



Wood Environment & Infrastructure Americas, Inc.  
285 Davidson Avenue  
Suite 405  
Somerset, New Jersey 08873  
USA

T: 732-302-9500

[www.woodplc.com](http://www.woodplc.com)

November 6, 2019

State of Delaware  
Department of Natural Resources & Environmental Control  
Office of the Secretary  
89 Kings Highway  
Dover, Delaware 19901

**RE: COASTAL ZONE ACT STATUS DECISION APPLICATION  
KUEHNE CHEMICAL NATURAL GAS ELECTRICAL GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DELAWARE**

To Whom It May Concern:

The enclosed Coastal Zone Act (CZA) Status Decision Application is being submitted on behalf of Tangent Energy Solutions (Tangent) by Wood Environment & Infrastructure Americas, Inc. (Wood) for the Kuehne Chemical Natural Gas Electrical Generator Project, located in Delaware City, New Castle County, Delaware. The proposed activity is for the installation and operation of three (3) 2-megawatt (MW) peak shaving natural gas-fired reciprocating internal combustion engines (RICE) on an existing developed portion of the Kuehne Chemical Company facility, located at 1645 River Road, Delaware City, Delaware 19706.

A CZA Status Decision Application has been prepared in lieu of an Application for a Coastal Zone Act Permit for it is our belief that the proposed activity involves a minor addition to the operation of an existing industrial facility. The proposed activity is consistent with the current zoning and land use for the facility, and are sited on existing paved ground, outside of the floodplain and wetland areas. Based on this assessment, we believe that a Coastal Zone Act Permit is not needed for this proposed activity. Three (3) hard copies and one (1) electronic copy on CD of the Status Decision Application are enclosed.

If you have any questions regarding the information we have provided, please contact either Ms. Lysa Modica at (978) 392-5351 or [lysamodica@woodplc.com](mailto:lysamodica@woodplc.com), or Mr. Charles R. Harman at (732) 302-9500 x 127 or [charles.harman@woodplc.com](mailto:charles.harman@woodplc.com). Thank you.

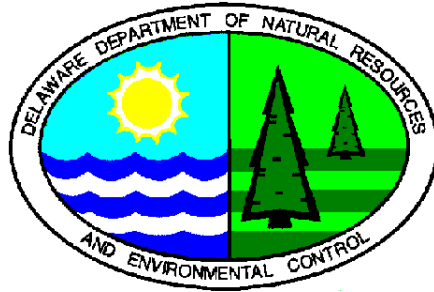
Sincerely,

Wood Environment & Infrastructure Solutions, Inc.

Lysa Modica  
Senior Project Manager

Charles R. Harman, P.W.S.  
Principal Ecologist/Branch Manager





## **APPLICATION FOR A COASTAL ZONE ACT STATUS DECISION**

**State of Delaware  
Department of Natural Resources & Environmental Control  
Office of the Secretary**

November 5, 2019  
Kuehne Chemical Natural Gas Electrical Generator Project  
Tangent Energy Solutions

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## Attachments

- 1 Applicant Agent Authorization
- 2 Figures and Site Plan
- 3 Nonconforming Use Boundary (Excerpted from Appendix B of the CZA Rules)
- 4 Delaware Coastal Zone Act Permit
- 5 New Castle County Zoning Map
- 6 Product Brochure
- 7 Emissions Calculations
- 8 Product Sound Datasheet

## **CZA Status Decision Application Instructions**

1. Complete all parts of the application. For questions which are not applicable to your project, do not leave blank; present a statement that clearly states why the section is not applicable to your project.
2. Because all applicants' projects are different, this word document template will provide you flexibility for needed space to answer the questions. Please insert additional lines for text where needed for your application. If appropriate, attach extra pages referencing each answer by the corresponding question number.
3. Submit eight complete hard copies of the permit application to:

State of Delaware  
Department of Natural Resources & Environmental Control  
Office of the Secretary  
89 Kings Highway  
Dover, DE 19901

In addition to the eight hard copies, submit a complete electronic "pdf" copy of the permit application on cd-rom.

4. Comply, if required, or as requested by the DNREC Secretary, with [7 Delaware Code, Chapter 79, Section 7902](#). If requested, but not completed, your application will not be considered administratively complete until this form is reviewed.
5. Be sure to include your permit application fee of \$3,000; otherwise the application will not be considered administratively complete. Make checks payable to the "State of Delaware."
6. Be advised that the application for a Delaware Coastal Zone Act Status Decision is a public document, which may be displayed at DNREC offices, public libraries, and the web, among others. If this application requires you to place confidential information or data in the application to make it administratively complete, note the Delaware Freedom of Information Act ([29 Delaware Code, Chapter 100](#)) and [DNREC's Freedom of Information Act Regulation](#), Section 6 (Requests for Confidentiality), for the proper procedure in requesting confidentiality.

*Note: This application template was last revised by DNREC on August 31, 2007. Please discard any previous versions.*

**PART 1**

**CERTIFICATION BY APPLICANT**

Under the penalty of perjury pursuant to 11 Delaware Code §1221-1235, I hereby certify that all the information contained in this Delaware Coastal Zone Act Status Decision Application and in any attachments is true and complete to the best of my belief.

I hereby acknowledge that all information in this application will be public information subject to the Delaware Freedom of Information Act, except for clearly identified proprietary information agreed to by the Secretary of the Department of Natural Resources & Environmental Control.

Michael Barth, PE  
Print Name of Applicant

Mike Barth  
Signature of Applicant

Project Engineer  
Title

1/16/19  
Date

## PART 2

### APPLICANT INFORMATION AND SITE IDENTIFICATION

2.1 Identification of the applicant:

Company Name: Tangent Generation Resources  
Address: 204 Gale Lane, Kennett Square, Pennsylvania 19348  
Telephone: 610-444-2800  
Fax: 570-809-0362

2.2 Primary contact: Please list the name, phone number and email of a preferred contact within your company in case the DNREC needs to contact you regarding this permit application.

Mike Barth, PE  
Telephone: 610-444-2800 x 221  
mbarth@edgegen.com

2.3 Site of proposed project (if different from above):

1645 River Road  
New Castle, Delaware 19720

2.4 Authorized agent (if any):

Name: Charles R. Harman, PWS  
Address: Wood Environment & Infrastructure Solutions, Inc., 285 Davidson Avenue,  
Suite 405, Somerset, New Jersey 08873  
Telephone: 732-302-9500 x 127  
Fax: 732-302-9504

*If you have an authorized agent for this permit application process, provide written authorization from client for being the authorized agent. (See **Attachment 1**)*

2.5 Is the applicant claiming confidentiality in any section of their application?

YES  
**X NO**

If yes, see instructions on page 3.

## PART 3

### PROJECT SUMMARY

*Provide a one-page summary describing the proposed project or use. Include a brief quantitative description of any anticipated environmental impacts.*

Tangent Generation Resources (edgeGEN), a Distributed Energy Resources (DER) company, is proposing to install and operate three (3) 2-megawatt (MW) peak shaving natural gas-fired reciprocating internal combustion engines (RICE) and appurtenant structures on a parcel of land located on the Kuehne Company facility located in Delaware City, New Castle County, Delaware (see **Attachment 2**). The street address of the facility is 1645 River Road, New Castle, Delaware 19720.

As a peak shaving facility, the project will operate during peak grid conditions and high locational marginal price hours. Operation of the engines will be limited to no more than 2,500 hours per year per engine. The three engines are available to run either concurrently or separately. It is anticipated that they are more likely to run concurrently. Potential emissions are calculated based on the project operating 24 hours per day and 2,500 hours per year; typical daily operations are expected to be no more than 8 hours per day except in extreme high demand situations. Therefore, typical total daily and annual emissions will be lower than those presented in Section 4.13 of this application and overall, typical operation will be less than the permitted hours. Electricity generated by the engines will be supplied to the Kuehne Chemical Plant. Decisions regarding operation and maintenance of the RICE plant will be made solely by Tangent. Compliance with the 2,500 hour per year limit will be demonstrated using a non-resettable hour meter. The hour meter will be monitored prior to and after every run to assure the hour limit is not exceeded.

The RICE will consist of three new Cummins C2000 N6CB 4-stroke lean-burn natural gas-fired spark ignition engines. The appurtenant structures are radiators used for cooling the engines. The engines will use selective catalytic reduction (SCR) for the control of nitrogen oxides (NO<sub>x</sub>) and an oxidation catalyst for control of carbon monoxide (CO) and volatile organic compounds (VOC). New Castle County is attainment for all criteria pollutants except ozone. New Castle County is designated as marginal attainment under the 2008 and 2015 ozone standards. Delaware is also part of the Northeast Ozone Transport Region (NOTR).

The generators will be placed within an existing permitted and approved Coastal Zone boundary on Kuehne's property. Each generator measures approximately 15 feet by 40 feet by 20 feet in height and weighs approximately 100,000 pounds. The generators will provide peak shaving capabilities for the operations at the facility. Each of the three (3) transformers associated with the generators will contain approximately 600 gallons of either *ENVIROTEMP™ FR3™ FLUID* (Cargill, CAS Number 8001-22-7) or *HYTRANS 61* (San Joaquin Refining Co., CAS Number 128-37-0) for a total of approximately 1,800 gallons of transformer oil in enclosed transformers.

The project will result in air emissions. As discussed in Section 6 of this application, air quality impacts from the project will be minimized by using clean fuels and add-on pollution control

equipment. The project will also demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) for all pollutants and averaging periods. As a result, the project will not interfere with attainment or maintenance of the NAAQS. Proposed NO<sub>x</sub> and CO emissions will be limited to 0.59 lb/MWh and 2 lb/MWh, respectively, Proposed emissions will comply with the 7 DE. Admin 1144 regulatory limits of 0.6 lb/MWh and 2 lb/MW. SO<sub>2</sub> emissions from the project will be 0.02 lb/MWh which is lower than the state average of 0.1 lb/MWh (as reported in eGRID2016). CO<sub>2</sub> emissions from the project (1,119 lb/MWh) will be higher than the state average of 887 lb/MWh.

The engines have controls and communications in place that will alert Tangent of any fault condition (warning and / or shutdown). These alerts are automatically generated by the generator controller and sent to Tangent electronically. Tangent has also developed proprietary software that is used to monitor the engine when it is running. Depending on the fault the engine will automatically shut down to a safe condition.



