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. The hot gases then react (releasing energy) in the combustion chamber and while passing through another ceramic bed, thereby heating it to the combustion chamber outlet temperature. The process flows are then switched, feeding the inlet stream to the hot bed. This cyclic process affords high energy recovery (up to 95%). Generally, it is impractical for thermal oxidizers to reduce VOC emissions from a properly operated natural gas-fired combustion unit. This is due to the large energy input required to obtain the required destruction temperature because the exhaust stream lacks adequate fuel. Therefore, the Regenerative Thermal Oxidizer (RTO) is not a technically feasible option for the finish mill air heaters.

Oxidation Catalyst

Catalytic oxidation is a widely used control technology to control pollutants where the waste gas is passed through a flame area and then through a catalyst bed for complete combustion of the waste in the gas. This technology is typically applied for destruction of organic vapors and is considered a technology for controlling VOC emissions. A catalyst is an element or compound that speeds up a reaction at lower temperatures (compared to thermal oxidation) without the catalyst undergoing change itself. Catalytic oxidizers operate at 650°F to 1000°F and require approximately 1.5 to 2.0 ft^3 of catalyst per 1,000 scf gas flow.

Emissions from some emission units may contain significant amounts of particulates. These particulates can poison the catalyst resulting in the failure of catalytic oxidation. For some fuels, such as coal and residual oil, contaminants would likely be present in such concentrations so as to foul catalysts quickly, thereby making such systems infeasible due to the need to constantly replace catalyst materials. In addition, the use of oxidation catalysts on units with high sulfur fuels can also result in the creation of sulfuric acid mist through the conversion of SO_2 to SO_3 and subsequent combination with moisture in the exhaust gas. The use of an oxidation catalyst to control VOC emissions is feasible for gas-fired units because the fuel is a low sulfur fuel with relatively low concentrations of other contaminants, such as metals. Due to the lower operating temperature requirements, it is possible to use catalytic oxidizers on reformer exhaust gases. While it is physically feasible to use catalytic oxidation, it is not normally used to control VOC emissions from natural gas combustion due to excessive costs associated with raising the temperature of a low heating value gas.

Much like the thermal oxidizer, a catalytic oxidizer uses high temperatures in the presence of a catalyst to combust VOC in the exhaust stream. This works for exhaust steams with significant organic content. The exhaust stream from the startup heater does not contain sufficient organic material to support combustion and a large amount of additional combustion fuel is required. Therefore, catalytic incineration in not a technically feasible option for the finish mill air heaters.

Good Combustion Practices
This type of control is appropriate for any type of fuel combustion source. Combustion process controls involve combustion chamber designs and operating practices that improve the oxidation process and minimize incomplete combustion. Factors affecting VOC emissions include firing temperatures, residence time in the combustion zone and combustion chamber mixing characteristics. The use of good combustion practices is a technically feasible option for the finish mill air heaters.

5.2.2.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling VOC emissions from the finish mill air heaters:

Control Technology	Pollution Control Efficiency (%)
Good Combustion Practices	Base Case

5.2.2.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations.

A review of VOC BACT analysis for natural gas-fired process heaters in the RBLC shows add-on control technology is not practical, consistent with the information reviewed for the BACT determination above. VOC emissions are controlled exclusively by good combustion practices and limits on the operation of the combustion unit.

Table 5-4. Recent Permit Limitations and Determinations of BACT for VOC (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	VOC Limit	Control
Boilers and Heaters (natural gas and diesel fired)	AK-0084	Donlin Gold LLC	6/30/2017	29.29 MMBtu/hr	0.0015 lb/MMBtu (ULSD), 3-hr average	GCP
Small heaters and dryers sn-05 through sn-11, sn-16, and sn-17	AR-0155	Big River Steel LLC	11/7/2018	-	0.0054 lb/MMBtu	Combustion of natural gas and GCP
Small heaters and dryers sn-16 through sn-19b	AR-0159	Big River Steel LLC	4/5/2019	-	0.0054 lb/MMBtu	Combustion of natural gas and GCP
Small heaters and dryers sn-10 through sn-13	AR-0159	Big River Steel LLC	4/5/2019	-	0.0054 lb/MMBtu	Combustion of natural gas and GCP
Cold mill space heaters	AR-0159	Big River Steel LLC	4/5/2019	-	0.0054 lb/MMBtu	Combustion of natural gas and GCP
Two natural gas heaters	FL-0364	Seminole Electric Cooperative, Inc.	3/21/2018	9.9 MMBtu/hr	0.005 lb/MMBtu	-
Ladle Preheater	IL-0132	Nucor Steel Kankakee, Inc.	1/25/2021	-	0.005 lb/MMBtu	GCP
Space Heaters	IN-0285	Whiting Clean Energy, Inc.	8/2/2017	-	0.0053 lb/MMBtu	-
Forced Air Heaters	IN-0307	Grain Processing Corporation	9/7/2018	-	0.026 lb/hr	-
Indirect fuel-gas heater	KS-0030	Mid-Kansas Electric Company, LLC - Rubart Station	3/31/2016	2 MMBtu/hr	0.011 lb/hr	-
Process heaters	KS-0032	CHS Mcpherson Refinery, Inc.	12/14/2015	-	0.005 lb/MMBtu	-
FGFUELHTR (Two fuel pre-heaters identified as EUFUELHTR1 & EUFUELHTR2)	MI-0423	Indeck Niles, LLC	1/4/2017	27 MMBtu/hr	0.15 lb/hr, hourly, each	GCP

EUFUELHTR (Fuel pre-heater)	MI-0424	Holland Board of Public Works - East 5th street	12/5/2016	3.7 MMBtu/hr	0.03 lb/hr	GCP
EUFUELHTR1: Natural gas fired fuel heater	MI-0435	DTE Electric Company	7/16/2018	20.8 MMBtu/hr	0.17 lb/hr, hourly	GCP
EUFUELHTR2: Natural gas fired fuel heater	MI-0435	DTE Electric Company	7/16/2018	3.8 MMBtu/hr	0.03 lb/hr, hourly	GCP
FGFUELHEATERS	MI-0440	Michigan State University	5/22/2019	25 MMBtu/hr	0.005 lb/MMBtu, hourly, each	GCP
FGFUELHTR (2 fuel pre-heaters)	MI-0445	Indeck Niles, LLC	11/26/2019	27 MMBtu/hr	0.07 lb/hr, hourly, each	GCP
Heaters (Gas-Fired)	OK-0173	CMC Steel Oklahoma	1/19/2016	-	0.0055 lb/MMBtu	Natural Gas Fuel
Ladle Preheater #2	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.0054 lb/MMBtu, 1-hr	-
Ladle Preheater #3	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.0054 lb/MMBtu, 1-hr	-
Ladle Preheater #1	TN-0183	Sinova Silicon LLC	4/25/2022	10 MMBtu/hr	0.0054 lb/MMBtu, 1-hr	-
Natural Gas-Fired Space Heaters (P44)	WI-0297	Green Bay Packaging - Mill Division	12/10/2019	8.5 MMBtu/hr	0.0055 lb/MMBtu	-
Natural Gas-Fired Space Heaters (P53)	WI-0297	Green Bay Packaging - Mill Division	12/10/2019	8.5 MMBtu/hr	0.0055 lb/MMBtu	Natural Gas Fuel
Natural Gas-Fired Space and Unit Heater (P30)	WI-0299	WPL-Riverside Energy Center	8/20/2020	15.5 MMBtu/hr	0.0054 lb/MMBtu	Only combust natural gas in each heater
Natural Gas-Fired Heater (P04)	WI-0300	Nemadji Trail Energy Center	9/1/2020	10 MMBtu/hr	0.005 lb/MMBtu	Only combust pipeline quality natural gas and operate and maintain the process according to manufacturer's recommendations

Natural Gas-Fired Heater (P05)	WI-0300	Nemadji Trail Energy Center	9/1/2020	10 MMBtu/hr	0.005 lb/MMBtu	Only combust pipeline quality natural gas and operate and maintain the process according to manufacturer's recommendations
Space and Water Heaters (P113)	WI-0314	Wisconsin Public Service Division - Weston Plant	3/10/2022	3 MMBtu/hr	0.0055 lb/MMBtu	Use of good combustion practices and use of pipeline quality natural gas.

5.2.2.5 Selection of BACT (Step 5)

Heidelberg is currently subject to an existing BACT emission rate of 0.005 lb VOC/MMbtu (equivalent to 5.5 lb/MMscf) to be demonstrated through good combustion practices. This BACT determination was made based on furnaces in other industries (i.e. metals, fuels, and starch drying). Determining the BACT limit based on a comparison to furnaces and other industries is not appropriate for finish mill air heaters since the finish mill air heaters are not similar to the furnaces found in the RBLC search results. As stated previously, the composition of exhaust gas of a finish mill air heater employed in a cement plant varies from that of a furnace as it includes exhaust from the combustion of air plus recirculated air that had contacted the raw materials being processed.

There are no comparable finish mill air heaters at cement plants listed in the RBLC; however, similar heaters used in other industries are provided in Table 5-4, which consider emissions from combustion only. As stated previously, the Continental Cement Company was issued a permit on April 30, 2024 for their facility in Hannibal, Missouri. The permit includes a VOC BACT limit of 5.5 lb/MMscf (equivalent to 0.005 lb/MMbtu) for their finish mill air heater. The selected BACT for the Continental Cement Company's facility was based on the original VOC BACT limit for the Mitchell Plant, as the Mitchell Plant is the only other portland cement facility with finish mill air heaters found in the RBLC. As the Continental Cement Company's facility has not yet been constructed or demonstrated compliance with the 5.5 lb/MMscf VOC limit, and was selected because of the Mitchell Plant's VOC BACT limit based on furnaces in other industries, the VOC emission limit for this facility should be excluded from this BACT analysis. Should the plant ultimately be constructed, it is likely Continental Cement Company finds itself in the same position as the Mitchell Plant with respect to the finish mill air heater – unable to demonstrate compliance with the furnace-based BACT standard.

As with CO emissions, VOC emissions from the finish mill air heaters are dependent on the raw materials used at the Mitchell Plant. Therefore, a VOC emissions limit reflective of the raw materials used by Heidelberg is the most appropriate for the finish mill air heaters. Based on internal stack testing completed at the Mitchell Plant, Heidelberg proposes the VOC BACT limit for the finish mill air heaters be updated to 0.3 lb/MMbtu.

5.3 Natural Gas-Fired Emergency Generator BACT Analysis

Heidelberg will install one emergency generator powered by a natural gas-fired 80 kW engine at the Mitchell plant. This engine will be certified to meet the emissions standards of 40 CFR 60, Subpart JJJJ (NSPS JJJJ) and will consume only pipeline quality natural gas. Combustion of the natural gas will result in emissions of NOx, CO, VOC, and GHGs. All proposed limits for this engine will either meet or be more stringent than the NSPS JJJJ limits.

5.3.1 NOx BACT Evaluation

In accordance with NSPS JJJJ, the engine will be limited to 100 hours per year of non-emergency maintenance checks and readiness testing, and will comply with the 2.30 g/hp-hr emission limit for NOx. To stay in compliance with the 100 hours per year of non-emergency maintenance and readiness testing, Heidelberg will use a non-resettable hour meter to monitor and record the monthly engine operation to ensure non-emergency operation does not exceed 100 hours for each rolling 12-month period.

NOx from the engine is primarily due to thermal NOx generation. NOx formed in the high-temperature, post-flame region of the combustion equipment is "thermal NOx". NOx can also be formed as a result of fuel NOx. "Fuel NOx" forms when the fuels containing nitrogen are burned. When these fuels are burned, the nitrogen bonds break and some of the resulting free nitrogen oxidizes to form NOx. With excess air, the degree of fuel NOx formation is primarily a function of the nitrogen content of the fuel.

5.3.1.1 Identification of Potential Control Technologies (Step 1)

Candidate control options identified from literature review include those classified as pollution reduction techniques. NOx reduction options include:

- Selective Catalytic Reduction (SCR)
- Selective Non-Catalytic Reduction (SNCR)
- Good Combustion Practices

5.3.1.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Selective Catalytic Reduction
Selective Catalytic Reduction (SCR) process involves the mixing of anhydrous or aqueous ammonia vapor with flue gas and passing the mixture through a catalytic reactor to reduce NOx to water and N_2. Under optimal conditions, SCR has a removal efficiency up to 90% when used on steady state processes. The efficiency of removal will be reduced for processes that are not stable or require frequent changes in the mode of operation.

The most important factor affecting SCR efficiency is temperature. SCR can operate in a flue gas window ranging from 480°F to 800°F, although the optimum temperature range depends on the type of catalyst and the flue gas composition. In this particular service, the minimum target temperature is approximately 750°F. Temperature below the optimum decrease catalyst activity and allow NH_3 to slip through; above the optimum range, ammonia will oxidize to form additional NOx. SCR efficiency is also largely dependent on the stoichiometric molar ratio of NH_3:NOx; variation of the ideal 1:1 ratio to 0.5:1 ratio can reduce the removal efficiency to 50%.

Unreacted reagent may form ammonium sulfates which may plug or corrode downstream equipment. Particulate-laden streams may blind the catalyst and may necessitate the application of a soot blower.

Based on this information, the use of selective catalytic reduction is not a technically feasible option for the emergency generator engine.

Selective Non-Catalytic Reduction
With selective non catalytic reduction (SNCR), NOx is selectively removed by the injection of ammonia or urea into the flue gas at an appropriate temperature window of 1600°F to 2100°F and without employing a catalyst. Similar to SCR without a catalyst bed, the injected chemicals selectively reduce the NOx to molecular nitrogen and water.