**PART 4**

**PROJECT INFORMATION**

- 4.1 Is the proposed project entirely or partly a new, or improved, or extended pier or other ship docking facility?  
YES  
**X NO**

If yes, will it be used at least in part for bulk cargo transfers by the applicant?  
YES  
NO  
**X N/A**

If no, please explain what it will handle:

- 4.2 Is this project entirely for pollution control purposes?  
YES  
**X NO**

- 4.3 Is this project a new research and development facility?  
YES  
**X NO**

- 4.4 Is this project a new or expanding (flow rate) public sewage wastewater treatment plant?  
YES  
**X NO**

- 4.5 Will the proposed project meet the following definition of “Manufacturing” as found in the Coastal Zone Act: “Manufacturing means the mechanical or chemical transformation of organic or inorganic substances into new products, characteristically using power driven machines and materials handling equipment, and including establishments engaged in assembling component parts of manufactured products, provided the new product is not a structure or other fixed improvement.”  
YES  
**X NO**

If no, explain what kind of activity will be carried out at this project site:

The proposed project is the installation of three (3) peak shaving natural gas-fired internal combustion engines for generating electricity during periods of peak demand and high price locational marginal price hours. The project does not meet the definition of

“manufacturing” within the Coastal Zone Regulations (Title 7 Delaware Administrative Code Regulation 101) because the project will convert and distribute electrical energy. The project falls under one of the uses not regulated in Section 5.5 “Facilities used in transmitting, distributing, transforming, switching, and otherwise transporting and converting electrical energy”. No electricity will be provided to the grid, nor will plant capacity be increased

4.6 Will the project have the following equipment or facilities?

- |                                     |          |            |                 |
|-------------------------------------|----------|------------|-----------------|
| a. Smoke stacks                     | <b>X</b> | <b>YES</b> | NO              |
| b. Tanks                            | <b>X</b> | <b>YES</b> | NO <sup>1</sup> |
| c. Distillation or reaction columns | YES      | <b>X</b>   | <b>NO</b>       |
| d. Chemical processing equipment    | YES      | <b>X</b>   | <b>NO</b>       |
| e. Scrubbing towers                 | YES      | <b>X</b>   | <b>NO</b>       |
| f. Pickling equipment               | YES      | <b>X</b>   | <b>NO</b>       |
| g. Waste treatment lagoons          | YES      | <b>X</b>   | <b>NO</b>       |
| h. Smelters                         | YES      | <b>X</b>   | <b>NO</b>       |
| i. Incinerators                     | YES      | <b>X</b>   | <b>NO</b>       |

4.7 Will the project use 20 acres or more?

YES  
**X NO**

How many acres will it use? Approximately 0.2 acres.

4.8 Does this facility appear in Appendix B of the Coastal Zone Act Regulations (the list of the nonconforming uses)?

**X YES**<sup>2</sup>  
NO

If no, proceed to question 4.11

4.9 Will the proposed activity described in this application occur entirely within the lines delineating the area of nonconformity for this site, as seen in the Appendices of the Regulations?

**X YES (See Attachment 3)**  
NO  
N/A

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<sup>1</sup> Each engine enclosure will contain an oil make up tank, a water tank, and a urea tank, all of which will be equipped with secondary containment. One 250-gallon tank will be installed in the project area to replace a 10,000-gallon tank being removed. Final location of this tank will be determined during the final project design phase, but it will not be located in the floodplain.

<sup>2</sup> The Kuehne Chemical Company facility appears in Appendix B (as the Chloramone facility).

4.10 Will the proposed activity or use straddle this line?

YES  
**X NO**  
N/A

If yes, describe what equipment, facilities, or machinery will be within the delineated area of nonconformity AND what will be outside of this area of nonconformity:

4.11 Is the proposed project or use part of a manufacturing use that was in operation prior to and on June 28, 1971?

**X YES (The facility has been in continuous operation since 1967; The Kuehne Company acquired the property in 1989)**  
NO

4.12 Has this facility ever been granted a Coastal Zone Act Permit?

**YES (Attachment 4)**  
NO

If yes, please provide the following information:

<b>Applicant Name</b>	<b>Permit Number</b>	<b>Date Issued</b>
Kuehne Chemical Company	334	10/29/2002

4.13 Does the new or expanded use involve any change in existing:

- a. processes?                    YES   **X NO**
- b. facilities?                    **X YES**   NO
- c. buildings?                    YES   **X NO**
- d. emissions discharge?       **X YES**   NO

If yes, please explain each in detail. Use the following tables to help describe any new or changed air or water emissions.

The new facilities will be comprised of ancillary equipment to support the peak shaving engines and will include radiators for cooling, electric generators in weather protected sound attenuating enclosures, step-up transformers, electrical interconnect conductors, electrical conduits, iron piping for cooling systems, and concrete pads to support new equipment.

**Air Emissions**

Pollutant	Existing Emissions		Net Increase/Decrease		New Total Emissions		Percent Change (compare tons/year)
	Lbs/day	Tons/year	Lbs/day	Tons/year	Lbs/day	Tons/year	
PM/PM10/PM2.5	0	0	26.3	1.4	26.3	1.4	NA
SO2	0	0	0.87	0.05	0.87	0.05	NA
NOx	0	0	85.1	4.4	85.1	4.4	NA
CO	0	0	287.4	15.0	287.4	15.0	NA
VOC	0	0	70.2	3.7	70.2	3.7	NA
CO2	0	0	86.8 TPD	11,396	86.8 TPD	11,396	NA

Maximum potential emissions reflect 3 engines operating 24 hours per day and 2,500 hours per engine per year.

**Water emissions**

Pollutant	Current Discharge Concentration (ppm)	New or Discharge Concentration (ppm)	Current Discharge		Net Increase/Decrease		New Total Emissions	
			Lbs/day	Tons/year	Lbs/day	Tons/year	Lbs/day	Tons/year
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

- 4.14 Will this project directly or indirectly increase plant production over present capacity?  
 YES  
**X NO**

If yes, explain in what way and by how much:

- 4.15 Will this project result in the production of any new products, either directly or indirectly, at this facility?  
 YES  
**X NO**

If yes, list each new product:

- 4.16 List materials and/or ingredients to be utilized by this proposed project and how they will be transported to the site.

Major items are to include the following:

- Engine-generator in weather protect, sound attenuating enclosures - quantity 3
- Electric step-up transformer – quantity 3

- Miscellaneous electrical switches and fuses
- Electrical interconnect conductors
- Electrical conduits
- Concrete pads to support this new equipment
- Radiators
- Oxidation Catalyst and Selective Catalytic Reduction

All items are to be transported to site via commercial trucking transport company.

## PART 5

### PROJECT SITE AND ZONING

5.1 In a separate attachment, provide a map of appropriate scale to clearly show the site. Mark important natural features and project buildings and processing equipment of the proposed project such as roads, wetlands, railway sidings, drainage ways, tanks, sewer systems, water mains, wells etc.

A draft site plan and associated figures are provided in **Attachment 2**.

5.2 What is the current SIC code for the proposed use?

4911

5.3 What is the current zoning and planned land use of the proposed project site?

The current zoning is Heavy Industrial (New Castle County Zoning Code “HI”) per the official New Castle County Zoning Map appearing the Comprehensive Plan (<https://www.nccde.org/403/Zoning>) (**Attachment 5**). The planned land use will remain as heavy industrial.

5.4 Will the proposed project require a zoning change?

YES

NO

If yes:

A. To what classification will it be changed?

B. What zoning authority is responsible for reviewing and approving the change?

5.5 Will the project require new supporting facilities?

YES

NO

If yes, describe each facility, and how it will be used:

## PART 6

### PROJECT DESCRIPTION AND PROJECT IMPACTS

- 6.1 On a separate attachment labeled “**Project Description**,” provide a concise but complete description of the proposed project or use. Be sure to answer the following questions:
- a. How does this project relate to any existing manufacturing operations and facilities (if this is not for an entirely new manufacturing plant)?
  - b. What effects will there be, if any, on land use acreage, manufacturing production capacity, modification of current product line(s), and safety risks to the public and to company employees?
  - c. Is this project or use a complete, single project, or is it part of a long-term, large-scale project that has other components to it that may need approval under the Coastal Zone Act at a later date?
  - d. If it is part of a larger project, describe the entire project in detail and mention ALL major machinery, facilities, land, products, and processes involved.
- 6.2 On a separate attachment labeled “**Environmental Impacts**,” provide a detailed and accurate impact analysis that describes the proposed project’s impacts on:
- a. air quality
  - b. local surface and ground water quality
  - c. surface and groundwater withdrawals
  - d. habitat loss
  - e. solid and hazardous waste generation
  - f. noise
  - g. odors
  - h. local aesthetic quality
  - i. any other notable factors not listed above
  - j. Provide a detailed statement describing the proposed project’s potential to pollute should equipment malfunction or human error occur, including a description of backup controls, backup power, and safety provisions.
- 6.3 On a separate attachment labeled “**Other Project Impacts**,” provide a detailed and accurate analysis on how the proposed project will impact each of the following (include both positive and negative impacts):
- a. the economy (corporate, state, county)
  - b. county and municipal comprehensive plans/zoning
  - c. effect upon neighboring land uses
  - d. the impacts, if any, that *supporting facilities* will have on the environment, the economics of the area, zoning, neighboring land uses, and aesthetic quality.

## **Project Description**

(Refer to Question 6.1)

Tangent Generation Resources (edgeGEN) is proposing to install and operate three (3) 2-megawatt (MW) natural gas-fired peak shaving<sup>3</sup> reciprocating internal combustion engines (RICE) on an existing approved Coastal Zone heavy industrial area located on the Kuehne Company (previously Chloramone) facility located in New Castle, New Castle County, Delaware. The RICE will consist of three new Cummins C2000N6CB natural gas-fired spark ignition engines. The street address of the facility is 1645 River Road, New Castle, Delaware 19720.

The generators will be placed within an existing permitted and approved Coastal Zone boundary on Kuehne's property. Each generator measures approximately 15 feet by 40 feet by 20 feet in height and weighs approximately 100,000 pounds. The generators will provide peak shaving capabilities for the operations at the facility. The emissions exhaust stacks will be located on the roof of each engine enclosure in the middle of the structure at an approximate height of 26 feet above ground level. Each of the three (3) transformers associated with the generators will contain approximately 600 gallons of either *ENVIROTEMP™ FR3™ FLUID* (Cargill, CAS Number 8001-22-7) or *HYTRANS 61* (San Joaquin Refining Co., CAS Number 128-37-0) for a total of approximately 1,800 gallons of oil.