This approach avoids the problem related to catalyst fouling but the temperature window and reagent mixing residence time is critical for conducting the necessary chemical reaction. At the proper temperature, urea decomposes to produce ammonia which is responsible for NOx reduction. At a higher temperature, the rate of a competing reaction for the direct oxidation of ammonia that actually forms NOx becomes significant. At a lower temperature, the rates of NOx reduction reactions become too slow resulting in urea slip (i.e. emissions of unreacted urea).

Optimal implementation of SNCR requires the employment of an injection system that can accomplish thorough reagent/gas mixing within the temperature window while accommodating spatial and production

rate temperature variability in the gas stream. The attainment of maximum NOx control performance therefore requires that the source exhibit a favorable opportunity for the application of this technology relative to the location of the reaction temperature range.
The use of selective non-catalytic reduction is a technically feasible option for the emergency generator engine.

Good Combustion Practices
NOx emissions are caused by oxidation of nitrogen gas in the combustion air during fuel combustion. This occurs due to high combustion temperatures and insufficiently mixed air and fuel in the cylinder where pockets of excess oxygen occur. These effects can be minimized through air-to-fuel ratio control, ignition timing reduction, and exhaust gas recirculation. This type of control is included in RBLC for the control of NOx emissions from emergency engines. Therefore, the use of good combustion practices is a technically feasible option for the emergency generator engine.

5.3.1.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling NOx emissions from the natural gas-fired emergency engine:

Control Technology	Pollution Control Efficiency (%)
Selective Non-Catalytic Reduction (SNCR)	65-75%
Good Combustion Practices	Base Case

5.3.1.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations.

EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency ICE.

> *"The EPA also evaluated the BDT for emergency stationary CI ICE… The use of add-on controls such as CDPF, oxidation catalyst, and NOX adsorber could not be justified as BDT due to the cost of the technology relative to the emission reduction that would be obtained. This is discussed in more detail later in this preamble and in the documents supporting the proposal. The EPA, therefore, determined that the engine technologies developed by engine manufacturers to meet the Tier 2 and Tier 3 nonroad diesel engine standards, and those Tier 4 standards that do not require aftertreatment, are the BDT for 2007 model year and later emergency stationary CI ICE with a displacement of less than 10 liters per cylinder… stationary CI ICE with a displacement between 10 and 30 liters per cylinder are similar to marine CI engines, and EPA believes it is appropriate to rely on the technologies used to meet Tier 2 emission standards for marine CI engines. Therefore, for 2007 model year and later emergency stationary CI ICE with a displacement of greater than or equal to 10 and less than 30 liters per cylinder, the basis for the BDT are the technologies used to meet Tier 2 emission standards for marine CI engines."*

EPA's cost information for NSPS Subpart IIII is found in the supporting documents for the proposed NSPS.

It is expected that the same conclusions EPA came to for compression ignition engines would hold true for spark ignition engines. EPA did not require add-on controls for emergency SI ICE in NSPS JJJJ. Consistent with EPA's economic analysis, Heidelberg has determined that SNCR are not BACT for NOx emissions from the emergency engines.

With all add-on NOx control options eliminated, combustion design controls, the top and only remaining available and technically feasible NOx control option, will be applied to achieve compliance with the proposed BACT limits. This is consistent with a review of NOx BACT analysis for natural gas-fired emergency engines in the RBLC.

Table 5-5. Recent Permit Limitations and Determinations of BACT for NOx (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	NOx Limit	Control
Natural gas fired emergency generators	AR-0171	Nucor Corporation	2/14/2019	-	2 g/kW-hr	GCP
Emergency Engine	CA-1225	Sierra Pacific Industries	4/25/2014	256 hp	0.78 lb/hr	-
Emergency Engine Generators	IL-0132	Nucor Steel Kankakee, Inc.	1/25/2021	-	1 g/hp-hr	Each engine shall be designed and operated to comply with NSPS for stationary spark ignition internal combustion engines, 40 CFR 60 Subpart JJJJ
EGEN2 - Admin Building Emergency Generator	LA-0401	Koch Methanol St. James, LLC	12/20/2023	210 hp	0.92 lb/hr	Compliance with the requirements of 40 CFR 60 Subpart JJJJ
Emergency Generator	NE-0064	Norfolk Crush, LLC	11/21/2022	620 hp	2 g/hp-hr, 3-hr average	-

Emergency Engine Intermediate Lift Station Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	2 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards
Emergency Engine Lift Station A Sanitary Water Pump	PA-0326	shell chem appalachia llc	2/18/2021	-	5.39 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards
Small Internal Combustion Engines	WI-0324	Sio International Wisconsin	2/28/2023	-	0.02 g/bhp	Use of a 3-way catalyst, engine design, and GCP

5.3.1.5 Selection of BACT (Step 5)

Heidelberg proposes BACT for the natural gas-fired emergency engine to be good combustion practices (i.e., operate under manufacturer's guidance), equipment design, and hours of operation to ensure compliance will all applicable requirements of NSPS Subpart JJJJ. Heidelberg proposes a BACT emission limit for NOx for the natural gas-fired emergency engine of 2.0 g/hp-hr. This limit is equal to that of the applicable NSPS Subpart JJJJ standards. No specific emission limits beyond those required by NSPS Subpart JJJJ are necessary.

To comply with the proposed BACT limit, Heidelberg purchased an engine certified by the manufacturer to meet this emission level. Operation of the engine for the purposes of maintenance checks and readiness testing will be limited to 100 hours per year. Heidelberg believes that the proposed NOx BACT limit is consistent with the most stringent limits for comparable engines.

5.3.2 CO BACT Evaluation

CO from the natural gas-fired emergency engine is entirely from the incomplete combustion of carbon in the fuel. Conditions leading to incomplete combustion include the following: insufficient oxygen availability, poor fuel/air mixing, reduced combustion temperature, reduced combustion gas residence time, and load reduction. In addition, combustion modifications taken to reduce NOx emissions may result in increased CO emissions.

5.3.2.1 Identification of Potential Control Technologies (Step 1)

Candidate control options identified from literature review include those classified as pollution reduction techniques. CO reduction options include:

- Regenerative Thermal Oxidation
- Recuperative Thermal Oxidizer
- Catalytic Oxidation
- Combustion Design Controls

5.3.2.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Regenerative Thermal Oxidation
The thermal oxidizer has a high temperature combustion chamber that is maintained by a combination of auxiliary fuel, waste gas compounds, and supplemental air added when necessary. This technology is typically applied for destruction of organic vapors, nevertheless it is also considered as a technology for controlling CO emissions. Upon passing through the flame, the waste gas containing CO is heated. The mixture continues to react as it flows through the combustion chamber.

The required level of CO destruction of the waste gas that must be achieved within the time that it spends in the thermal combustion chamber dictates the reactor temperature. The shorter the residence time, the higher the reactor temperature must be. Most thermal units are designed to provide no more than 1 second of residence time to the waste gas with typical temperatures of 1,200°F to 2,000°F. Once the unit is designed and built, the residence time is not easily changed, so that the required reaction temperature becomes a function of the particular gaseous species and the desired level of control.

A Regenerative Thermal Oxidizer incorporates heat recovery and greater thermal efficiency through the use of direct contact heat exchangers constructed of a ceramic material that can tolerate the high temperatures needed to achieve ignition of the waste stream.

The inlet gas first passes through a hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. The hot gases then react (releasing energy) in the combustion chamber and while passing through another ceramic bed, thereby heating it. The process flows are then switched, feeding the inlet stream to the hot bed. This cyclic process affords very high energy recovery (up to 95%). The higher capital costs associated with these high-performance heat exchangers and combustion chambers may be offset by the increased auxiliary fuel savings to make such a system economical.

This control is not included in RBLC for the control of CO emissions from emergency engines. EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency ICE. Therefore, this technology is eliminated from further BACT determination.

Recuperative Thermal Oxidizers
This control technology oxidizes combustible materials by raising the temperature of the material above the auto-ignition point in the presence of oxygen and maintaining the high temperature for sufficient time to complete combustion. The operating temperature ranges from 1,100ºF to 1.200ºF and the waste stream inlet pollutants concentration is as low as 500 to 50,000 scfm.

Additional fuel is required to reach the ignition temperature of the waste gas stream. Oxidizers are not recommended for controlling gases with sulfur containing compounds because of the formation of highly corrosive acid gases. Thermal oxidizers do not reduce emissions of CO from properly operated natural gas combustion units without the use of a catalyst.

This control is not included in RBLC for the control of CO emissions from emergency engines. EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency ICE. Therefore, this technology is eliminated from further BACT determination.

Catalytic Oxidizers
Catalytic oxidation is also a widely used control technology to control pollutants where the waste gas is passed through a flame area and then through a catalyst bed for complete combustion of the waste in the gas. This technology is typically applied for destruction of organic vapors, nevertheless it is considered as a technology for controlling CO emissions. A catalyst is an element or compound that speeds up a reaction at lower temperatures compared to thermal oxidation without undergoing change itself. Catalytic oxidizers operate at 600°F to 800°F and approximately require 1.5 to 2.0 ft^3 of catalyst per 1000 standard ft^3 per gas flow rate. Similar to thermal incineration; waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Typical waste stream inlet flow rate ranges from 700 to 50,000 scfm and waste stream inlet pollutant concentration is as low as 1ppmv.

The use of a catalytic oxidizer is a technically feasible option for controlling CO emissions from the natural gas-fired emergency engine.

Good Combustion Practices
CO emissions are caused through incomplete combustion. When fuel and air are not well mixed in the combustion zone, low oxygen regions form where fuel will partially combust, resulting in CO and unburned hydrocarbons that exit with the exhaust. CO formation can be minimized by improving the fuel air mixing through enhanced fuel injection systems, air management systems, combustion system designs, and pre-mixed diesel combustion. This type of control is included in RBLC for the control of CO emissions from

emergency engines. Therefore, the use of good combustion practices is a technically feasible option for controlling CO emissions from the natural gas-fired emergency engine.

5.3.2.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling CO emissions from the natural gas-fired emergency engine:

Control Technology	Pollution Control Efficiency (%)
Oxidation Catalyst	90%
Good Combustion Practices	Base Case

5.3.2.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations. As previously stated, EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency CI ICE which would also be the case for emergency SI ICE. Based on EPA's economic analysis, Heidelberg has determined that the top remaining CO control option, good combustion practices, will be applied to achieve compliance with the proposed BACT limit. This is consistent with a review of CO BACT analysis for natural gas-fired emergency engines in the RBLC.

Table 5-6. Recent Permit Limitations and Determinations of BACT for CO (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	VOC Limit	Control
Natural gas fired emergency generators	AR-0171	Nucor Corporation	2/14/2019	-	4 g/kW-hr	GCP
Emergency Engine	CA-1225	Sierra Pacific Industries	4/25/2014	256 hp	4 lb/hr, 3-hr average	-
Emergency Engine Generators	IL-0132	Nucor Steel Kankakee, Inc.	1/25/2021	-	2 g/hp-hr	Each engine shall be designed and operated to comply with NSPS for stationary spark ignition internal combustion engines, 40 CFR 60 Subpart JJJJ
100 KW emergency generator	IN-0288	Waupaca Foundry, Inc.	6/25/2018	1.12 Mmbtu/hr	0.317 lb/MMbtu	-
EGEN2 - Admin Building Emergency Generator	LA-0401	Koch Methanol St. James, LLC	12/20/2023	210 hp	1.85 lb/hr	Compliance with the requirements of 40 CFR 60 Subpart JJJJ
Emergency Generator	NE-0064	Norfolk Crush, LLC	11/21/2022	620 hp	4 g/hp-hr, 3-hr average	-
Emergency Engine Intermediate Lift Station Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	4 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards

Emergency Engine Lift Station A Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	387 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards

5.3.2.5 Selection of BACT (Step 5)

Heidelberg proposes a CO BACT emission limit of 4.0 g/hp-hr. This limit is equal to that of the applicable NSPS Subpart JJJJ standard.

To comply with the proposed BACT limit, Heidelberg purchased an engine certified by the manufacturer to meet this emission level. Operation of the engine for the purposes of maintenance checks and readiness testing will be limited to 100 hours per year. Heidelberg believes that the proposed CO BACT limit is consistent with the most stringent limits for comparable engines (i.e., engines that are permitted for emergency use only and that are certified under NSPS JJJJ).

5.3.3 VOC BACT Evaluation

VOC from the engines is generated as a result of natural gas combustion. Carbon in the fuel that is not oxidized completely results in VOC formation.

5.3.3.1 Identification of Potential Control Technologies (Step 1)

Candidate control options identified from literature review include those classified as pollution reduction techniques. VOC reduction options include:

- Regenerative Thermal Oxidation
- Recuperative Thermal Oxidizer
- Catalytic Oxidation
- Combustion Design Controls

5.3.3.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Regenerative Thermal Oxidation
The thermal oxidizer has a high temperature combustion chamber that is maintained by a combination of auxiliary fuel, waste gas compounds, and supplemental air added when necessary. This technology is typically applied for destruction of organic vapors, nevertheless it is also considered as a technology for controlling VOC emissions. Upon passing through the flame, the waste gas containing VOC is heated. The mixture continues to react as it flows through the combustion chamber.

The required level of VOC destruction of the waste gas that must be achieved within the time that it spends in the thermal combustion chamber dictates the reactor temperature. The shorter the residence time, the higher the reactor temperature must be. Most thermal units are designed to provide no more than 1 second of residence time to the waste gas with typical temperatures of 1,200°F to 2,000°F. Once the unit is designed and built, the residence time is not easily changed, so that the required reaction temperature becomes a function of the particular gaseous species and the desired level of control.

A Regenerative Thermal Oxidizer incorporates heat recovery and greater thermal efficiency through the use of direct contact heat exchangers constructed of a ceramic material that can tolerate the high temperatures needed to achieve ignition of the waste stream.