The project does not meet the definition of "manufacturing" within the Coastal Zone Regulations (Title 7 Delaware Administrative Code Regulation 101) because the project will convert and distribute electrical energy. As noted in Section 4.5, while the Project does not meet the definition of manufacturing, it does fall under one of the uses not regulated in Section 5.5: "Facilities used in transmitting, distributing, transforming, switching, and otherwise transporting and converting electrical energy". Kuehne's electricity is currently supplied by Delmarva Power (DPL) via existing distribution lines to the site. No utility infrastructure will change as a result of this project because it is a "behind the meter" installation.

The project will allow Kuehne to remain cost competitive in their existing manufacturing operations by providing a peak shaving energy source for operations. The proposed industrial use is consistent with the Heavy Industrial zoning district and the industrial land use of the facility. The project will not result in an increased production capacity, but will provide energy savings for the facility, and reduce the amount of electricity draw from the grid. The proposed engines are of high quality, supplied by a known and trusted manufacturer (Cummins) of these types of machinery, and will not pose an increase in safety risk to the public or employees (see **Attachment 6**). The engines will be sited on a secure facility and maintained and monitored for safe operation. The project is a single and complete project and is not a phased element of future projects that will require CZA review.

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<sup>3</sup> Peak shaving is the reduction of electrical power usage by a facility during a period when the serving utility is experiencing a heavy demand for power.



## **Environmental Impacts** (Refer to Question 6.2)

### Air Quality

As previously discussed, the proposed project will be operated for peak shaving purposes. Air quality impacts will result from emissions of criteria pollutants during operation of the engines. The engines will fire natural gas as the sole fuel. The project is seeking allowable operation of 2500 hours per year per engine. Emissions from the engines will be minimized using SCR controls and an oxidation catalyst.

Peak Shaving periods occur during times of high electricity demand. During these peak periods the local utility relies heavily on older less efficient generating assets (typically combusting fuels such as coal and oil) to produce electricity. The generation units being installed will reduce the demand on the utility to run these less efficient and dirtier power sources. Greenhouse gas emission factors from sources such as coal and oil are higher than emissions produced from a typical natural gas unit (see table 2018 Emissions Factors for Greenhouse Gas Inventories published by the EPA.) The proposed units for the Kuehne site are high efficiency generators with emission controls which will reduce the electricity demand on the grid during peak use periods. So, while these units don't reduce the total amount of electricity being consumed, the on-site generation will result in a reduction of greenhouse gas and criteria pollutant emissions during peak energy periods by using clean energy combustion units.

Air emissions from the proposed project will meet the requirements of the New Source Performance Standards (NSPS) 40 CFR 60 Subpart JJJJ and 7 DE. Admin. Code 1102 and 1144. Proposed NO<sub>x</sub> and CO emissions will be limited to 0.59 lb/MWh and 2 lb/MWh, respectively. Proposed emissions will comply with the 1144 regulatory limits of 0.6 lb/MWh and 2 lb/MWh for NO<sub>x</sub> and CO, respectively. These limits are also well below the NSPS Subpart JJJJ limits of 1 g/bhp-hr NO<sub>x</sub> and 2 g/bhp-hr CO (proposed project limits are 0.2 g/bhp-hr for NO<sub>x</sub> and 0.675 g/bhp-hr CO). Potential emissions from the project will be well below major source and major modification thresholds under 7 DE. Admin. Code 1125 (Prevention of Significant Deterioration [PSD] and Non-attainment New Source Review [NNSR]) and 7 DE. Admin. Code 1130 (Title V Operating Permit Program).

Compliance with the 2,500 hour per year limit will be demonstrated using a non-resettable hour meter. The hour meter will be monitored prior to and after every run to assure the hour limit is not exceeded. Tangent will monitor run hours remotely with our 24/7 operations center. If any of the engines approach the 2,500 hour per year limit, operations will be curtailed to ensure that limit is not exceeded.

In addition, as part of the air permit application required under 7 DE. Admin. Code 1102, the project will be required to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) for permit approval. Therefore, the project is not expected to interfere with the attainment or maintenance of ambient air quality standards.

SO<sub>2</sub> emissions from the project will be 0.02 lb/MWh which is lower than the state average of 0.1 lb/MWh (as reported in eGRID2016). CO<sub>2</sub> emissions from the project (1,119 lb/MWh) will be

higher than the state average of 887 lb/MWh. Potential emissions are based on the assumption that the project will operate 24 hours per day and 2,500 hours per year. Typical daily emissions are expected to be no more than 8 hours per day except in extreme high demand situations. Therefore, daily emissions are expected to be lower than those presented in Section 4.13 of this application. An emission summary is provided in **Attachment 7**.

The project will not have an impact on the local surface water quality or ground water quality. Proper erosion and sedimentation (E&S) controls will be in place prior to any construction activities, as reviewed and certified by the New Castle Conservation District, which will avoid impacts to surface water. Ground water will not be impacted from the construction activities as all structures will be placed on previously developed ground. An Oil Spill Contingency Plan (OSCP) will be developed to address the Spill Prevention, Control, and Countermeasures (SPCC) rule.

### Surface and Groundwater Withdrawals

The project will be housed in the southeastern portion of the site. This area is bounded on all sides by paved, developed land. The entire Kuehne site is bounded by freshwater wetlands to the north and east, beyond which lies Red Lion Creek. Industrial properties lie to the west and south. The entire site is at a slightly higher elevation than the surrounding areas, but it is currently paved, so the project will not change either the quantity or the quality of stormwater run-off. The generators will be completely enclosed. Fluids will be inside tanks in the enclosures, which will provide a double containment system. In light of this design feature, the project will not have any impact on groundwater quality to the Red Lion Creek or associated habitat.

Presently, this area is used as an open storage area and includes an old construction trailer and a 10,000-gallon diesel storage tank. Both will be decommissioned for this project. A 250-gallon diesel tank will be added to replace the 10,000-gallon tank and added to the site's existing SPCC plan. The tank's ultimate location will be determined during the final design phase of the project, but it will be located outside the floodplain. There are no plans to alter the composition of the ground surface, so there will be no change to stormwater that exits the site and no change in either the volume or direction of flows into the wetlands. The project does not require the withdrawal of any groundwater either during construction or during operations. Therefore, this project will not have an impact on surface water or groundwater withdrawals.

### Habitat Loss

According to the U.S. Fish & Wildlife Service, there are eleven listed species in the State of Delaware, six animals and five plants. After consulting with both the USFWS and the DNRC, it has been determined that the project as proposed will not result in habitat loss. None of these sensitive species nor their habitats are present on the site, and the engines will be installed in an existing developed area.

### Solid and Hazardous Waste Generation

The project will produce solid waste during the construction phase, comprising typical non-hazardous construction debris. This waste will be disposed of off-site. The operation of the engines will not produce any solid or hazardous waste. The maintenance of the engines will produce a nominal amount of solid and hazardous waste which will be properly disposed of in accordance with the type and classification of the waste material. Based upon the proposed operating hours, it is expected that engine oil will be replaced annually. Each oil replacement will produce approximately 300 gallons of waste oil that will be properly disposed.

### Noise

The engine-generators will be pre-packaged by Cummins in sound attenuating enclosures to limit noise contribution to 65 dBA at 23 feet. The engines are in a heavy industrial area and will be 1.56 miles from the Sikh Center of Delaware, the closest non-industrial/commercial receptor to the engines and 1.92 miles to the nearest residential area. The sound datasheet for this engine-generators (unhoused) is provided in **Attachment 8**; however, it should be noted that the proposed engines will be housed with attenuating enclosures (limiting noise to 65 dBA at 23 feet, thus further attenuating their sound output.

## Odors

During construction, the project will not produce odors over that which is typical for a general construction activity. Such odors would originate from construction materials and equipment. Odors are not anticipated to be released during the operation and maintenance of the engines.

## Local Aesthetic Quality

The project will install industrial engines on existing developed land, for an industrial facility, in an area zoned for Heavy Industry. The proposed engines are consistent with the existing surrounding land use and thus will not impact the local aesthetic quality of the landscape.

## Potential to Pollute

These units burn only natural gas and use state-of-the-art emissions control technology making them cleaner than existing power plants in the area. In addition, these engines will offset emissions from older, less clean power plants in the area. This in turn will have a positive impact on overall air quality in the area as these engines are typically run during high demand days. Kuehne's electricity needs will be partially met by these units, reducing the need for electricity from the grid. This project does not increase the facility's production capacity or power consumption. Having the units located on site also reduces electricity transmission losses associated with DELMARVA's transmission and distribution system, further reducing overall emissions.

The potential to pollute the surrounding environment either from an equipment malfunction or human error would result in a release of air emissions above standards, or less likely, a release of transformer oil. The release of transformer oil is highly unlikely due to their robust and proven design and construction. The design has been used successfully in hundreds of projects across the country for this purpose. If a spill were to occur, it would be limited to the immediate vicinity of the transformer, which is a high traffic area for plant and would be detected quickly and easily. To address the potential accidental release of transformer oil, an OSCP will be developed to address the SPCC rule.

Tangent will have sole responsibility over operation and maintenance of the engines. Engine and control equipment performance will be monitored remotely by Tangent personnel. The engines have controls and communications in place that will alert Tangent of any fault condition (warning and / or shutdown). These alerts are automatically generated by the generator controller and sent to Tangent electronically. Tangent has also developed proprietary software that is used to monitor the engine when it is running. Depending on the fault the engine will automatically shut down to a safe condition.

If any increases in air emissions occur due to an engine fault, Tangent will be notified immediately through the remote monitoring system. Necessary corrective action will be implemented to address any fault.

Parameters such as temperatures, pressures, load and frequency are measured during every run. In addition, each engine has a run hour meter that will be monitored prior to and after every run

to ensure that each engine does not exceed the 2,500 hour/year run limit. These meters will be monitored remotely 24/7 in the operations center.

The SCR control panel also has an alarm function that will let us know if it goes into a fault condition. If a malfunction of the SCR or oxidation catalyst occurs, the engines will alert Tangent immediately.

The engines have back up batteries which will keep the controls functioning for the life of the batteries upon a loss of power.

### Flood Risk

According to current FEMA mapping, the project is located outside the 100-year flood zone but within the 1% margin of error zone. As described above, the proposed project will not change either the elevation or the permeability of the area.

As this area has the potential to flood under abnormal circumstances, there are mitigating factors that negate the risk, such as the double-walled containment system and elevating the engines above the ground due to the 14-inch generator base. As a result, the water would have to rise an extra 14 inches to reach the base of the secondary enclosure. It is very unlikely that a floating object would penetrate or displace the enclosure due to its robust design and weight (>100,000 pounds).

Additionally, each of the three transformers associated with the generators will contain approximately 600 gallons of either *ENVIROTEMP™ FR3™ FLUID* (Cargill, CAS Number 8001-22-7) or *HYTRANS 61* (San Joaquin Refining Co., CAS Number 128-37-0) for a total of approximately 1,800 gallons of transformer oil in enclosed transformers. The transformers have been designed robustly to minimize the risk of a spill. This same design has been used successfully in hundreds of projects across the country. If a spill were to occur, it would be limited to the immediate vicinity of the transformer. This is a high traffic area for plant, so any spill would be detected quickly and easily. The transformers are subject to the Spill Prevention, Control and Countermeasures (SPCC) that requires Tangent to develop an oil spill contingency plan (OSCP) and an oil spill response plan.

In light of these various design features and contingency plans, if the project area were to experience a flood of this magnitude, there would be no anticipated increase in either levels of contaminants or in impacts from floodwaters on the surrounding area over current conditions.

**Other Project Impacts**  
(Refer to Question 6.3)

The project will have a positive impact on the corporate economy from the energy cost savings that will be realized. The project is expected to have neither a positive nor a negative impact on the county or state economy.

The project will have a neutral impact on county zoning. This area is zoned for Heavy Industry, and the proposed engines are consistent with that zoning. This project delays construction of additional infrastructure needed by the local utilities. This in turn reduces the need for future zoning changes of the project area.

The area around the Site is also zoned Heavy Industrial (New Castle County Zoning Code “HI”). Therefore, the project will have a neutral impact on neighboring land uses as the proposed engines are consistent with the current land use of the project area.

Currently all the electricity used by this facility is supplied by existing power plants. There are energy losses associated with relaying power through the existing energy grid. These losses will be reduced as Kuehne uses these peak shaving engines that are located onsite. Additionally, the proposed units burn natural gas and are designed with scrubber and oxidation catalyst technology to reduce air emissions. These engines therefore produce fewer air emissions than the power plants in the area. Any localized emission increases will be controlled by highly efficient emission control equipment. Overall emissions levels in the vicinity are expected to decrease due to improving DELMARVA’s fuel mix.

The project will not include any supporting facilities, thus impacts to the environment, economics, zoning, land use, and aesthetic quality from supporting facilities are not applicable.

Kuehne anticipates that this project will create approximately 30 temporary construction, engineering, maintenance, and project management jobs, as well as supporting six remote permanent jobs involving monitoring, maintenance and dispatch.

***END OF APPLICATION***

***ATTACHMENTS TO FOLLOW***

***ATTACHMENT 1***

***APPLICANT AGENT AUTHORIZATION***





Wood Environment & Infrastructure Solutions, Inc.  
285 Davidson Avenue  
Suite 405  
Somerset, New Jersey 08873  
USA

T: 732-302-9500

[www.woodplc.com](http://www.woodplc.com)

November 6th, 2019

State of Delaware  
Department of Natural Resources & Environmental Control  
Office of the Secretary  
89 Kings Highway  
Dover, Delaware 19901

**RE: AGENT AUTHORIZATION FOR APPLICANT  
APPLICATION FOR A COASTAL ZONE ACT STATUS DECISION  
KUEHNE CHEMICAL NATURAL GAS ELECTRICAL GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DELAWARE**

To Whom It May Concern:

This letter authorizes Mr. Charles R. Harman, PWS of Wood Environment & Infrastructure Solutions, Inc. (Wood) to act on my behalf as an Agent for the Applicant for the above-referenced Coastal Zone Act Status Decision Application for the Kuehne Chemical Natural Gas Electrical Generator Project. My information as Applicant, and Mr. Harman's information as Agent, is presented below, and appears on the Status Decision Application form.

**Applicant**

Mike Barth, PE  
edgeGEN  
204 Gale Lane  
Kennett Square, Pennsylvania 19348  
T: 610-444-2800 x 221  
F: 507-809-0362  
[mbarth@edgegen.com](mailto:mbarth@edgegen.com)

**Agent**

Charles R. Harman, PWS  
Wood Environment & Infrastructure Solutions, Inc.  
285 Davidson Avenue, Suite 405  
Somerset, New Jersey 08873  
T: 732-302-9500 x 127  
F: 732-302-9504  
[charles.harman@woodplc.com](mailto:charles.harman@woodplc.com)

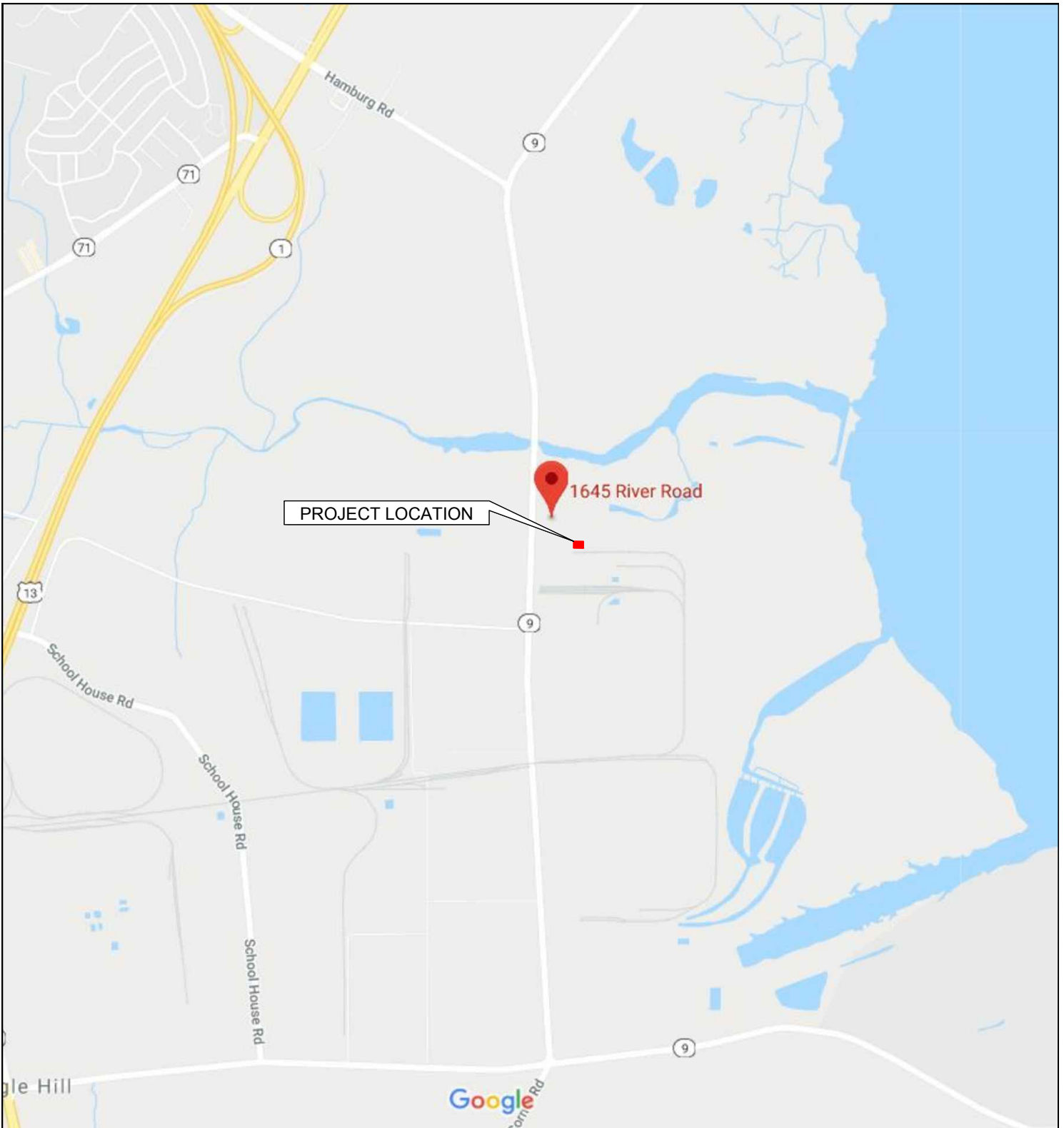
Sincerely,

edgeGEN

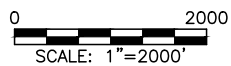
Michael Barth, PE  
Project Engineer



***ATTACHMENT 2***  
***FIGURES AND SITE PLAN***



SOURCE: GOOGLE MAPS



**wood.** Environment & Infrastructure Solutions, Inc.  
285 Davidson Avenue, Suite 405  
Somerset, New Jersey 08873

Figure 1

STREET MAP

KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

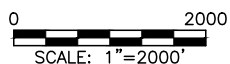
Rev. By: PKP

Contract No.: 348810018

12/17/18



SOURCE: U.S.G.S. 7.5 MINUTE QUADRANGLES, SAINT GEORGES, DE, 2016, AND DELAWARE CITY, DELEWARE, 2016



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Figure 2

USGS TOPOGRAPHIC MAP

KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

Rev. By: PKP

Contract No.: 348810018

12/7/18



SOURCE: GOOGLE MAPS



0 1000  
SCALE: 1"=1000'