The inlet gas first passes through a hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. The hot gases then react (releasing energy) in the combustion chamber and while passing through another ceramic bed, thereby heating it. The process flows are then switched, feeding the inlet stream to the hot bed. This cyclic process affords very high energy recovery (up to 95%). The higher capital costs associated with these high-performance heat exchangers and combustion chambers may be offset by the increased auxiliary fuel savings to make such a system economical.

This control is not included in RBLC for the control of VOC emissions from emergency engines. As previously stated, EPA determined in the development of NSPS Subpart IIII that add-on controls are economically infeasible for emergency CI ICE which would also be the case for emergency SI ICE. Therefore, this technology is eliminated from further BACT determination.

Recuperative Thermal Oxidizers
This control technology oxidizes combustible materials by raising the temperature of the material above the auto-ignition point in the presence of oxygen and maintaining the high temperature for sufficient time to complete combustion. The operating temperature ranges from 1,100ºF - 1.200ºF and the waste stream inlet pollutants concentration is as low as 500 to 50,000 scfm. Thermal oxidizers do not reduce emissions of VOC from properly operated natural gas combustion units without the use of a catalyst.

This control is not included in RBLC for the control of VOC emissions from emergency engines. EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency ICE which would also be the case for emergency SI ICE. Therefore, this technology is eliminated from further BACT determination.

Catalytic Oxidizers
Catalytic oxidation is also a widely used control technology to control pollutants where the waste gas is passed through a flame area and then through a catalyst bed for complete combustion of the waste in the gas. This technology is typically applied for destruction of organic vapors, nevertheless it is considered as a technology for controlling VOC emissions. A catalyst is an element or compound that speeds up a reaction at lower temperatures compared to thermal oxidation without undergoing change itself. Catalytic oxidizers operate at 600°F to 800°F and approximately require 1.5 to 2.0 ft^3 of catalyst per 1000 standard ft^3 per gas flow rate.

Similar to thermal incineration; waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Typical waste stream inlet flow rate ranges from 700 to 50,000 scfm and waste stream inlet pollutant concentration is as low as 1ppmv.

The use of a catalytic oxidizer is a technically feasible option for controlling VOC emissions from the natural gas-fired emergency engine.

Good Combustion Practices
VOC emissions are caused through incomplete combustion. When fuel and air is not well mixed in the combustion zone, low oxygen regions form where fuel will partially combust, resulting in VOC and unburned hydrocarbons that exit with the exhaust. VOC formation can be minimized by improving the fuel air mixing through enhanced fuel injection systems, air management systems, combustion system designs, and pre-mixed diesel combustion. This type of control is included in RBLC for the control of VOC emissions from fire pump & emergency engines. Therefore, good combustion practices is considered a technically feasible option for controlling VOC emissions from the natural gas-fired emergency generator.

5.3.3.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling VOC emissions from the natural gas-fired emergency engine:

Control Technology	Pollution Control Efficiency (%)
Oxidation Catalyst	90%
Good Combustion Practices	Base Case

5.3.3.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations. As previously stated, EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency CI ICE which would also be the case for emergency SI ICE. Based on EPA's economic analysis, Heidelberg has determined that the top remaining VOC control option, good combustion practices, will be applied to achieve compliance with the proposed BACT limit. This is consistent with a review of VOC BACT analysis for natural gas-fired emergency engines in the RBLC.

Table 5-7. Recent Permit Limitations and Determinations of BACT for VOC (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	VOC Limit	Control
Natural gas fired emergency generators	AR-0171	Nucor Corporation	2/14/2019	-	4 g/kW-hr	GCP
Emergency Engine Generators	IL-0132	Nucor Steel Kankakee, Inc.	1/25/2021	-	0.7 g/hp-hr	Each engine shall be designed and operated to comply with NSPS for stationary spark ignition internal combustion engines, 40 CFR 60 Subpart JJJJ
100 KW emergency generator	IN-0288	Waupaca Foundry, Inc.	6/25/2018	1.12 Mmbtu/hr	0.36 lb/MMbtu	-
Emergency Generators (2 units)	LA-0276	Colonial Pipeline Company	12/15/2016	-	-	Comply with standards of NSPS Subpart JJJJ
EGEN2 - Admin Building Emergency Generator	LA-0401	Koch Methanol St. James, LLC	12/20/2023	210 hp	0.46 lb/hr	-
EUEMERGEN1	MI-0446	FCA US LLC	10/30/2020	500 hr/yr	0.5 g/hp-hr, hourly	-
EUEMERGEN2	MI-0446	FCA US LLC	10/30/2020	500 hr/yr	0.5 g/hp-hr, hourly	-
EUEMERGEN3	MI-0446	FCA US LLC	10/30/2020	500 hr/yr	1.0 g/hp-hr, hourly	-
EUEMERGEN4	MI-0446	FCA US LLC	10/30/2020	500 hr/yr	1.0 g/hp-hr, hourly	-
Emergency Generator	NE-0064	Norfolk Crush, LLC	11/21/2022	620 hp	1.0 g/hp-hr, 3-hr average	-

Emergency Engine Intermediate Lift Station Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	1.0 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards
Emergency Engine Lift Station A Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	5.39 g/hp-hr	The use of certified engines, design of engines to include turbocharger and an intercooler/aftercooler, GCP and proper operation and maintenance including certification to applicable federal emission standards
Two Emergency Generators (P38 and P39)	WI-0267	Green Bay Packaging, Inc.	9/6/2018	50 kW	-	Meet 40 CFR 60, Subpart JJJJ, limit operation to no more than 200 hr/yr
P38 & P39 Emergency Generator	WI-0292	Green Bay Packaging, Inc.	4/1/2019	-	200 hrs, 12-month period	Hours of Operation
Natural Gas-Fired Emergency Generator (P37)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	230 hp	200 hrs, 12-month period	Only fire natural gas
Natural Gas-Fired Emergency Generator (P38)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	375 hp	200 hrs, 12-month period	Only fire natural gas
Natural Gas-fired Emergency Generator (P39)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	675 hp	200 hrs, 12-month period	Only fire natural gas

5.3.3.5 Selection of BACT (Step 5)

As discussed above, the engine will be limited to 100 hours per year of non-emergency maintenance checks and readiness testing and will comply with the NSPS Subpart JJJJ limit of 1.0 g/hp-hr or 86 ppmvd at 15 percent oxygen.

Heidelberg proposed BACT for the natural gas-fired emergency engine to be good combustion practices (i.e., operation under manufacturer's guidance), engine design, and limit annual non-emergency operation to 100 hours to ensure compliance will all applicable requirements of NSPS Subpart JJJJ. No specific emission limits beyond those required by NSPS Subpart JJJJ are necessary. To stay in compliance with the 100 hours per year of non-emergency maintenance and readiness testing, Heidelberg will use a non-resettable hour meter to monitor and record the monthly engine operation to ensure non-emergency operation does not exceed 100 hours for each rolling 12-month period. Heidelberg believes that the proposed VOC BACT limit is consistent with the most stringent limits for comparable engines (i.e., engines that are permitted for emergency use only and that are certified under NSPS JJJJ).

5.3.4 GHG BACT Evaluation

Greenhouse gas emissions from the emergency engine are produced from the combustion of hydrocarbons present in the natural gas fuel.

5.3.4.1 Identification of Potential Control Technologies (Step 1)

The following potential CO_2 control strategies for the natural gas-fired emergency engine were considered as part of this BACT analysis:

- Carbon Capture and Storage
- Good Combustion/Operating Practices
- Selection of the Lowest Carbon Fuel

5.3.4.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Carbon Capture and Storage
Carbon sequestration is a potential carbon capture/removal and storage technology that can be considered for CO2 emissions control from the natural gas-fired emergency engine.

Carbon sequestration involves separation and capture of CO_2 from the engine exhaust gases, pressurization of the captured CO_2, transportation of the captured CO_2 via pipeline, and injection and long-term geologic storage of the captured CO_2. The carbon sequestration technology is still under development and has not been demonstrated at any cement plant in the U.S. Currently, there are no available CO_2 pipelines that could transport emissions from the Mitchell plant.

Additionally, carbon capture and sequestration (CCS) is not considered an available control option for emergency equipment that operates on an intermittent basis and must be immediately available during plant emergencies without the constraint of starting up the CCS process. Therefore, CCS is considered technically infeasible.

Good Combustion/Operating Practices
Good combustion/operating practices are a potential control option for optimizing the fuel efficiency of the emergency generator. Natural gas-fired engines typically operate in a lean premix mode to ensure an effective staging of air/fuel ratios in the engine to maximize fuel efficiency and minimize incomplete

combustion. Furthermore, the proposed engine is sufficiently automated to ensure optimal fuel combustion and efficient operation leaving minimal need for operator tuning of these aspects of operation. Therefore, good combustion/operating practices is a technically feasible option for the emergency generator engine.

Fuel Selection
Heidelberg proposes the use of pipeline quality natural gas only for the emergency generator. Table C-1 of 40 CFR Part 98 shows CO_2 emissions per unit heat input (MMBtu) for wide variety of industrial fuel types. Only landfill and other biomass gases (captured methane) and coke oven gas result in lower CO_2 emissions per unit heat input than natural gas; however, as biomass gases and coke oven gas are not readily available for the compressor station, Heidelberg is proposing to use the available fuel type with the lowest carbon intensity. Therefore, selection of the lowest carbon fuel is a technically feasible option for the emergency generator engine.

5.3.4.3 Ranking of Remaining Control Technologies (Step 3)

Good combustion practices and lower carbon fuel selection are the remaining technically feasible control options for minimizing CO_2 emissions from the natural gas-fired emergency generator. It is unclear which option has a more significant impact on emissions of CO_2 from the Mitchell plant.

Control Technology	Pollution Control Efficiency (%)
Good Combustion/Operating Practices	Base Case
Selection of Lowest Carbon Fuel	Base Case

5.3.4.4 Evaluation of Most Stringent Controls (Step 4)

CCS is not considered an available control option for emergency equipment that operates on an intermittent basis and must be immediately available during plant emergencies without the constraint of starting up the CCS process. Operating the generator set using good combustion practices is a technically feasible CO_2 control option. Natural gas, the lowest carbon fuel, is a technically feasible option for CO_2 control of the emergency generator.

No adverse energy, environmental, or economic impacts are associated with fuel efficient engine selection for reducing GHG emissions from the emergency generator engine. Natural gas is the lowest emitting carbon fuel that could be relied upon for the proposed operation.

Table 5-8. Recent Permit Limitations and Determinations of BACT for GHG (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	GHG Limit	Control
Natural gas fired emergency generators	AR-0171	Nucor Corporation	2/14/2019	-	121 lb/MMBtu	GCP
Emergency Engine Generators	IL-0132	Nucor Steel Kankakee, Inc.	1/25/2021	-	-	-
Emergency Engine Intermediate Lift Station Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	43.4 tons, 12 rolling months	Combined CO2e emissions from emergency NG generators shall not exceed 43.4 tons 12 month rolling basis
Emergency Engine Lift Station A Sanitary Water Pump	PA-0326	Shell Chem Appalachia LLC	2/18/2021	-	-	-
Two Emergency Generators (P38 and P39)	WI-0267	Green Bay Packaging, Inc.	9/6/2018	50 kW	-	Meet 40 CFR 60, Subpart JJJJ, limit operation to no more than 200 hr/yr
P38 & P39 Emergency Generator	WI-0292	Green Bay Packaging, Inc.	4/1/2019	-	200 hrs, 12-month period	Hours of Operation
Natural Gas-Fired Emergency Generator (P37)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	230 hp	200 hrs, 12-month period	-
Natural Gas-Fired Emergency Generator (P38)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	375 hp	200 hrs, 12-month period	Only fire natural gas
Natural Gas-fired Emergency Generator (P39)	WI-0297	Green Bay Packaging, Inc.	12/10/2019	675 hp	200 hrs, 12-month period	Only fire natural gas

5.3.4.5 Selection of BACT (Step 5)

Heidelberg has determined that good combustion practice and exclusive combustion of natural gas is BACT for the proposed natural gas-fired emergency generator. Heidelberg will comply through the exclusive use of natural gas as fuel.

Heidelberg proposes a CO2e emission limit of 25.0 tons per 12 consecutive month period The proposed CO_2 equivalent (CO_2e) limit is based on 500 hours of engine operation and the GHG Mandatory Reporting Rule emission factors for natural gas-fired combustion (40 CFR 98, Subpart A) and the Global Warming Potentials of 1 lb CO_2e/lb CO_2, 25 lb CO_2e/lb CH_4, and 298 lb CO_2e/lb N_2O (40 CFR 98, equation A-1).

The limit is consistent in magnitude to other CO_2e emission limits in terms of tpy. The variability in tpy emission limits can be explained by variability in the horsepower ratings and engine specific fuel consumption rates for the engine.

5.4 Diesel-Fired Emergency Engine BACT Analysis

Heidelberg will install one emergency generator to be powered by a diesel-fired 400 kW engine. The engine will be run on ULSD, with a maximum sulfur content of 0.0015 weight percent (15 ppmw). Combustion of the ULSD will yield emissions of NO_X, CO, VOC, and GHGs. The generator will be subject to NSPS IIII. All proposed limits for the engine will either meet or be more stringent than NSPS IIII limits.

5.4.1 NOx BACT Evaluation

During combustion processes, NOx emissions can form in three different ways: thermal NOx, fuel NOx, and prompt NOx. Thermal NOx occurs as a result of the reaction of nitrogen and oxygen in the combustion air, usually in the high temperature flame zone near the burners. Fuel NOx is a result of the reaction of any fuel-bound nitrogen compounds with oxygen during combustion. Prompt NOx occurs through early reactions of the nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NOx is usually small compared to thermal NOx emissions.