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Figure 3

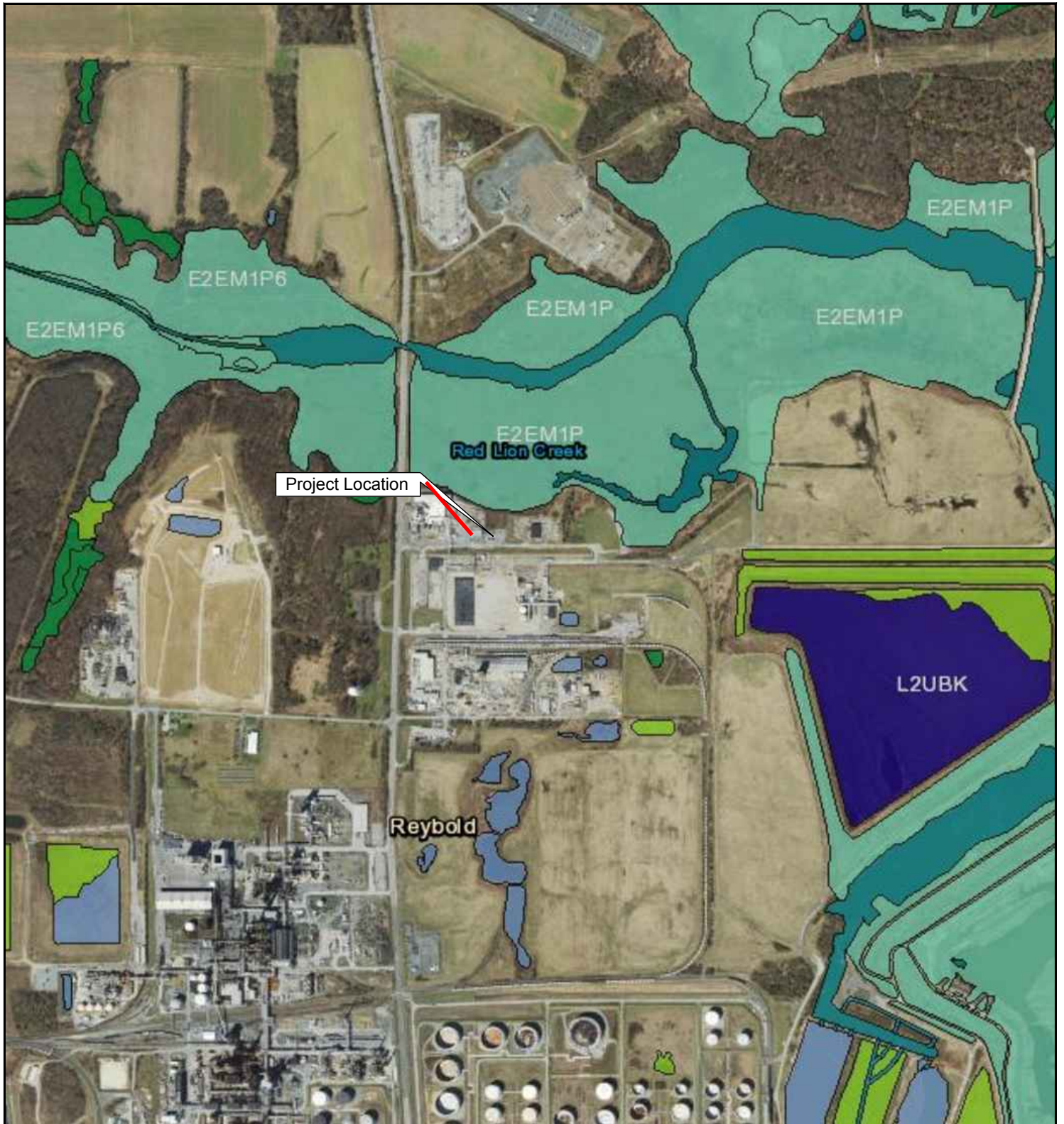
AERIAL PHOTO

KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

Rev. By: PKP

Contract No.: 348810018

12/17/18

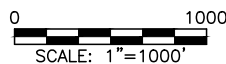


SOURCE: NATIONAL WETLANDS INVENTORY



**Wetlands**

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine



**wood.**

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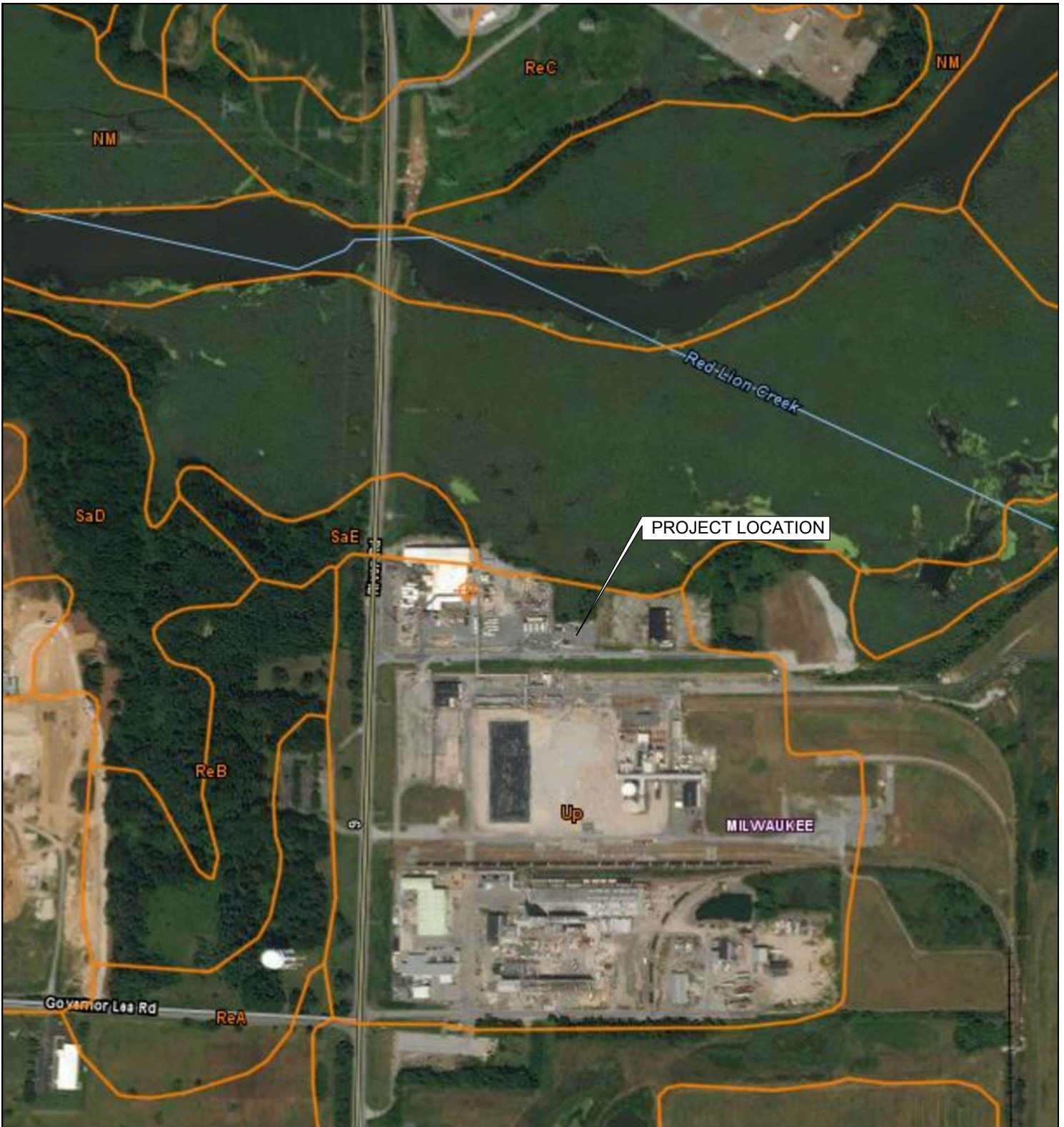
Figure 4

NWI MAP  
KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

Rev. By: PKP

Contract No.: 348810018

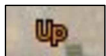
12/17/18



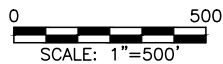
SOURCE: USDA SOILS MAPS



**LEGEND**



USDA URBAN LAND



**wood.**

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Somerset, New Jersey 08873

Figure 5

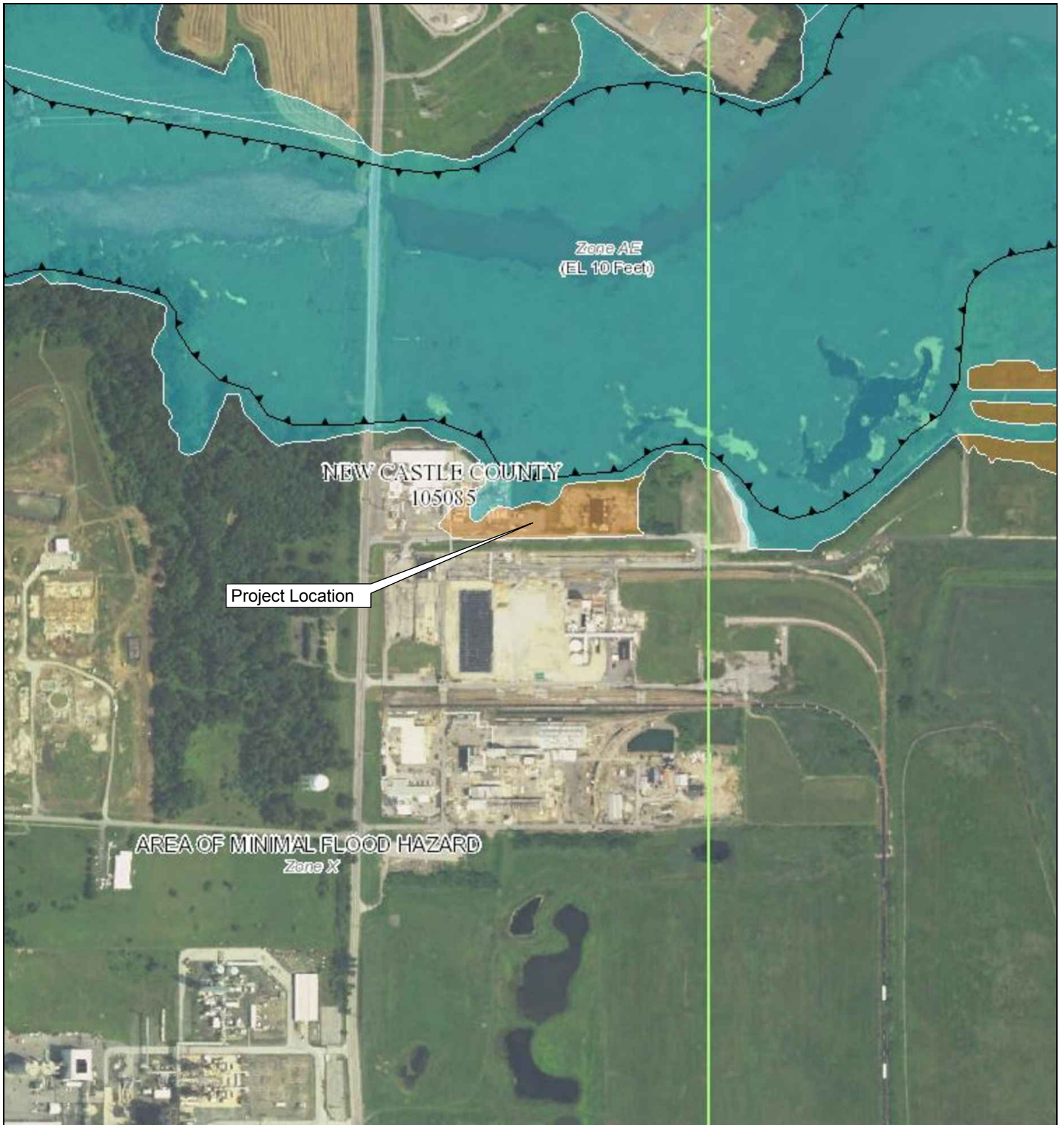
USDA SOILS MAP

KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

Rev. By: PKP

Contract No.: 348810018

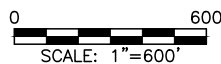
12/17/18



SOURCE: FEMA FLOOD MAPS



- Without Base Flood Elevation (BFE)  
Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile. Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes, Zone X
- Area with Flood Risk due to Levee Zone D



**wood.**

Environment & Infrastructure Solutions, Inc.  
285 Davidson Avenue, Suite 405  
Somerset, New Jersey 08873

Figure 6

FEMA FLOOD MAP

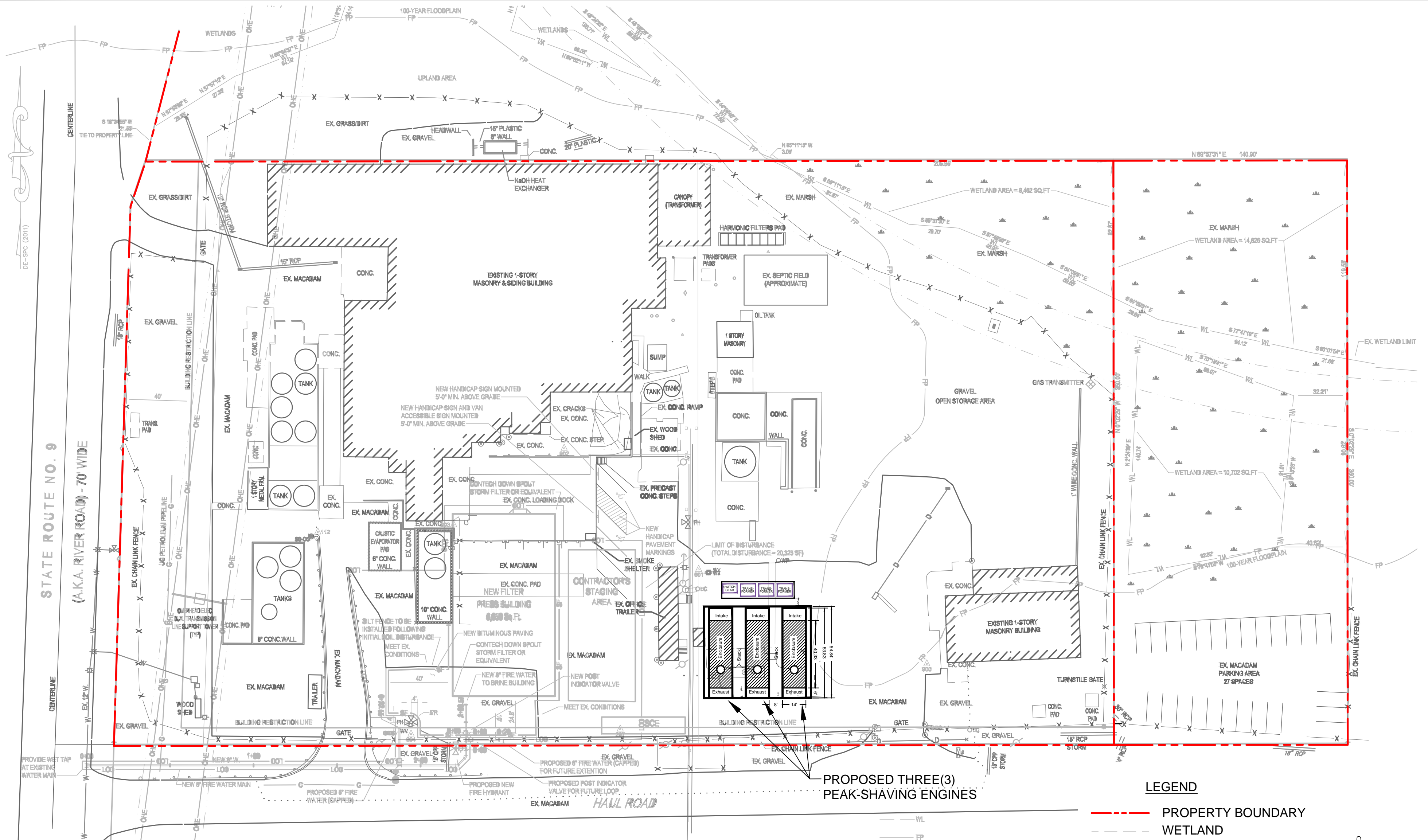
KUEHNE CHEMICAL NATURAL GAS ELECTRICAL  
GENERATOR PROJECT  
DELAWARE CITY, NEW CASTLE COUNTY, DE

Rev. By: PKP

Contract No.: 348810018

12/17/18





**NOT FOR CONSTRUCTION**

REVISIONS			
NO.	DESCRIPTION	BY	DATE

SEAL:

CLIENT: **TANGENT ENERGY SOLUTIONS, INC.**  
 206 GALE LANE, KENNETT SQUARE, PENNSYLVANIA 19348

Environment & Infrastructure Solutions, Inc.  
 285 DAVIDSON AVENUE, SUITE 405  
 SOMERSET, NJ 08873-4153

PROJECT: **KUEHNE CHEMICAL NATURAL GAS ELECTRICAL GENERATOR PROJECT**  
 DELAWARE CITY, NEW CASTLE COUNTY, DELAWARE

TITLE: **OVERALL SITE PLAN**

DATE: 10/29/19  
 PROJECT NO: 348810018  
 SCALE: AS SHOWN  
 SHEET No. 1 of 1

***ATTACHMENT 3***

***NONCONFORMING USE BOUNDARY***

***(EXCERPTED FROM APPENDIX B OF  
THE CZA RULES)***

# Chloramone



0 0.05 0.1 Miles

***ATTACHMENT 4***

***DELAWARE COASTAL ZONE ACT  
PERMIT***



STATE OF DELAWARE  
DEPARTMENT OF NATURAL RESOURCES  
AND ENVIRONMENTAL CONTROL

OFFICE OF THE  
SECRETARY

89 KINGS HIGHWAY  
DOVER, DELAWARE 19901

PHONE: (302) 739-4403  
FAX: (302) 739-6242

October 25, 2002

Mr. Robert Field  
Kuehne Chemical Company  
1645 River Road  
P. O. Box 294  
Delaware City, Delaware 19706

CERTIFIED MAIL  
Return Receipt Requested

Re: Coastal Zone Act Permit Decision

Dear Mr. Field:

My decision on your application for a Coastal Zone Act (CZA) Permit to install 20 new electrolizers at your Delaware City facility is to grant the Permit. Your increase in the production of chlorine gas and sodium hydroxide will not lead to an increase in the production of your final product, sodium hypochlorite. The impact of this project to the environment is minimal and will be more than offset by the combined benefits of your Offset Proposal. I remind you that you must implement and maintain the Offset Proposal, or your CZA Permit will be voided. I have enclosed your Permit and urge you to keep a copy of it at the Delaware City site.

There is a fourteen (14) day appeal period following the date of the enclosed legal notice. Two newspapers will bill you for the publication of this legal notice. If no appeal is received, this decision becomes final. If an appeal is received, you will be immediately notified.

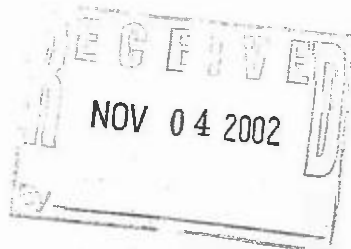
Should you have any questions or concerns about this decision, please call Dennis Brown at 739-3091.

Sincerely,

John A. Hughes  
Secretary

Enclosures (2)

334-decisi on -letter



*Delaware's Good Nature depends on you!*

DELAWARE  
COASTAL ZONE ACT  
PERMIT

NUMBER: 334

ISSUED TO: Kuehne Chemical Company


TO PERMIT: Installation and use of twenty (20) new electrolizer cells for a maximum chlorine production of 133 tons per day.

SITE LOCATION: 1645 River Road (Rt. 9) & Red Lion Creek  
Delaware City, Delaware

Conditions Incorporated and Made Part of this Permit:

1. This permit is conditional upon the permittee's compliance with all other applicable permit requirements of the State of Delaware and the implementation of any Offset Project(s) as identified in your application.
2. Issuance of this permit does not relieve the permittee of the legal obligation of complying with all building permit, subdivision and other applicable code requirements of the county and municipality wherein the permitted project is located.
3. If there are significant deviations from the plan and operations approved by the Secretary, the permittee shall notify the Secretary as soon as possible. This permit may be revoked and a new permit application required if the Secretary deems the deviation to substantially change the nature or scale of the project and to be of actual or probable harm to the purposes of the Coastal Zone Act.
4. Are special condition(s) attached to this permit on one or more separate pages?  No  Yes

Signature

  
John A. Hughes, Secretary  
Department of Natural Resources & Environmental Control

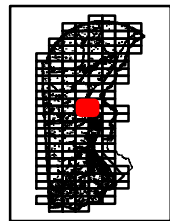
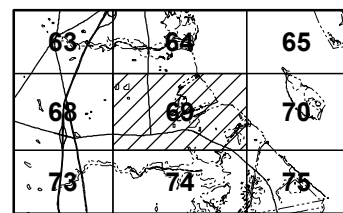
Date: 10-29-02

***ATTACHMENT 5***

***NEW CASTLE COUNTY ZONING MAP***



THIS MAP IN WHOLE OR IN PART MAY NOT BE PRODUCED IN ANY FORM OR BY ANY MEANS WITHOUT WRITTEN PERMISSION OF THE DEPARTMENT OF LAND USE OF NEW CASTLE COUNTY.