5.4.1.1 Identification of Potential Control Technologies (Step 1)

Using RBLC search and permit review results, potentially applicable NO_X control technologies for Reciprocating Internal Combustion Engines (RICE) were identified. These technologies include:

- Selective Catalytic Reduction
- Non-Selective Catalytic Reduction
- Lean NOx Catalyst
- Good Combustion Practices

5.4.1.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Selective Catalytic Reduction
Selective Catalytic Reduction (SCR) chemically reduces the NO_X molecule into molecular nitrogen and water vapor. A nitrogen-based reagent such as ammonia is injected into the exhaust gas stream upstream of a catalyst. The reagent reacts selectively with the NO_X within a specific temperature range in the presence of the catalyst and oxygen to reduce the NO_X to nitrogen and water. SCR is capable of NO_X reduction efficiencies in the range of 80-95%.

The NO_X reduction reaction is only effective within a given temperature range, depending on the waste gas composition and type of catalyst. Optimum temperatures range from 600°F to 750°F for conventional catalyst types and 470°F to 510°F for platinum catalysts. SCR systems are capable of reducing NO_X in low-concentration waste streams (as low as 20 ppm). Above 850°F, ammonia begins to be oxidized to form additional NO_X. The optimal effectiveness is also dependent on the ammonia-to-NO_X ratio, space velocity, the ratio of flue gas flow rate to catalyst volume, and residence time.

The use of selective catalytic reduction is considered a technically feasible option for controlling emissions of NOx from the diesel-fired emergency generator.

Non-Selective Catalytic Reduction
Nonselective Catalytic Reduction also involves placing a catalyst in the exhaust stream of the engine and can simultaneously reduce NOx, CO, and VOCs. The reaction requires that the oxygen levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios. Under this condition, in the presence of the catalyst, NOx is reduced by the CO, resulting in nitrogen and CO_2. CO is oxidized to CO_2 and hydrocarbons are oxidized to CO_2 and water vapor. The catalyst used is generally a mixture of platinum and rhodium, with optimal catalyst operating temperatures between 800°F and 1,200°F. NOx can be reduced by 80-95% under rich-burn conditions.

The application of NSCR requires fuel-rich engine operation and is therefore limited to rich-burn engines (gasoline). Diesel engines tend to operate under lean-burn conditions. Therefore, NSCR is not considered to be technically feasible for the emergency diesel-fired engine.

Lean NOx Catalyst
Lean NOx catalysts use a porous material made of zeolite with a precious metal or base metal catalyst. NOx emissions are controlled by injecting a small amount of diesel fuel or other hydrocarbon reductant into the exhaust upstream of the catalyst, which reduces NOx to N_2. The zeolites provide sites to attract the hydrocarbons to facilitate the NOx reduction reactions. NOx reductions are in the range of 25-40%. The use of a lean NOx catalyst is a technically feasible control technology.

Good Combustion Practices
Maximum reduction of thermal NOx generation can be achieved by control of both the combustion temperature and the air-to-fuel ratio. Due to the high flame temperatures and pressures of internal combustion engines, the majority of NOx formed is thermal NOx. With diesel fuel, little fuel NOx is formed.

Combustion Controls may include exhaust gas recirculation, injection timing retard, air-to-fuel ratio, and water injection. Good combustion practices is a technically feasible control technology to reduce NOx emissions from the emergency generator.

5.4.1.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the control technologies may be ranked as follows for controlling NOx emissions from the diesel gas-fired emergency engine:

Control Technology	Pollution Control Efficiency (%)
Selective Catalytic Reduction	80-95%
Lean NOx Catalyst	25-40%
Good Combustion Practices	Reduction Varies

5.4.1.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations. As previously stated, EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency CI ICE. Based on EPA's economic analysis, Heidelberg has determined that the top remaining NOx control option, good combustion practices, will be applied to achieve compliance with the proposed BACT limit.

None of the emergency engines in the RBLC search results have any post-combustion controls. Heidelberg is proposing compliance with the 40 CFR 60 Subpart IIII limit, consistent with the great majority of projects listed in RBLC.

Table 5-9. Recent Permit Limitations and Determinations of BACT for NOx (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	NOx Limit	Control
Diesel Fired Emergency Generator	AL-0301	Nucor Steel Tuscaloosa, Inc.	7/22/2014	800 hp	0.015 lb/hp-hr	-
Escape Capsule Diesel Engine	FL-0347	Anadarko Petroleum Corporation	9/16/2014	39 hp	-	Use of good combustion practices based on the most recent manufacturer's specifications issued for engine
1,500 kW Emergency Diesel Generator	FL-0367	Shady Hills Energy Center, LLC	7/27/2018	14.82 MMBtu/hr	6.4 g/kW-hr	Operate and maintain the engine according to the manufacturer's written instructions
1,500 kW Emergency Diesel Generator	FL-0371	Shady Hills Energy Center, LLC	6/7/2021	14.82 MMBtu/hr	6.4 g/kW-hr	-
Emergency Generator (CC-GEN2)	IN-0359	Nucor Steel	3/30/2023	500 hp	3 g/hp-hr	Certified engine
EP 11-01 - Melt Shop Emergency Generator	KY-0110	Nucor	7/23/2020	260 hp	2.98 g/hp-hr	GCP
EP 10-07 - Air Separation Plant Emergency Generator	KY-0110	Nucor	7/23/2020	700 hp	4.77 g/hp-hr	GCP
EP 11-04 - IT Emergency Generator	KY-0110	Nucor	7/23/2020	190 hp	2.98 g/hp-hr	GCP
EP 11-05 - Radio Tower Emergency Generator	KY-0110	Nucor	7/23/2020	61 hp	3.5 g/hp-hr	GCP
Air Separation Unit Emergency Generator (EP 08-08)	KY-0115	Nucor Steel Gallatin, LLC	4/19/2021	700 hp	-	GCP
Cold Mill Complex Emergency Generator (EP 09-05)	KY-0115	Nucor Steel Gallatin, LLC	4/19/2021	350 hp	-	GCP

Emergency Generator Diesel Engines	LA-0364	FG LA LLC	1/6/2020	550 hp	-	Compliance with the limitations imposed by 40 CFR 63 Subpart IIII and operating the engine in accordance with the engine manufacturer's instructions and/or written procedures designed to maximize combustion efficiency and minimize fuel usage.
06-22 - AO-5 Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	4.24 lb/hr	GCP and compliance with NSPS Subpart IIII
53-22 - PAO Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	4.24 lb/hr	GCP and compliance with NSPS Subpart IIII
Emergency Engine/Generator	MA-0039	Footprint Power Salem Harbor Development LP	1/30/2014	7.4 MMBtu/hr	4.8 g/bhp-hr	-
Emergency Diesel Generator Engine (EUEMRGRICE in FGRICE)	MI-0421	Arauco North America	8/26/2016	500 hr/yr	22.6 lb/hr	Certified engines, limited operating hours.
EUEMENGINE (Diesel fuel emergency engine)	MI-0423	Indeck Niles, LLC	1/4/2017	22.68 MMBtu/hr	6.4 g/kW-hr	GCP and meeting NSPS IIII requirements.
EUEMRGRICE1 in FGRICE (Emergency diesel generator engine)	MI-0425	Arauco North America	5/9/2017	500 hr/yr	21.2 lb/hr	Certified engines, limited operating hours.
EUEMRGRICE2 in FGRICE (Emergency Diesel Generator Engine)	MI-0425	Arauco North America	5/9/2017	500 hr/yr	4.4 lb/hr	Certified engines, limited operating hours
EULIFESAFETYENG - One diesel-fueled emergency engine/generator	MI-0434	Ford Motor Company	3/22/2018	500 kW	4 g/hW-hr	GCP

EUEMENGINE (diesel fuel emergency engine)	MI-0445	Indeck Niles, LLC	11/26/2019	22.68 MMBtu/hr	6.4 g/kW-hr	GCP and meeting NSPS Subpart IIII requirements
Emergency diesel generator engine (EUEMRGRICE1 in FGRICE)	MI-0448	Arauco North America	12/18/2020	500 hr/yr	21.2 lb/hr	Certified engines, limited operating hours
Emergency diesel generator engine (EUEMRGRICE2 in FGRICE)	MI-0448	Arauco North America	12/18/2020	500 hr/yr	4.4 lb/hr	Certified Engines, Limited Operating Hours
EUFPRICE--A 315 HP diesel-fueled emergency engine	MI-0454	Lansing Board Of Water And Light	12/20/2022	2.5 MMBtu/hr	3 g/hp-hr	GCP
Emergency Diesel GEN	VA-0328	Novi Energy	4/26/2018	500 hr/yr	4.8 g/hp-hr	GCP and the use of ultra low sulfur diesel (S15 ULSD) fuel oil with a maximum sulfur content of 15 ppmw.
Emergency Diesel Generator - 300 kW	VA-0332	Chickahominy Power Llc	6/24/2019	500 hr/yr	4.8 g/hp-hr	GCP, high efficiency design, and the use of ultra low sulfur diesel (S15 ULSD) fuel oil with a maximum sulfur content of 15 ppmw.
Emergency Generator - ESDG14	WV-0027	Knauf Insulation Inc.	9/15/2017	900 bhp	4.77 g/hp-hr	Engine Design

5.4.1.5 Selection of BACT (Step 5)

There is a combined limit in NSPS Subpart IIII for NMHC (equivalent to VOC) and NOx. The applicable emission limit in NSPS Subpart IIII for the diesel-fired emergency generator is 6.4 g/kW-hr (equivalent to 4.77 g/hp-hr) for NMHC + NOx on a 3-hour average basis. Heidelberg proposes a BACT emission limit equivalent to the NSPS limit of 4.77 g/hp-hr for the diesel-fired emergency generator for NMHC + NOx.

To comply with the proposed BACT limit, Heidelberg purchased an engine certified by the manufacturer to meet the emissions level. Operation of the engine for the purposes of maintenance checks and readiness testing will be limited to 100 hours per year. Based on review of the RBLC database, Heidelberg believes that the proposed NOx BACT limit is consistent with established NOx limit for comparable emergency generators.

5.4.2 CO BACT Evaluation

Carbon monoxide (CO) emissions are formed during combustion processes because of incomplete combustion of carbon in the fuel. This occurs if there is a lack of available oxygen near the fuel molecule during combustion, if the gas temperature is too low, or if the residence time is too short.

5.4.2.1 Identification of Potential Control Technologies (Step 1)

Potentially available control options for reducing CO emissions from the diesel-fired emergency generator are listed below:

- Non-Selective Catalytic Reduction
- Diesel Oxidation Catalyst
- Diesel Particulate Filters
- Lean NOx Catalyst
- Good Combustion Practices

5.4.2.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Non-Selective Catalytic Reduction

Nonselective Catalytic Reduction (NSCR) involves placing a catalyst in the exhaust stream of the engine and can simultaneously reduce NOx, CO, and VOCs. The reaction requires that the oxygen levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios. Under this condition, in the presence of the catalyst, NOx is reduced by the CO, resulting in nitrogen and CO_2. CO is oxidized to CO_2 and hydrocarbons are oxidized to CO_2 and water vapor. The catalyst used is generally a mixture of platinum and rhodium, with optimal catalyst operating temperatures between 800°F and 1,200°F. CO can be reduced by 90-99% under rich-burn conditions.

The application of NSCR requires fuel-rich engine operation and is therefore limited to rich-burn engines (gasoline). Diesel engines tend to operate under lean-burn conditions. Therefore, NSCR is not considered to be technically feasible for the diesel-fired emergency generator.

Diesel Oxidation Catalyst

Diesel oxidation catalysts usually consist of a stainless steel canister that contains a honeycomb structure onto which catalytic metals such as platinum or palladium are coated. The diesel oxidation catalyst can reduce particulate, VOC, and CO emissions by oxidizing them at an adequate exhaust temperature to become CO_2 and water. CO emissions can be reduced by 70-99%. The use of a diesel oxidation catalyst is considered technically feasible for reducing CO emissions from the diesel-fired emergency generator.

Diesel Particulate Filters
Diesel particulate filters consist of a filter in the exhaust stream designed to collect a significant fraction of the particulate emissions while allowing the exhaust gases to pass through. After a pre-established pressure drop is reached, the buildup of particulate is often incinerated through the use of heat provided by a variety of sources such as fueled burners, electric heaters, engine intake, and throttling. The filter is then cleaned and regenerated for further use. Catalytic coatings on diesel particulate filters can also reduce CO and VOC emissions. CO emissions can be reduced by 90%. The use of diesel particulate filters is considered technically feasible for reducing CO emissions from the diesel-fired emergency generator.

Lean NOx Catalyst
Lean NOx catalysts use a porous material made of zeolite with a precious metal or base metal catalyst. NOx emissions are controlled by injecting a small amount of diesel fuel or other hydrocarbon reductant into the exhaust upstream of the catalyst, which reduces NOx to N_2. The zeolites provide sites to attract the hydrocarbons to facilitate the NOx reduction reactions and reduce CO emissions around 60%. The use of a lean NOx catalyst is considered technically feasible for reducing CO emissions from the diesel-fired emergency generator.

Good Combustion Practices
CO emissions are caused through incomplete combustion. When fuel and air are not well mixed in the combustion zone, low oxygen regions form where fuel will partially combust, resulting in CO and unburned hydrocarbons that exit with the exhaust. CO formation can be minimized by improving the fuel air mixing through enhanced fuel injection systems, air management systems, combustion system designs, and pre-mixed diesel combustion. Good combustion practices is considered technically feasible for reducing CO emissions form the diesel-fired emergency generator.

5.4.2.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the remaining control technologies may be ranked as follows for controlling CO emissions from diesel-fired emergency generator:

Control Technology	Pollution Control Efficiency (%)
Diesel Oxidation Catalyst	70-99%
Diesel Particulate Filter	90%
Lean NOx Catalyst	60%
Good Combustion Practices	Reduction Varies

5.4.2.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations. As previously stated, EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency CI ICE. Based on EPA's economic analysis, Heidelberg has determined that the top remaining CO control option, good combustion practices, will be applied to achieve compliance with the proposed BACT limit.

None of the emergency engines in the RBLC search results have any post-combustion controls. Heidelberg is proposing compliance with the 40 CFR 60 Subpart IIII limit, consistent with the great majority of projects listed in RBLC.

Table 5-10. Recent Permit Limitations and Determinations of BACT for CO (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	NOx Limit	Control
Diesel Fired Emergency Generator	AL-0301	Nucor Steel Tuscaloosa, Inc.	7/22/2014	800 hp	0.0055 lb/hp-hr	-
Escape Capsule Diesel Engine	FL-0347	Anadarko Petroleum Corporation	9/16/2014	39 hp	-	GCP based on the most recent manufacturer's specifications issued for engine
1,500 kW Emergency Diesel Generator	FL-0367	Shady Hills Energy Center, LLC	7/27/2018	14.82 MMBtu/hr	3.5 g/kW-hr	Operate and maintain the engine according to the manufacturer's written instructions
1,500 kW Emergency Diesel Generator	FL-0371	Shady Hills Energy Center, LLC	6/7/2021	14.82 MMBtu/hr	3.5 g/kW-hr	-
Emergency Generator (CC-GEN2)	IN-0359	Nucor Steel	3/30/2023	500 hp	2.61 g/hp-hr	Oxidation catalyst and certified engine
EP 11-01 - Melt Shop Emergency Generator	KY-0110	Nucor	7/23/2020	260 hp	2.61 g/hp-hr	GCP
EP 10-07 - Air Separation Plant Emergency Generator	KY-0110	Nucor	7/23/2020	700 hp	2.61 g/hp-hr	GCP
EP 11-04 - IT Emergency Generator	KY-0110	Nucor	7/23/2020	190 hp	2.61 g/hp-hr	GCP
EP 11-05 - Radio Tower Emergency Generator	KY-0110	Nucor	7/23/2020	61 hp	3.73 g/hp-hr	GCP
Air Separation Unit Emergency Generator (EP 08-08)	KY-0115	Nucor Steel Gallatin, LLC	4/19/2021	700 hp	-	GCP
Cold Mill Complex Emergency Generator (EP 09-05)	KY-0115	Nucor Steel Gallatin, LLC	4/19/2021	350 hp	-	GCP

Emergency Generator Diesel Engines	LA-0364	FG LA LLC	1/6/2020	550 hp	-	Compliance with the limitations imposed by 40 CFR 63 Subpart IIII and operating the engine in accordance with the engine manufacturer's instructions and/or written procedures designed to maximize combustion efficiency and minimize fuel usage.
06-22 - AO-5 Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	3.81 lb/hr	GCP and compliance with NSPS Subpart IIII
53-22 - PAO Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	3.81 lb/hr	GCP and compliance with NSPS Subpart IIII
Emergency Engine/Generator	MA-0039	Footprint Power Salem Harbor Development LP	1/30/2014	7.4 MMBtu/hr	2.6 g/hp-hr	-
Emergency Diesel Generator Engine (EUEMRGRICE in FGRICE)	MI-0421	Arauco North America	8/26/2016	500 hr/yr	3.5 g/kW-hr	GCP
EUEMENGINE (Diesel fuel emergency engine)	MI-0423	Indeck Niles, LLC	1/4/2017	22.68 MMBtu/hr	3.5 g/kW-hr	GCP and compliance with NSPS Subpart IIII
EUEMRGRICE1 in FGRICE (Emergency diesel generator engine)	MI-0425	Arauco North America	5/9/2017	500 hr/yr	3.5 g/kW-hr	GCP
EUEMRGRICE2 in FGRICE (Emergency Diesel Generator Engine)	MI-0425	Arauco North America	5/9/2017	500 hr/yr	3.5 g/kW-hr	GCP
EUFPRICE--A 315 HP diesel fueled emergency engine	MI-0441	Lansing Board of Water and Light	12/21/2018	2.5 MMBtu/hr	2.6 g/hp-hr	GCP

EUEMENGINE (diesel fuel emergency engine)	MI-0445	Indeck Niles, LLC	11/26/2019	22.68 MMBtu/hr	3.5 g/kW-hr	GCP and compliance with NSPS Subpart IIII
EUFPRICE--A 315 HP diesel fueled emergency engine	MI-0447	Lansing Board of Water and Light	1/7/2021	2.5 MMBtu/hr	2.6 g/hp-hr	GCP
Emergency diesel generator engine (EUEMRGRICE1 in FGRICE)	MI-0448	Arauco North America	12/18/2020	500 hr/yr	3.5 g/kW-hr	GCP
Emergency diesel generator engine (EUEMRGRICE2 in FGRICE)	MI-0448	Arauco North America	12/18/2020	500 hr/yr	3.5 g/kW-hr	GCP
EUFPRICE--A 315 HP diesel-fueled emergency engine	MI-0454	Lansing Board of Water and Light	12/20/2022	2.5 MMBtu/hr	2.6 g/hp-hr	GCP
Emergency Generator	TX-0939	Entergy Texas, Inc.	3/13/2023	18.7 MMBtu/hr	0.006 lb/hr	GCP, limited to 100 hr/yr
Emergency Diesel GEN	VA-0328	Novi Energy	4/26/2018	500 hr/yr	2.6 g/hp-hr	GCP and the use of ultra low sulfur diesel (S15 ULSD) fuel oil with a maximum sulfur content of 15 ppmw.
Emergency Diesel Generator - 300 kW	VA-0332	Chickahominy Power LLC	6/24/2019	500 hr/yr	2.6 g/hp-hr	GCP, high efficiency design, and the use of ultra low sulfur diesel (S15 ULSD) fuel oil with a maximum sulfur content of 15 ppmw.

5.4.2.5 Selection of BACT (Step 5)

Heidelberg proposes a CO BACT emission limit of 2.61 g/hp-hr (equivalent to 3.5 g/kW-hr) on a 3-hour average basis for the diesel-fired emergency generator, which is consistent with the applicable NSPS Subpart IIII emissions limit.[16]

To comply with the proposed BACT limits, Heidelberg purchased an engine certified by the manufacturer to meet the emissions level. Operation of the engine for the purposes of maintenance checks and readiness testing (per recommendations from the government, manufacturer/vendor, or insurance) will be limited to 100 hours per year. Based on review of the RBLC database, Heidelberg believes that the proposed CO BACT limit is consistent with the most stringent limits shown in the RBLC for comparable emergency generators.

5.4.3 VOC BACT Evaluation

VOCs from internal combustion engines result from incomplete combustion. This may be due to factors such as poor fuel and air mixing before or during combustion, incorrect air-to-fuel ratios, excessively large fuel drops, and/or low cylinder temperature due to excessive cooling. These are all factors related to the design and maintenance of the engine.

5.4.3.1 Identification of Potential Control Technologies (Step 1)

Using RBLC search and permit review results, potentially applicable VOC control technologies for RICE were identified. These technologies include:

- Non-Selective Catalytic Reduction
- Diesel Oxidation Catalyst
- Diesel Particulate Filters
- Lean NOx Catalyst
- Good Combustion Practices

5.4.3.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Non-Selective Catalytic Reduction
Nonselective Catalytic Reduction (NSCR) involves placing a catalyst in the exhaust stream of the engine and can simultaneously reduce NOx, CO, and VOCs. The reaction requires that the oxygen levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios. Under this condition, in the presence of the catalyst, NOx is reduced by the CO, resulting in nitrogen and CO_2. CO is oxidized to CO_2 and hydrocarbons are oxidized to CO_2 and water vapor. The catalyst used is generally a mixture of platinum and rhodium, with optimal catalyst operating temperatures between 800°F and 1,200°F. VOC can be reduced by 50-90% under rich-burn conditions.
The application of NSCR requires fuel-rich engine operation and is therefore limited to rich-burn engines (gasoline). Diesel engines tend to operate under lean-burn conditions. Therefore, NSCR is not considered to be technically feasible for the diesel-fired emergency generator.

Diesel Oxidation Catalyst
Diesel oxidation catalysts usually consist of a stainless steel canister that contains a honeycomb structure onto which catalytic metals such as platinum or palladium are coated. The diesel oxidation catalyst can reduce particulate, VOC and CO emissions by oxidizing them at an adequate exhaust temperature to

[16] Pursuant to §60.4202(b)(2) and §60.4205(b), the emergency generator engine must meet the Tier 2 emissions and opacity standards specified in §1039 Appendix I and §1039.105.

become CO2 and water. VOC emissions can be reduced by 60-99%. The use of a diesel oxidation catalyst is considered technically feasible for reducing VOC emissions from the diesel-fired emergency generator.

Diesel Particulate Filters
Diesel particulate filters consist of a filter in the exhaust stream designed to collect a significant fraction of the particulate emissions while allowing the exhaust gases to pass through. After a pre-established pressure drop is reached, the buildup of particulate is often incinerated through the use of heat provided by a variety of sources such as fueled burners, electric heaters, engine intake, and throttling. The filter is then cleaned and regenerated for further use. Catalytic coatings on diesel particulate filters can also reduce CO and VOC emissions. VOC emissions can be reduced by 60-80%. The use of diesel particulate filters is considered technically feasible for reducing VOC emissions from the diesel-fired emergency generator.

Lean NOx Catalyst
Lean NOx catalysts use a porous material made of zeolite with a precious metal or base metal catalyst. NOx emissions are controlled by injecting a small amount of diesel fuel or other hydrocarbon reductant into the exhaust upstream of the catalyst, which reduces NOx to N_2. The zeolites provide sites to attract the hydrocarbons to facilitate the NOx reduction reactions and reduce VOC emissions around 60%. The use of a lean NOx catalyst is considered technically feasible for reducing VOC emissions from the diesel-fired emergency generator.

Good Combustion Practices
VOC emissions are caused through incomplete combustion. When fuel and air are not well mixed in the combustion zone, low oxygen regions form where fuel will partially combust, resulting in VOC and unburned hydrocarbons that exit with the exhaust. VOC formation can be minimized by improving the fuel air mixing through enhanced fuel injection systems, air management systems, combustion system designs, and pre-mixed diesel combustion. Good combustion practices is considered technically feasible for reducing VOC emissions form the diesel-fired emergency generator.

5.4.3.3 Ranking of Remaining Control Technologies (Step 3)

Based on the technical feasibility analysis in Step 2, the remaining control technologies may be ranked as follows for controlling VOC emissions from diesel-fired emergency generator:

Control Technology	Pollution Control Efficiency (%)
Diesel Oxidation Catalyst	60-99%
Diesel Particulate Filter	60-80%
Lean NOx Catalyst	60%
Good Combustion Practices	Reduction Varies

5.4.3.4 Evaluation of Most Stringent Controls (Step 4)

The fourth step in a BACT analysis is to complete the top-down analysis of the applicable control technologies and document the results. The control technologies are evaluated on the basis of economic and environmental considerations. As previously stated, EPA determined in the development of NSPS IIII that add-on controls are economically infeasible for emergency CI ICE. Based on EPA's economic analysis, Heidelberg has determined that the top remaining VOC control option, good combustion practices, will be applied to achieve compliance with the proposed BACT limit.

None of the emergency engines in the RBLC search results have any post-combustion controls. Heidelberg is proposing compliance with the 40 CFR 60 Subpart IIII limit, consistent with the great majority of projects listed in RBLC.

Table 5-11. Recent Permit Limitations and Determinations of BACT for VOC (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	VOC Limit	Control
Escape Capsule Diesel Engine	FL-0347	Anadarko Petroleum Corporation	9/16/2014	39 hp	-	GCP based on the most recent manufacturer's specifications issued for engine
Emergency Generator (CC-GEN2)	IN-0359	Nucor Steel	3/30/2023	500 hp	1.13 g/hp-hr	Certified engine
EP 11-01 - Melt Shop Emergency Generator	KY-0110	Nucor	7/23/2020	260 hp	-	GCP
EP 10-07 - Air Separation Plant Emergency Generator	KY-0110	Nucor	7/23/2020	700 hp	-	GCP
EP 11-04 - IT Emergency Generator	KY-0110	Nucor	7/23/2020	190 hp	-	GCP
EP 11-05 - Radio Tower Emergency Generator	KY-0110	Nucor	7/23/2020	61 hp	-	GCP
Emergency Generator Diesel Engines	LA-0364	FG LA LLC	1/6/2020	550 hp	-	Compliance with the limitations imposed by 40 CFR 63 Subpart IIII and operating the engine in accordance with the engine manufacturer's instructions and/or written procedures designed to maximize combustion efficiency and minimize fuel usage
GEN-2 - Emergency Generator No. 2	LA-0390	Deridder Sawmill	5/10/2022	750 hp	1.98 lb/hr	GCP and maintenance and compliance with applicable 40 CFR 60 Subpart JJJJ limitation for VOC

06-22 - AO-5 Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	0.11 lb/hr	GCP and compliance with NSPS Subpart IIII
53-22 - PAO Emergency Generator	LA-0394	Shell Chemical LP	12/12/2023	670.5 hp	0.11 lb/hr	GCP and compliance with NSPS Subpart IIII
EUEMENGINE (Diesel fuel emergency engine)	MI-0423	Indeck Niles, LLC	1/4/2017	22.68 MMBtu/hr	1.87 lb/hr	GCP
Emergency Generator	TX-0939	Entergy Texas, Inc.	3/13/2023	18.7 Mmbtu/hr	0.001 lb/hr	GCP, limited to 100 hr/yr

5.4.3.5 Selection of BACT (Step 5)

There is a combined limit in NSPS Subpart IIII for NMHC (equivalent to VOC) and NO_X. The applicable emission limit in NSPS Subpart IIII for the diesel-fired emergency generator is 6.4 g/kW-hr (equivalent to 4.77 g/hp-hr) for NMHC + NO_X on a 3-hour average basis. Heidelberg proposes a BACT emission limit equivalent to the NSPS limit of 4.77 g/hp-hr for NMHC + NO_X, as stated previously.