LEGEND

- ZONING LINE
- CORPORATE LIMIT LINE
- HYDROLOGY LINE
- PARCEL LINE
- ZONING EXHIBIT LINE
- REZONING ORDINANCE
- ZONING CLASSIFICATION

ZONING CLASSIFICATIONS	
NC2A	Single Family (2 ac.)
NC40	Single Family (40,000 sq. ft.)
NC21	Single Family (21,000 sq. ft.)
NC15	Single Family (15,000 sq. ft.)
NC10	Single Family (10,000 sq. ft.)
NC6.5	Single Family (6,500 sq. ft.)
NC5	Single Family (5,000 sq. ft.)
NCsd	Semi-Detached
NCth	Townhouses
Ncga	Garden Apartments
Ncap	Apartments
Ncpud	Existing Planned Development
NCmm	Manufactured Mobile
S	Suburban
ST	Suburban Transition
SE	Suburban Estate
SR	Suburban Reserve
TN	Traditional Neighborhood
CN	Commercial Neighborhood
CR	Commercial Regional

ON	Office Neighborhood
OR	Office Regional
BP	Business Park
I	Industrial
HI	Heavy Industrial
EX	Extraction
OVERLAY DISTRICTS	
H	Historic Preservation
AG	Agricultural Preservation
CL	Development Option
HT	Hometown Overlay



**NEW CASTLE COUNTY, DE**  
**OFFICIAL ZONING MAP**  
 ADOPTED SEPTEMBER 22, 1998 MAP NO. **69**  
 GRID BASED ON THE DELAWARE STATE PLANE COORDINATE SYSTEM  
 0 200 400 Feet  
 Revised: 8/28/2018



***ATTACHMENT 6***  
***PRODUCT BROCHURE***

**Generator set data sheet**  
**2000 kW Continuous**



**Model:** C2000 N6CB  
**Frequency:** 60 Hz  
**Fuel type:** Natural gas MI 72+  
**Emissions NOx:** 1.0 g/bhp-hr  
**LT water inlet temp:** 50 °C (122 °F)  
**HT water outlet temp:** 92 °C (197 °F)

<b>Measured sound performance data sheet:</b>	<b>MSP-3057</b>
<b>Prototype test summary data:</b>	<b>PTS-616</b>
<b>Remote radiator cooling outline:</b>	<b>A059D245</b>

<b>Fuel consumption (ISO3046/1)</b>	<b>See Note</b>	<b>100% of rated load</b>	<b>90% of rated load</b>	<b>75% of rated load</b>	<b>50% of rated load</b>
Fuel consumption (LHV) ISO3046/1, kW (MMBTU/hr)	2,4,6,7	5225 (17.85)	4759 (16.25)	4044 (13.81)	2882 (9.84)
Mechanical efficiency ISO3046/1, percent	2,7	39.9%	39.4%	38.6%	36.1%
Electrical efficiency ISO3046/1, percent	2,6,7	38.3%	37.8%	37.1%	34.7%

**Engine**

Engine manufacturer	Cummins
Engine model	QSV91-G4
Configuration	V18
Displacement, L (cu.in)	91.6 (5591)
Aspiration	Turbocharged (4)
Gross engine power output, kWm (hp)	2062 (2764)
BMEP, bar (psi)	18.3 (265)
Bore, mm (in)	180 (7.09)
Stroke, mm (in)	200 (7.87)
Rated speed, rpm	1514
Piston speed, m/s (ft/min)	10 (1968)
Compression ratio	11.4:1
Lube oil capacity, L (qt)	582 (615)
Overspeed limit, rpm	1800
Regenerative power, kW	N/A
Full load lubricating oil consumption, g/kWe-hr (g/hp-hr)	0.4 (0.3)

**Fuel**

Minimum gas supply pressure at DMV, bar (psi) <sup>7</sup>	0.24 (3.5)
Min methane index	72

## Starting system(s)

Electric starter voltage, volts	24
Min battery capacity @ 40 °C (104 °F), AH	720
Air starter pressure, barg (psig)	10.3 (150)
Air starter flow, Nm <sup>3</sup> /s (scfm)	0.37 (780)

## Genset dimensions (see Note 1)

Genset length, m (ft)	7.3 (23.95)
Genset width, m (ft)	1.98 (6.5)
Genset height, m (ft)	2.94 (9.65)
Genset weight (wet), kg (lbs)	25462 (56134)

## Energy data

	See Note	100% of rated load	90% of rated load	75% of rated load	50% of rated load
Continuous generator electrical output, kWe @ 1.0 pf	6,10	2000	1800	1500	1000
Heat dissipated in lube oil cooler, kW (MMBTU/h)	5	284 (0.97)	275 (0.94)	245 (0.84)	186 (0.64)
Heat dissipated in block, kW (MMBTU/h)	5	681 (2.32)	670 (2.29)	644 (2.20)	583 (1.99)
Total heat rejected in LT circuit, kW (MMBTU/h)	5	181 (0.62)	166 (0.57)	138 (0.47)	98 (0.33)
Total heat rejected in HT circuit, kW (MMBTU/h)	5	1408 (4.81)	1302 (4.44)	1117 (3.81)	832 (2.84)
Unburnt, kW (MMBTU/h)	13	131 (0.45)	120 (0.41)	106 (0.36)	83 (0.28)
Heat radiated to ambient, kW (MMBTU/h)	5	223 (0.76)	202 (0.69)	171 (0.58)	120 (0.41)
Available exhaust heat to 105C, kW (MMBTU/h)	5	1222 (4.17)	1128 (3.85)	971 (3.31)	708 (2.42)

## Intake air flow

Intake air flow mass, kg/s (lb/hr)	5	3.32 (26314)	3.02 (23947)	2.52 (19969)	1.76 (13907)
Intake air flow volume, m <sup>3</sup> /s @ 0 °C (scfm)	5	2.58 (5753)	2.34 (5235)	1.95 (4366)	1.36 (3040)
Max air cleaner restriction, mmHG (in H <sub>2</sub> O)		18 (10)	--	--	--

## Exhaust air flow

Exhaust gas flow mass, kg/s (lb/hr)	5	3.44 (27243)	3.13 (24798)	2.61 (20687)	1.82 (14418)
Exhaust gas flow volume, m <sup>3</sup> /s (cfm)	5,16	7.11 (15045)	6.58 (13938)	5.62 (11889)	4.07 (8612)
Exhaust temperature after turbine, °C (°F)	2,5	456 (854)	469 (877)	486 (907)	516 (961)
Max exhaust system back pressure, mmHG (in H <sub>2</sub> O)	14	37 (20)	--	--	--

## HT cooling circuit

HT circuit engine coolant volume, l (gal)		498 (132)	498 (132)	498 (132)	498 (132)
HT coolant flow @ max ext restriction, m <sup>3</sup> /h (gal/min)	3	70 (308)	70 (308)	70 (308)	70 (308)
Max HT engine coolant inlet temp, °C (°F)	3,8	72 (162)	73 (164)	76 (169)	80 (176)
HT coolant outlet temp, °C (°F)	3,8	92 (198)	92 (198)	92 (198)	92 (198)
Max pressure drop in external HT circuit, bar (psig)		1.5 (22)	1.5 (22)	1.5 (22)	1.5 (22)
HT circuit max pressure, bar (psig)		6.0 (87)	6.0 (87)	6.0 (87)	6.0 (87)
Min static head, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)

<b>LT cooling circuit</b>	<b>See Note</b>	<b>100% of rated load</b>	<b>90% of rated load</b>	<b>75% of rated load</b>	<b>50% of rated load</b>
LT circuit engine coolant volume, l (gal)		59 (16)	59 (16)	59 (16)	59 (16)
LT coolant flow @ max ext restriction, m <sup>3</sup> /h (gal/min)	3	50 (220)	50 (220)	50 (220)	50 (220)
Max LT engine coolant inlet temp, °C (°F)	3,9	50 (122)	50 (122)	50 (122)	50 (122)
LT coolant outlet temp, °C (°F) reference only	3,9	53.4 (128)	53.6 (128)	52.6 (127)	52.3 (126)
Max pressure drop in external LT circuit, bar (psig)		1.5 (22)	1.5 (22)	1.5 (22)	1.5 (22)
LT circuit max pressure, bar (psig)		6.0 (87)	6.0 (87)	6.0 (87)	6.0 (87)
Min static head, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	0.5 (7)

## Emissions

NO <sub>x</sub> emissions wet, ppm	15	134	131	136	126
NO <sub>x</sub> emissions, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	15	429 (1.0)	418 (0.9)	429 (1.0)	392 (1.0)
THC emissions wet, ppm	13	1242	1255	1347	1550
THC emissions, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	13	1368 (3.1)	1374 (3.1)	1460 (3.4)	1654 (4.1)
CH <sub>4</sub> emissions wet, ppm	13	975	984	1057	1213
CH <sub>4</sub> emissions mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	13	1092 (2.4)	1095 (2.5)	1165 (2.7)	1316 (3.2)
NMHC emissions wet, ppm	13	267	271	290	337
NMHC emissions mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	13	277 (0.6)	279 (0.6)	296 (0.7)	339 (0.8)
VOC emissions (wet)	13	226	230	244	281
VOC emissions, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	13	191 (0.4)	194 (0.4)	202 (0.5)	225 0.6
Formaldehyde (wet) ppm	13	90.6	92.5	95.8	98.3
Formaldehyde, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	13	190 (0.4)	193 (0.4)	198 (0.5)	200 (0.5)
CO emissions (dry), ppm	15	570	571	558	531
CO emissions, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	15	1115 (2.5)	1110 (2.5)	1074 (2.5)	1006 (2.5)
CO <sub>2</sub> emissions (dry), percent	15	6.0	6.0	6.1	6.2
CO <sub>2</sub> emissions, mg/Nm <sup>3</sup> @ 5% O <sub>2</sub> (g/hp-h)	15	183079 (409)	183249 (414)	183228 (422)	183976 (451)
O <sub>2</sub> emissions (dry), percent	15	9	9	9	9
Particulates PM10, g/hp-h	15	<0.06	<0.06	<0.06	<0.06