To comply with the proposed BACT limits, Heidelberg purchased an engine certified by the manufacturer to meet these emissions levels. Operation of the engine for the purposes of maintenance checks and readiness testing will be limited to 100 hours per year. Based on review of the RBLC database, Heidelberg believes that the proposed VOC BACT limit is consistent with established VOC limit for comparable emergency generators.

5.4.4 GHG BACT Evaluation

CO_2 is by far the dominant GHG from this source. CH_4 and N_2O are present only in very small amounts, are incidental to combustion, and trend with the CO_2 emissions. There are no known supplemental controls for N_2O or methane emissions from diesel engines. To the extent measures are identified that reduce CO_2, the other GHGs may be also reduced accordingly. Therefore, this BACT analysis focused on CO_2 as a surrogate for all GHG emissions.

5.4.4.1 Identification of Potential Control Technologies (Step 1)

The available GHG emission control strategies for diesel-fired emergency generators that were analyzed as part of this BACT analysis include:

- Carbon Capture and Storage
- Good Combustion/Operating Practices and Fuel Efficient Design

5.4.4.2 Elimination of Technically Infeasible Control Technologies (Step 2)

Carbon Capture and Storage
Carbon sequestration involves separation and capture of CO_2 from the engine exhaust gases, pressurization of the captured CO_2, transportation of the captured CO_2 via pipeline, and injection and long-term geologic storage of the captured CO_2. The carbon sequestration technology is still under development and has not been demonstrated at any cement plant in the U.S. Currently, there are no available CO_2 pipelines that could transport emissions from the Mitchell plant.

Additionally, carbon capture and sequestration (CCS) is not considered an available control option for emergency equipment that operates on an intermittent basis and must be immediately available during plant emergencies without the constraint of starting up the CCS process. Therefore, CCS is considered technically infeasible.

Good Combustion/Operating Practices and Fuel Efficient Design
Good combustion and operating practices are a potential control option for maintaining the combustion efficiency of the emergency equipment. Good combustion practices include proper maintenance and tune-up of the emergency generator per the manufacturer's specifications.

Since Heidelberg is proposing to install a new emergency generator, the equipment will meet the latest efficiency and pollutant performance standards specified in NSPS Part 60 Subpart IIII and NESHAP Part 63 Subpart ZZZZ. The diesel engine is built with automatic control of the air-to-fuel ratio that ensures it operates when needed and meets the applicable standards. The use of good combustion/operating practices and a fuel efficient design is a technically feasible option for reducing CO_2 emissions from the diesel-fired emergency generator.

5.4.4.3 Ranking of Remaining Control Technologies (Step 3)

Good combustion practices is the only remaining technically feasible control option for minimizing CO_2 emissions from the diesel-fired emergency generator.

Control Technology	Pollution Control Efficiency (%)
Good Combustion/Operating Practices	Base Case

5.4.4.4 Evaluation of Most Stringent Controls (Step 4)

CCS is not considered an available control option for emergency equipment that operates on an intermittent basis and must be immediately available during plant emergencies without the constraint of starting up the CCS process. Operating the generator set using good combustion practices is a technically feasible CO_2 control option.

No adverse energy, environmental, or economic impacts are associated with fuel efficient engine selection for reducing GHG emissions from the emergency generator engine.

Table 5-12. Recent Permit Limitations and Determinations of BACT for GHG (2014 – 2024)

Process	RBLC ID	Facility	Permit Issuance Date	Production Capacity	GHG Limit	Control
Emergency Generator (CC-GEN2)	IN-0359	Nucor Steel	6/2/2022	500 hp	163.6 lb/MMBtu	Good engineering design and manufacturer's recommended operating and maintenance procedures.
EP 11-01 - Melt Shop Emergency Generator	KY-0110	Nucor	1/24/2020	260 hp	-	GCP
EP 10-07 - Air Separation Plant Emergency Generator	KY-0110	Nucor	1/24/2020	700 hp	-	GCP
EP 11-04 - IT Emergency Generator	KY-0110	Nucor	1/24/2020	190 hp	-	GCP
EP 11-05 - Radio Tower Emergency Generator	KY-0110	Nucor	1/24/2020	61 hp	-	GCP

Emergency Generator Diesel Engines	LA-0364	FG LA LLC	1/14/2019	550 hp	-	Compliance with the limitations imposed by 40 CFR 63 Subpart IIII and operating the engine in accordance with the engine manufacturer's instructions and/or written procedures designed to maximize combustion efficiency and minimize fuel usage.
06-22 - AO-5 Emergency Generator	LA-0394	Shell Chemical LP	2/3/2023	670.5 hp	-	GCP and compliance with NSPS Subpart IIII
53-22 - PAO Emergency Generator	LA-0394	Shell Chemical LP	2/3/2023	670.5 hp	-	GCP and compliance with NSPS Subpart IIII
Emergency Engine/Generator	MA-0039	Footprint Power Salem Harbor Development LP	9/9/2013	7.4 MMBtu/hr	162.85 lb/MM Btu	-
Emergency Diesel Generator Engine (EUEMRGRICE in FGRICE)	MI-0421	Arauco North America	6/30/2016	500 hr/yr	223 ton/yr	GCP
EUEMENGINE (Diesel fuel emergency engine)	MI-0423	Indeck Niles, LLC	10/25/2016	22.68 Mmbtu/hr	928 ton/yr	GCP
EUEMRGRICE1 in FGRICE (Emergency diesel generator engine)	MI-0425	Arauco North America	3/6/2017	500 hr/yr	209 ton/yr	GCP
EUEMRGRICE2 in FGRICE (Emergency Diesel Generator Engine)	MI-0425	Arauco North America	3/6/2017	500 hr/yr	70 ton/yr	GCP
EUFPRICE--A 315 HP diesel fueled emergency engine	MI-0441	Lansing Board of Water and Light	10/16/2018	2.5 MMBtu/hr	20 ton/yr	GCP and energy efficiency measures.

EUEMENGINE (diesel fuel emergency engine)	MI-0445	Indeck Niles, LLC	8/20/2019	22.68 Mmbtu/hr	928 ton/yr	GCP
EUFPRICE--A 315 HP diesel fueled emergency engine	MI-0447	Lansing Board of Water and Light	9/22/2020	2.5 MMBtu/hr	20 ton/yr	Low carbon fuel (pipeline quality natural gas), GCP and energy efficiency measures.
Emergency diesel generator engine (EUEMRGRICE1 in FGRICE)	MI-0448	Arauco North America	9/4/2020	500 hr/yr	590 ton/yr	GCP
Emergency diesel generator engine (EUEMRGRICE2 in FGRICE)	MI-0448	Arauco North America	9/4/2020	500 hr/yr	209 ton/yr	GCP
EUFPRICE--A 315 HP diesel-fueled emergency engine	MI-0454	Lansing Board of Water and Light	10/25/2022	2.5 MMBtu/hr	20 ton/yr	Low carbon fuel (pipeline quality natural gas), GCP and energy efficiency measures.
Emergency Engine Generators	TX-0766	Golden Pass Products, LLC	4/3/2015	750 hp	40 hr/yr	Equipment specifications & work practices - GCP and limited operational hours
Emergency Generator	TX-0939	Entergy Texas, Inc.	6/6/2022	18.7 Mmbtu/hr	-	GCP, limited to 100 hr/yr
Emergency Diesel GEN	VA-0328	Novi Energy	11/15/2017	500 hr/yr	981 ton/yr	use of S15 ULSD and high efficiency design and operation
Emergency Diesel Generator - 300 kW	VA-0332	Chickahominy Power LLC	11/5/2018	500 hr/yr	1203 ton/yr	GCP, high efficiency design, and the use of ultra low sulfur diesel (S15 ULSD) fuel oil with a maximum sulfur content of 15 ppmw.

5.4.4.5 Selection of BACT (Step 5)

Heidelberg has determined that good combustion practices and fuel efficient design is BACT for the proposed diesel-fired emergency generator. Heidelberg proposes a CO2e emission limit of 154.74 tons per 12 consecutive month period. The proposed CO_2 equivalent (CO_2e) limit is based on 500 hours of engine operation and the GHG Mandatory Reporting Rule emission factors for diesel-fired combustion (40 CFR 98, Subpart A) and the Global Warming Potentials of 1 lb CO_2e/lb CO_2, 25 lb CO_2e/lb CH_4, and 298 lb CO_2e/lb N_2O (40 CFR 98, equation A-1).

The limit is consistent in magnitude to other CO_2e emission limits in terms of tpy. The variability in tpy emission limits can be explained by variability in the horsepower ratings and engine specific fuel consumption rates for the engine.

APPENDIX A. APPLICATION FORMS

AIR PERMIT APPLICATION COVER SHEET

State Form 50639 (R4 / 1-10)

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

IDEM – Office of Air Quality – Permits Branch
100 N. Senate Avenue, MC 61-53 Room 1003
Indianapolis, IN 46204-2251
Telephone: (317) 233-0178 or
Toll Free: 1-800-451-6027 x30178 (within Indiana)
Facsimile Number: (317) 232-6749
www.IN.gov/idem

NOTES:

- The purpose of this cover sheet is to obtain the core information needed to process the air permit application. This cover sheet is required for all air permit applications submitted to IDEM, OAQ. Place this cover sheet on top of all subsequent forms and attachments that encompass your air permit application packet.
- Submit the completed air permit application packet, including all forms and attachments, to **IDEM Air Permits Administration** using the address in the upper right hand corner of this page.
- IDEM will send a bill to collect the filing fee and any other applicable fees.
- Detailed instructions for this form are available on the Air Permit Application Forms website.

FOR OFFICE USE ONLY
PERMIT NUMBER:
093-48031-00002 AI# 11776
DATE APPLICATION WAS RECEIVED:
Received by State of Indiana IDEM - OAQ Via Email 7/1/2024 KB-3

1. Tax ID Number: [redacted]

PART A: Purpose of Application

Part A identifies the purpose of this air permit application. For the purposes of this form, the term "source" refers to the plant site as a whole and NOT to individual emissions units.

2. Source / Company Name: Heidelberg Materials US Cement LLC **3. Plant ID:** 093 – 0002

4. Billing Address: 180 North Meridian Road

City: Mitchell **State:** IN **ZIP Code:** 47446 –

5. Permit Level: ☐ Exemption ☐ Registration ☐ SSOA ☐ MSOP ☐ FESOP ☒ TVOP ☐ PBR

6. Application Summary: *Check all that apply. Multiple permit numbers may be assigned as needed based on the choices selected below.*

☐ Initial Permit ☐ Renewal of Operating Permit ☐ Asphalt General Permit
☐ Review Request ☐ Revocation of Operating Permit ☐ Alternate Emission Factor Request
☐ Interim Approval ☐ Relocation of Portable Source ☐ Acid Deposition (Phase II)
☐ Site Closure ☐ Emission Reduction Credit Registry

☐ Transition (between permit levels) *From:* *To:*

☐ Administrative Amendment: ☐ *Company Name Change* ☐ *Change of Responsible Official*
☐ *Correction to Non-Technical Information* ☐ *Notice Only Change*
☐ *Other (specify):*

☒ Modification: ☐ *New Emission Unit or Control Device* ☐ *Modified Emission Unit or Control Device*
☐ *New Applicable Permit Requirement* ☐ *Change to Applicability of a Permit Requirement*
☒ *Prevention of Significant Deterioration* ☐ *Emission Offset* ☐ *MACT Preconstruction Review*
☐ *Minor Source Modification* ☐ *Significant Source Modification*
☐ *Minor Permit Modification* ☒ *Significant Permit Modification*
☐ *Other (specify):*

7. Is this an application for an initial construction and/or operating permit for a **"Greenfield" Source**? ☐ Yes ☒ No

8. Is this an application for construction of a new emissions unit at an **Existing Source**? ☐ Yes ☒ No

Continued on Next Page

PART B: Pre-Application Meeting

Part B specifies whether a meeting was held or is being requested to discuss the permit application.

9. Was a meeting held between the company and IDEM prior to submitting this application to discuss the details of the project?

☐ No ☒ Yes: *Date:* 4/10/2024

10. Would you like to schedule a meeting with IDEM management and your permit writer to discuss the details of this project?

☒ No ☐ Yes: *Proposed Date for Meeting:*

PART C: Confidential Business Information

Part C identifies permit applications that require special care to ensure that confidential business information is kept separate from the public file.

Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in the Indiana Administrative Code (IAC). To ensure that your information remains confidential, refer to the IDEM, OAQ information regarding submittal of confidential business information. For more information on confidentiality for certain types of business information, please review IDEM's Nonrule Policy Document Air-031-NPD regarding Emission Data.

11. Is any of the information contained within this application being claimed as **Confidential Business Information**?

☒ No ☐ Yes

PART D: Certification Of Truth, Accuracy, and Completeness

Part D is the official certification that the information contained within the air permit application packet is truthful, accurate, and complete. Any air permit application packet that we receive without a signed certification will be deemed incomplete and may result in denial of the permit.

For a Part 70 Operating Permit (TVOP) or a Source Specific Operating Agreement (SSOA), a "responsible official" as defined in 326 IAC 2-7-1(34) must certify the air permit application. For all other applicants, this person is an "authorized Individual" as defined in 326 IAC 2-1.1-1(1).

☒ *I certify under penalty of law that, based on information and belief formed after reasonable inquiry, the statements and information contained in this application are true, accurate, and complete.*

Tracy Crowther
Name *(typed)*

Plant Manager
Title

Tracy Crowther
Signature

7/1/2024
Date

OAQ GENERAL SOURCE DATA APPLICATION
GSD-01: Basic Source Level Information

State Form 50640 (R5 / 1-10)
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Received by
State of Indiana
IDEM - OAQ
Via Email 7/1/2024 KB-3

IDEM – Office of Air Quality – Permits Branch
100 N. Senate Avenue, MC 61-53 Room 1003
Indianapolis, IN 46204-2251
Telephone: (317) 233-0178 or
Toll Free: 1-800-451-6027 x30178 (within Indiana)
Facsimile Number: (317) 232-6749
www.IN.gov/idem

NOTES:

- The purpose of GSD-01 is to provide essential information about the entire source of air pollutant emissions. GSD-01 is a required form.
- Detailed instructions for this form are available on the Air Permit Application Forms website.
- All information submitted to IDEM will be made available to the public unless it is submitted under a claim of confidentiality. Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in 326 IAC 17.1-4-1. Failure to follow these requirements exactly will result in your information becoming a public record, available for public inspection.

PART A: Source / Company Location Information

1. Source / Company Name: Heidelberg Materials US Cement LLC — **2. Plant ID**: 093 – 0002

3. Location Address: 180 North Meridian Road

City: Mitchell | **State**: IN | **ZIP Code**: 47446 –

4. County Name: Lawrence | **5. Township Name**: Marion

6. Geographic Coordinates:

Latitude: 38° 44' 08" | **Longitude**: 86° 27: 09"

7. Universal Transferal Mercadum Coordinates *(if known)*:

Zone: 16 | **Horizontal**: 547.100 | **Vertical**: 4287.400

8. Adjacent States: Is the source located within 50 miles of an adjacent state?

☐ No ☒ Yes – *Indicate Adjacent State(s):* ☐ Illinois (IL) ☐ Michigan (MI) ☐ Ohio (OH) ☒ Kentucky (KY)

9. Attainment Area Designation: Is the source located within a non-attainment area for any of the criteria air pollutants?

☒ No ☐ Yes – *Indicate Nonattainment Pollutant(s):* ☐ CO ☐ Pb ☐ NO_x ☐ O_3 ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ SO_2

10. Portable / Stationary: Is this a portable or stationary source? ☐ Portable ☒ Stationary

PART B: Source Summary

11. Company Internet Address *(optional)*:

12. Company Name History: Has this source operated under any other name(s)?

☐ No ☒ Yes – *Provide information regarding past company names in Part I, Company Name History.*

13. Portable Source Location History: Will the location of the portable source be changing in the near future?

☒ Not Applicable ☐ No ☐ Yes – *Complete Part J, Portable Source Location History, and Part K, Request to Change Location of Portable Source.*

14. Existing Approvals: Have any exemptions, registrations, or permits been issued to this source?

☐ No ☒ Yes – *List these permits and their corresponding emissions units in Part M, Existing Approvals.*

15. Unpermitted Emissions Units: Does this source have any unpermitted emissions units?

☒ No ☐ Yes – *List all unpermitted emissions units in Part N, Unpermitted Emissions Units.*

16. New Source Review: Is this source proposing to construct or modify any emissions units?

☒ No ☐ Yes – *List all proposed new construction in Part O, New or Modified Emissions Units.*

17. Risk Management Plan: Has this source submitted a Risk Management Plan?

☒ Not Required ☐ No ☐ Yes → Date submitted: EPA Facility Identifier: – –

Continued on Next Page

PART C: Source Contact Information

IDEM will send the original, signed permit decision to the person identified in this section. This person MUST be an employee of the permitted source.

18. Name of Source Contact Person: Michael Harding		
19. Title *(optional)*: Environmental Manager		
20. Mailing Address: 200 Mill Creek Road		
City: Mitchell	**State**: IN	**ZIP Code**: 47446 –
21. Electronic Mail Address *(optional)*: Michael.Harding@heidelbergmaterials.com		
22. Telephone Number: (812) 620 – 8714	**23. Facsimile Number** *(optional)*: ( ) –	

PART D: Authorized Individual/Responsible Official Information

IDEM will send a copy of the permit decision to the person indicated in this section, if the Authorized Individual or Responsible Official is different from the Source Contact specified in Part C.

24. Name of Authorized Individual or Responsible Official: Tracy Crowther		
25. Title: Plant Manager		
26. Mailing Address: 200 Mill Creek Road		
City: Mitchell	**State**: IN	**ZIP Code**: 47446 –
27. Telephone Number: (812) 849 – 7018	**28. Facsimile Number** *(optional)*: ( ) –	

29. Request to Change the Authorized Individual or Responsible Official: Is the source officially requesting to change the person designated as the Authorized Individual or Responsible Official in the official documents issued by IDEM, OAQ? *The permit may list the title of the Authorized Individual or Responsible Official in lieu of a specific name.*

☒ No ☐ Yes – ***Change Responsible Official to***:

PART E: Owner Information

30. Company Name of Owner: Heidelberg Materials US, Inc.		
31. Name of Owner Contact Person: Adam Swercheck		
32. Mailing Address: 7660 Imperial Way		
City: Allentown	**State**: PA	**ZIP Code**: 18195 – 1040
33. Telephone Number: (610) 295 – 1906	**34. Facsimile Number** *(optional)*: ( ) –	

34. Operator: Does the "Owner" company also operate the source to which this application applies?

☐ No – *Proceed to Part F below.* ☒ Yes – *Enter "SAME AS OWNER" on line 35 and proceed to Part G below.*

PART F: Operator Information

35. Company Name of Operator: Same As Owner		
36. Name of Operator Contact Person:		
37. Mailing Address:		
City:	**State**:	**ZIP Code**: –
38. Telephone Number: ( ) –	**39. Facsimile Number** *(optional)*: ( ) –	

Continued on Next Page

PART G: Agent Information

40. Company Name of Agent: Trinity Consultants

41. Type of Agent: ☒ Environmental Consultant ☐ Attorney ☐ Other (specify):

42. Name of Agent Contact Person: Emily Stewart

43. Mailing Address: 8900 Keystone Crossing, Suite 1070

City: Indianapolis | **State**: IN | **ZIP Code**: 46240 –

44. Electronic Mail Address *(optional)*: estewart@trinityconsultants.com

45. Telephone Number: (317) 451 – 8102 | **46. Facsimile Number** *(optional)*: ( ) –

47. Request for Follow-up: Does the "Agent" wish to receive a copy of the preliminary findings during the public notice period (if applicable) and a copy of the final determination? ☒ No ☐ Yes

PART H: Local Library Information

48. Date application packet was filed with the local library: Within 10 days of submittal of review request

49. Name of Library: Mitchell Community Public Library

50. Name of Librarian *(optional)*:

51. Mailing Address: 804 Main Street

City: Mitchell | **State**: IN | **ZIP Code**: 47446 –

52. Internet Address *(optional)*: www.mitchell.lib.in.us

53. Electronic Mail Address *(optional)*:

54. Telephone Number: (812) 849 – 2412 | **55. Facsimile Number** *(optional)*: ( ) –

PART I: Company Name History *(if applicable)*

Complete this section only if the source has previously operated under a legal name that is different from the name listed above in Section A.

56. Legal Name of Company	57. Dates of Use	
Lehigh Cement Company	2001	to 2010
Lehigh Portland Cement Company	1902	to 2001
Lehigh Cement Company LLC	2010	to 2022
Heidelberg Materials US Cement LLC	2023	to Current
		to
		to
		to
		to
		to
		to

58. Company Name Change Request: Is the source officially requesting to change the legal name that will be printed on all official documents issued by IDEM, OAQ?

☒ No ☐ Yes – ***Change Company Name to:***

Continued on Next Page

PART J: Portable Source Location History *(if applicable)*

Complete this section only if the source is portable and the location has changed since the previous permit was issued. The current location of the source should be listed in Section A.

59. Plant ID	60. Location of the Portable Source	61. Dates at this Location
–	N/A	to
–		to
–		to
–		to
–		to
–		to
–		to
–		to
–		to
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–		to
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–		to
–		to
–		to
–		to
–		to
–		to

PART K: Request to Change Location of Portable Source *(if applicable)*

Complete this section to request a change of location for a portable source.

62. Current Location:		
Address: N/A		
City:	**State**:	**ZIP Code**: –
County Name:		
63. New Location:		
Address: N/A		
City:	**State**:	**ZIP Code**: –
County Name:		

Continued on Next Page

PART L: Source Process Description

Complete this section to summarize the main processes at the source.

64. Process Description	65. Products	66. SIC Code	67. NAICS Code
Portland Cement Manufacturing Plant	Gray Portland Cement and Masonry Products	3241	32731

PART M: Existing Approvals *(if applicable)*

Complete this section to summarize the approvals issued to the source since issuance of the main operating permit.

68. Permit ID	69. Emissions Unit IDs	70. Expiration Date
45783	Title V Renewal	3/08/2028

PART N: Unpermitted Emissions Units *(if applicable)*

Complete this section only if the source has emission units that are not listed in any permit issued by IDEM, OAQ.

71. Emissions Unit ID	72. Type of Emissions Unit	73. Actual Dates		
		Began Construction	Completed Construction	Began Operation
	N/A			

PART O: New or Modified Emissions Units *(if applicable)*

Complete this section only if the source is proposing to add new emission units or modify existing emission units.

74. Emissions Unit ID	75. NEW	76. MOD	77. Type of Emissions Unit	78. Estimated Dates		
				Begin Construction	Complete Construction	Begin Operation
			N/A			

OAQ FEDERAL RULE INCORPORATION APPLICATION
FED-01: Summary of Federal Requirements – NSPS & NESHAP

State Form 53512 (R / 1-10)
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

IDEM – Office of Air Quality – Permits Branch
100 N. Senate Avenue, MC 61-53, Room 1003
Indianapolis, IN 46204-2251
Telephone: (317) 233-0178 or
Toll Free: 1-800-451-6027 x30178 (within Indiana)
Facsimile Number: (317) 232-6749
www.in.gov/idem

NOTES:

- The purpose of this form is to provide a standardized way for sources to identify the NSPS or NESHAP requirements that are applicable to the regulated source. Complete one (1) form for each federal rule that applies to the source. This is a required form.
- Detailed instructions for this form are available on the Air Permit Application Forms website.
- All information submitted to IDEM will be made available to the public unless it is submitted under a claim of confidentiality. Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in 326 IAC 17.1-4-1. Failure to follow these requirements exactly will result in your information becoming a public record.

Part A: Identification of Applicable Standard	
Part A identifies the applicable standard and affected source.	
1. Type of Standard:	☒ Part 60 NSPS ☐ Part 61 NESHAP ☐ Part 63 NESHAP (MACT)
2. Subpart Letter:	IIII
3. Source Category Name:	Stationary Compression Ignition Internal Combustion Engine
4. Affected Source *(Include all applicable emission unit IDs)*:	Diesel-Fired Emergency generator

Part B: Applicable Requirements

Part B specifies the specific requirements of the federal rule that are applicable to the process or emission unit.

5. Applicable Requirements: *Identify the section of the federal standard that is applicable at the lowest subsection level. For example, if all of 40 CFR 63.342(c) is applicable, "40 CFR 63.342(c)" is the appropriate citation. If only paragraph 2 of 40 CFR 63.342(c) is applicable, then the appropriate citation is 40 CFR 63.342(c)(2).*

- 40 CFR 60.4200(a)(2)(i), (a)(4)
- 40 CFR 60.4205(b)
- 40 CFR 60.4206
- 40 CFR 60.4207(b)
- 40 CFR 60.4209(a)
- 40 CFR 60.4211(a),(c),(f)(1), (f)(2)(i), (g)(3)
- 60 CFR 60.4218
- 40 CFR 60.4219
- Table 8

Continued on Next Page

Part C: Performance Testing Requirements	
Part C identifies the performance testing requirements that are applicable to the process or emission unit.	
6. Performance Testing:	N/A
7. Date of Initial Performance Test:	N/A
8. Test Methods:	N/A
9. Was the initial performance test approved by IDEM?	☐ Yes: *Date approved:* _____ ☐ No
10. Did the initial performance test show compliance with the rule?	☐ Yes ☐ No: *Date of next performance test:* _____

Part D: Important Dates		
Part D identifies specific dates associated with the federal standard that are applicable to the process or emission unit.		
11. Date Initial Notification was Submitted:	N/A	
12. Initial Compliance Date:	☒ Startup: TBD ☐ Other: _____	
13. Other Dates	Description: _____	Date: _____
	Description: _____	Date: _____
	Description: _____	Date: _____

Part E: Other Information
Part E identifies any additional information pertaining to the applicable federal rule. Attach additional information using form GSD-09 as necessary.
N/A

OAQ FEDERAL RULE INCORPORATION APPLICATION
FED-01: Summary of Federal Requirements – NSPS & NESHAP

State Form 53512 (R / 1-10)

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

IDEM – Office of Air Quality – Permits Branch
100 N. Senate Avenue, MC 61-53, Room 1003
Indianapolis, IN 46204-2251
Telephone: (317) 233-0178 or
Toll Free: 1-800-451-6027 x30178 (within Indiana)
Facsimile Number: (317) 232-6749
www.in.gov/idem

NOTES:

- The purpose of this form is to provide a standardized way for sources to identify the NSPS or NESHAP requirements that are applicable to the regulated source. Complete one (1) form for each federal rule that applies to the source. This is a required form.
- Detailed instructions for this form are available on the Air Permit Application Forms website.
- All information submitted to IDEM will be made available to the public unless it is submitted under a claim of confidentiality. Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in 326 IAC 17.1-4-1. Failure to follow these requirements exactly will result in your information becoming a public record.

Part A: Identification of Applicable Standard	
Part A identifies the applicable standard and affected source.	
1. Type of Standard:	☒ Part 60 NSPS ☐ Part 61 NESHAP ☐ Part 63 NESHAP (MACT)
2. Subpart Letter:	JJJJ
3. Source Category Name:	Stationary Spark Ignition Internal Combustion Engine
4. Affected Source *(Include all applicable emission unit IDs)*:	Natural Gas-Fired Emergency generator

Part B: Applicable Requirements

Part B specifies the specific requirements of the federal rule that are applicable to the process or emission unit.

5. Applicable Requirements: *Identify the section of the federal standard that is applicable at the lowest subsection level. For example, if all of 40 CFR 63.342(c) is applicable, "40 CFR 63.342(c)" is the appropriate citation. If only paragraph 2 of 40 CFR 63.342(c) is applicable, then the appropriate citation is 40 CFR 63.342(c)(2).*

- 40 CFR 60.4230(a)(4)(iv), (a)(6), (e)
- 40 CFR 60.4233(e)
- 40 CFR 60.4234
- 40 CFR 60.4236
- 40 CFR 60.4237(c)
- 40 CFR 60.4243(b)(1), (d)(1), (d)(2)(i), (d)(3), (e)
- 60 CFR 60.4245(a), (b), (e)
- 40 CFR 60.4246
- 40 CFR 60.4248
- Table 1 (Emegrency, 25 < HP < 130 requirement)
- Table 3
- Table 3

Continued on Next Page

Part C: Performance Testing Requirements	
Part C identifies the performance testing requirements that are applicable to the process or emission unit.	
6. Performance Testing:	N/A
7. Date of Initial Performance Test:	N/A
8. Test Methods:	N/A
9. Was the initial performance test approved by IDEM?	☐ Yes: *Date approved:* _____ ☐ No
10. Did the initial performance test show compliance with the rule?	☐ Yes ☐ No: *Date of next performance test:* _____

Part D: Important Dates		
Part D identifies specific dates associated with the federal standard that are applicable to the process or emission unit.		
11. Date Initial Notification was Submitted:	TBD	
12. Initial Compliance Date:	☒ Startup: TBD ☐ Other: _____	
13. Other Dates	Description: _____	Date: _____
	Description: _____	Date: _____
	Description: _____	Date: _____

Part E: Other Information
Part E identifies any additional information pertaining to the applicable federal rule. Attach additional information using form GSD-09 as necessary.
N/A

OAQ FEDERAL RULE INCORPORATION APPLICATION
FED-01: Summary of Federal Requirements – NSPS & NESHAP

State Form 53512 (R / 1-10)
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

IDEM – Office of Air Quality – Permits Branch
100 N. Senate Avenue, MC 61-53, Room 1003
Indianapolis, IN 46204-2251
Telephone: (317) 233-0178 or
Toll Free: 1-800-451-6027 x30178 (within Indiana)
Facsimile Number: (317) 232-6749
www.in.gov/idem

NOTES:

- The purpose of this form is to provide a standardized way for sources to identify the NSPS or NESHAP requirements that are applicable to the regulated source. Complete one (1) form for each federal rule that applies to the source. This is a required form.
- Detailed instructions for this form are available on the Air Permit Application Forms website.
- All information submitted to IDEM will be made available to the public unless it is submitted under a claim of confidentiality. Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in 326 IAC 17.1-4-1. Failure to follow these requirements exactly will result in your information becoming a public record.

Part A: Identification of Applicable Standard	
Part A identifies the applicable standard and affected source.	
1. Type of Standard:	☐ Part 60 NSPS ☐ Part 61 NESHAP ☒ Part 63 NESHAP (MACT)
2. Subpart Letter:	ZZZZ
3. Source Category Name:	Reciprocating Internal Combustion Engines (RICE)
4. Affected Source *(Include all applicable emission unit IDs)*:	Diesel-Fired Emergency Generator

Part B: Applicable Requirements

Part B specifies the specific requirements of the federal rule that are applicable to the process or emission unit.

5. Applicable Requirements: *Identify the section of the federal standard that is applicable at the lowest subsection level. For example, if all of 40 CFR 63.342(c) is applicable, "40 CFR 63.342(c)" is the appropriate citation. If only paragraph 2 of 40 CFR 63.342(c) is applicable, then the appropriate citation is 40 CFR 63.342(c)(2).*

- 40 CFR 63.6580
- 40 CFR 63.6585(a),(b)
- 40 CFR 63.6590(a)(2)(i), (b)(1)((i)
- 40 CFR 63.6645(f)

Continued on Next Page

Part C: Performance Testing Requirements

Part C identifies the performance testing requirements that are applicable to the process or emission unit.

6. Performance Testing:	N/A
7. Date of Initial Performance Test:	N/A
8. Test Methods:	N/A
9. Was the initial performance test approved by IDEM?	☐ Yes: *Date approved:* _____ ☐ No
10. Did the initial performance test show compliance with the rule?	☐ Yes ☐ No: *Date of next performance test:* _____

Part D: Important Dates

Part D identifies specific dates associated with the federal standard that are applicable to the process or emission unit.

11. Date Initial Notification was Submitted:	TBD
12. Initial Compliance Date:	☒ Startup: TBD ☐ Other: _____
13. Other Dates	Description: _____ Date: _____ Description: _____ Date: _____ Description: _____ Date: _____

Part E: Other Information

Part E identifies any additional information pertaining to the applicable federal rule. Attach additional information using form GSD-09 as necessary.

N/A

OAQ FEDERAL RULE INCORPORATION APPLICATION
FED-01: Summary of Federal Requirements – NSPS & NESHAP

State Form 53512 (R / 1-10)

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NOTES:

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- Detailed instructions for this form are available on the Air Permit Application Forms website.
- All information submitted to IDEM will be made available to the public unless it is submitted under a claim of confidentiality. Claims of confidentiality must be made at the time the information is submitted to IDEM, and must follow the requirements set out in 326 IAC 17.1-4-1. Failure to follow these requirements exactly will result in your information becoming a public record.

Part A: Identification of Applicable Standard	
Part A identifies the applicable standard and affected source.	
1. Type of Standard:	☐ Part 60 NSPS ☐ Part 61 NESHAP ☒ Part 63 NESHAP (MACT)
2. Subpart Letter:	ZZZZ
3. Source Category Name:	Reciprocating Internal Combustion Engines (RICE)
4. Affected Source *(Include all applicable emission unit IDs)*:	Natural Gas-Fired Emergency Generator

Part B: Applicable Requirements

Part B specifies the specific requirements of the federal rule that are applicable to the process or emission unit.

5. Applicable Requirements: *Identify the section of the federal standard that is applicable at the lowest subsection level. For example, if all of 40 CFR 63.342(c) is applicable, "40 CFR 63.342(c)" is the appropriate citation. If only paragraph 2 of 40 CFR 63.342(c) is applicable, then the appropriate citation is 40 CFR 63.342(c)(2).*

- 40 CFR 63.6580
- 40 CFR 63.6585(a),(b)
- 40 CFR 63.6590(a)(2)(ii) and (c)(6)

Continued on Next Page

Part C: Performance Testing Requirements	
Part C identifies the performance testing requirements that are applicable to the process or emission unit.	
6. Performance Testing:	N/A
7. Date of Initial Performance Test:	N/A
8. Test Methods:	N/A
9. Was the initial performance test approved by IDEM?	☐ Yes: *Date approved:* _____ ☐ No
10. Did the initial performance test show compliance with the rule?	☐ Yes ☐ No: *Date of next performance test:* _____

Part D: Important Dates		
Part D identifies specific dates associated with the federal standard that are applicable to the process or emission unit.		
11. Date Initial Notification was Submitted:	N/A	
12. Initial Compliance Date:	☒ Startup: TBD ☐ Other: _____	
13. Other Dates	Description: _____	Date: _____
	Description: _____	Date: _____
	Description: _____	Date: _____

Part E: Other Information
Part E identifies any additional information pertaining to the applicable federal rule. Attach additional information using form GSD-09 as necessary.
N/A

APPENDIX B. EMISSION CALCULATIONS

Appendix B: Emission Calculations
New Units Summary
Company Name: Heidelberg Materials US Cement LLC
Source Address: 180 North Meridian Road, Mitchell, Indiana 47446

Uncontrolled Emissions from New Emission Units (tons/year)

	PM	PM10	PM2.5	SO2	NOx	VOC	CO
Generators	0.03	0.03	0.03	0.28	1.55	1.49	1.04
Exemption Thresholds	5	5	5	10	10	10	25
Source Modification Required?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Appendix B: Emission Calculations
Potential Emissions from Generators
Company Name: Heidelberg Materials US Cement LLC
Source Address: 180 North Meridian Road, Mitchell, Indiana 47446

New Natural Gas-Fired Emergency Generator

Unit ID	Power Output Capacity	Power Output Capacity	Heat Input Capacity
	(kW)	*(hp)*	*(MMBtu/hr)*
Emergency Generator	80	122	0.85

Maximum Hours Operated per Year: 500

	Pollutants										
Criteria Pollutants	PM[3]	PM_{10} [3]	$PM_{2.5}$ [3]	SO_2	NO_X	VOC	CO	CO_2	CH_4	N_2O	CO_2e (GHGs)[4]
Emission Factor[1] (lb/MMBtu)	9.50E-03	1.94E-02	1.94E-02	5.88E-04	-	-	-	-	-	-	-
Emission Factor[2] (g/hp-hr)	-	-	-	-	2.00	1.00	4.00	-	-	-	-
Emission Factor[2] (kg/MMBtu)								53.06	0.001	0.00010	-
Potential Emissions (tons/yr)	2.03E-03	4.14E-03	4.14E-03	1.26E-04	0.13	0.07	0.27	24.97	4.71E-04	4.71E-05	25.00

Hazardous Air Pollutants[5] (HAPs)

Pollutant	Emission Factor (lb/MMBtu)	Potential Emissions (tons/yr)
Acetaldehyde	2.79E-03	5.96E-04
Acrolein	2.63E-03	5.62E-04
Benzene	1.58E-03	3.37E-04
1,3-Butadiene	6.63E-04	1.42E-04
Formaldehyde	2.05E-02	4.38E-03
Methanol	3.06E-03	6.53E-04
Total PAH[6]	1.41E-04	3.01E-05
Toluene	5.58E-04	1.19E-04
Xylene	1.95E-04	4.16E-05
	Total	**6.86E-03**

New Diesel-Fired Emergency Generator

Unit ID	Power Output Capacity	Power Output Capacity	Potential Throughput	Potential Fuel Usage
	(kW)	*(hp)*	*(hp-hr/yr)*	*(MMBtu/hr)*
Emergency Generator	400	536	268,200	3.75

Maximum Hours Operated per Year: 500

	Pollutants										
Criteria Pollutants	PM [8,10]	PM_{10} [8,10]	$PM_{2.5}$ [8,10]	SO_2	NO_X [9]	VOC [9]	CO [9]	CO_2	CH_4	N_2O	CO_2e (GHGs)[4]
Emission Factor[7] (lb/hp-hr)	-	-	-	0.0021	-	-	-	1.15	-	-	-
Emission Factor (g/hp-hr)	0.10	0.10	0.10	-	4.80	4.80	2.61	-	-	-	-
Emission Factor[11] (kg/MMBtu)	-	-	-	-	-	-	-	-	0.003	0.0006	-
Potential Emissions (tons/yr)	2.96E-02	2.96E-02	2.96E-02	0.27	1.42	1.42	0.77	154.22	6.21E-03	1.24E-03	154.74

Hazardous Air Pollutants[12] (HAPs)

Pollutant	Emission Factor (lb/MMBtu)	Potential Emissions (tons/yr)
Benzene	9.33E-04	8.76E-04
Toluene	4.09E-04	3.84E-04
Xylene	2.85E-04	2.68E-04
1,3-Butadiene	3.91E-05	3.67E-05
Formaldehyde	1.18E-03	1.11E-03
Acetaldehyde	7.67E-04	7.20E-04
Acrolein	9.25E-05	8.68E-05
Total PAH[6]	1.68E-04	1.58E-04
	Total	**3.64E-03**

Total from New Generators

	Pollutants										
Criteria Pollutants	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_X	VOC	CO	CO_2	CH_4	N_2O	CO_2e (GHGs)
Potential Emissions (tons/yr)	0.03	0.03	0.03	0.28	1.55	1.49	1.04	179.19	0.01	0.00	179.74

Hazardous Air Pollutants (HAPs)

Total HAP	1.05E-02	
Maximum Single HAP	5.48E-03	(Formaldehyde)

Notes

1. Emission Factors are from AP-42 (Supplement F, July 2000), Table 3.2-3 for natural gas-fired 4-stroke rich-burn engines.
2. Emission limits per BACT analysis.
3. PM emission factor is for filterable PM-10. PM10 emission factor is filterable PM10 + condensable PM. PM2.5 emission factor is filterable PM2.5 + condensable PM.
4. The GHG emissions are calculated using equation A-1 from 40 CFR Part 98, Subpart A. This methodology uses Global Warming Potentials (GWPs).

Global Warming Potentials

CO_2	1
CH_4	25
N_2O	298

5. HAP pollutants consist of the nine highest HAPs included in AP-42 Table 3.2-3.
6. PAH = Polyaromatic Hydrocarbon (PAHs are considered HAPs, since they are considered Polycyclic Organic Matter)
7. Emission Factors are from AP-42, Chapter 3.3, Table 3.3-1 for diesel-fired engines.
8. Emission factors are from vendor-provided emission gurantees.
9. Emission factor based on emission limit from NSPS Subpart IIII..
10. PM and PM2.5 emission factors are assumed to be equivalent to PM10 emission factor. No information was given regarding which method was used to determine the factor or the fraction of PM10 which is condensable.
11. Emission factors are from 40 CFR 98 Table C-2.
12. Emission factors are from AP-42, Chapter 3.3, Table 3.3-2.