## Genset de-rating

### Altitude and temperature derate multiplication factor

Barometer		Altitude		Table A													
In Hg	mbar	Feet	Meters	Derate multiplier with off grid operation													
16.0	540	16404	5000	0.60	0.60	0.60	0.55	0.50									
16.5	558	15584	4750	0.65	0.65	0.60	0.55	0.55	0.50								
17.1	577	14764	4500	0.70	0.65	0.65	0.60	0.55	0.50	0.50							
17.6	596	13944	4250	0.70	0.70	0.70	0.65	0.60	0.55	0.50							
18.2	616	13123	4000	0.75	0.70	0.70	0.70	0.65	0.60	0.55							
18.8	636	12303	3750	0.75	0.75	0.75	0.70	0.65	0.65	0.60	0.50	0.50					
19.5	657	11483	3500	0.80	0.80	0.75	0.75	0.70	0.65	0.65	0.55	0.55					
20.1	678	10663	3250	0.80	0.80	0.80	0.80	0.75	0.70	0.65	0.55	0.55					
20.7	701	9843	3000	0.85	0.85	0.80	0.80	0.80	0.75	0.70	0.60	0.60	0.50				
21.4	723	9022	2750	0.85	0.85	0.85	0.85	0.85	0.80	0.75	0.65	0.65	0.55				
22.1	747	8202	2500	0.90	0.90	0.90	0.85	0.85	0.80	0.80	0.70	0.70	0.60	0.50			
22.8	771	7382	2250	0.95	0.95	0.90	0.90	0.90	0.85	0.80	0.70	0.75	0.65	0.55			
23.5	795	6562	2000	0.95	0.95	0.95	0.95	0.90	0.90	0.85	0.75	0.75	0.70	0.55			
24.3	820	5741	1750	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.80	0.80	0.75	0.60	0.50		
25.0	846	4921	1500	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.85	0.85	0.75	0.65	0.55		
25.8	872	4101	1250	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.90	0.80	0.70	0.60		
26.6	899	3281	1000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.85	0.75	0.65	0.50	
27.4	926	2461	750	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.70	0.55	
28.3	954	1640	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.85	0.75	0.60	
29.1	983	820	250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	0.65	
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.85	0.70	
				°C	0	5	10	15	20	25	30	35	40	45	50	55	60
				°F	32	41	50	59	68	77	86	95	104	113	122	131	140
				Air filter inlet temperature													

#### Temperature & altitude derate

1. Determine derate multiplier vs. temperature and altitude in Table A or B.
2. Assumes the LT return temperature is 10 deg C (on grid) or 5 deg C (off grid) above the air filter inlet with a maximum LT temperature of 50 deg C.
3. If the LT temperature exceeds 50 deg C, consult factory for recommendations.
4. Altitude is based upon SAE standard ambient pressure vs. altitude. For low barometric conditions add 150m (500 ft) to site altitude.

Barometer		Altitude		Table B													
In Hg	mbar	Feet	Meters	Derate multiplier with on grid parallel operation													
16.0	540	16404	5000	0.65	0.60	0.60	0.60	0.55	0.55	0.50	0.50						
16.5	558	15584	4750	0.65	0.65	0.65	0.60	0.60	0.55	0.55	0.50						
17.1	577	14764	4500	0.70	0.70	0.65	0.65	0.65	0.60	0.55	0.55						
17.6	596	13944	4250	0.70	0.70	0.70	0.65	0.65	0.65	0.60	0.60	0.50					
18.2	616	13123	4000	0.75	0.75	0.70	0.70	0.70	0.65	0.65	0.60	0.55					
18.8	636	12303	3750	0.75	0.75	0.75	0.70	0.70	0.70	0.65	0.65	0.55	0.50				
19.5	657	11483	3500	0.80	0.80	0.75	0.75	0.75	0.75	0.70	0.65	0.60	0.55				
20.1	678	10663	3250	0.80	0.80	0.80	0.80	0.75	0.75	0.75	0.70	0.65	0.55	0.50			
20.7	701	9843	3000	0.85	0.85	0.85	0.80	0.80	0.80	0.75	0.75	0.65	0.60	0.55			
21.4	723	9022	2750	0.85	0.85	0.85	0.85	0.80	0.80	0.80	0.80	0.70	0.65	0.60	0.50		
22.1	747	8202	2500	0.90	0.90	0.90	0.85	0.85	0.85	0.80	0.80	0.75	0.70	0.60	0.55		
22.8	771	7382	2250	0.95	0.95	0.90	0.90	0.90	0.85	0.85	0.85	0.75	0.70	0.65	0.60	0.50	
23.5	795	6562	2000	0.95	0.95	0.95	0.95	0.90	0.90	0.90	0.85	0.80	0.75	0.60	0.50		
24.3	820	5741	1750	1.00	1.00	0.95	0.95	0.95	0.95	0.90	0.90	0.85	0.80	0.75	0.65	0.55	
25.0	846	4921	1500	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.85	0.85	0.75	0.70	0.60	
25.8	872	4101	1250	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.90	0.85	0.80	0.75	0.65	
26.6	899	3281	1000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.85	0.80	0.70	
27.4	926	2461	750	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.90	0.80	0.75	
28.3	954	1640	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.85	0.80	
29.1	983	820	250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.80	
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.85	
			°C	0	5	10	15	20	25	30	35	40	45	50	55	60	
			°F	32	41	50	59	68	77	86	95	104	113	122	131	140	
			Air filter inlet temperature														

	EE impact (%)	Est. % SPI reduction
	0	0
	- 0.4	20
	- 0.8	30

### Methane number capability

Load (percent of rated)			
100%	90%	75%	50%
72	66	57	42

**Heat rejection factor (altitude and ambient) for HT \* and LT circuits**

Barometer		Altitude		Table C													
In Hg	mbar	Feet	Meters	Multiplier for HT & LT heat rejection vs alt & temp													
16.0	540	16404	5000	1.15	1.16	1.18	1.19	1.20	1.21	1.23	1.24	1.25	1.27	1.28	1.29	1.31	
16.5	558	15584	4750	1.14	1.15	1.16	1.18	1.19	1.20	1.22	1.23	1.24	1.26	1.27	1.28	1.29	
17.1	577	14764	4500	1.13	1.14	1.15	1.17	1.18	1.19	1.21	1.22	1.23	1.24	1.26	1.27	1.28	
17.6	596	13944	4250	1.12	1.13	1.14	1.16	1.17	1.18	1.19	1.21	1.22	1.23	1.25	1.26	1.27	
18.2	616	13123	4000	1.11	1.12	1.13	1.14	1.16	1.17	1.18	1.20	1.21	1.22	1.24	1.25	1.26	
18.8	636	12303	3750	1.09	1.11	1.12	1.13	1.15	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	
19.5	657	11483	3500	1.08	1.10	1.11	1.12	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.23	1.24	
20.1	678	10663	3250	1.07	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.18	1.19	1.20	1.22	1.23	
20.7	701	9843	3000	1.06	1.07	1.09	1.10	1.11	1.13	1.14	1.15	1.17	1.18	1.19	1.20	1.22	
21.4	723	9022	2750	1.05	1.06	1.08	1.09	1.10	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.21	
22.1	747	8202	2500	1.04	1.05	1.07	1.08	1.09	1.10	1.12	1.13	1.14	1.16	1.17	1.18	1.20	
22.8	771	7382	2250	1.03	1.04	1.05	1.07	1.08	1.09	1.11	1.12	1.13	1.14	1.16	1.17	1.18	
23.5	795	6562	2000	1.02	1.03	1.04	1.06	1.07	1.08	1.09	1.11	1.12	1.13	1.15	1.16	1.17	
24.3	820	5741	1750	1.01	1.02	1.03	1.04	1.06	1.07	1.08	1.10	1.11	1.12	1.14	1.15	1.16	
25.0	846	4921	1500	0.99	1.01	1.02	1.03	1.05	1.06	1.07	1.09	1.10	1.11	1.12	1.14	1.15	
25.8	872	4101	1250	0.98	1.00	1.01	1.02	1.04	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14	
26.6	899	3281	1000	0.97	0.99	1.00	1.01	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.12	1.13	
27.4	926	2461	750	0.96	0.97	0.99	1.00	1.01	1.03	1.04	1.05	1.07	1.08	1.09	1.10	1.12	
28.3	954	1640	500	0.95	0.96	0.98	0.99	1.00	1.02	1.03	1.04	1.05	1.07	1.08	1.09	1.11	
29.1	983	820	250	0.94	0.95	0.97	0.98	0.99	1.00	1.02	1.03	1.04	1.06	1.07	1.08	1.10	
30.0	1012	0	0	0.93	0.94	0.95	0.97	0.98	0.99	1.01	1.02	1.03	1.05	1.06	1.07	1.08	
				°C	0	5	10	15	20	25	30	35	40	45	50	55	60
				°F	32	41	50	59	68	77	86	95	104	113	122	131	140
				Air filter inlet temperature													

**LT & HT circuit heat rejection calculation**

1. Determine derate multiplier vs. temperature derate per above in Table A or B.
2. Using the multiplier from #1 above as the percent load factor determine the heat rejection from the previous page.
3. From Table C find the HT and LT circuit multiplier.
4. Multiply the result of step 2 by the result of step 3 to obtain the heat rejection at your altitude and temperature.

\*For the HT coolant system, the sensitivity is 1/4 of that shown. For instance, if the table says 1.04, the actual factor for HT is 1.01.

## Alternator data

Voltage range	Connection configuration	Temp rise °C	Duty <sup>11</sup> cycle	Single phase factor	Alternator data sheet
380	Wye, 3 Phase	80/105	C	N/A	Note 12
400	Wye, 3 Phase	80/105	C	N/A	Note 12
416	Wye, 3 Phase	80/105	C	N/A	Note 12
440	Wye, 3 Phase	80/105	C	N/A	Note 12
480	Wye, 3 Phase	80/105	C	N/A	Note 12
600	Wye, 3 Phase	105	C	N/A	Note 12
4160	Wye, 3 Phase	80/105	C	N/A	Note 12
12470	Wye, 3 Phase	80/105	C	N/A	Note 12
13200	Wye, 3 Phase	80/105	C	N/A	Note 12
13800	Wye, 3 Phase	80/105	C	N/A	Note 12

## Continuous rating definition

Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.

Note:

1. Weights and set dimensions represent a generator set with its standard features only. See outline drawing for other configurations.
2. At ISO3046 reference conditions, altitude 1013 mbar (30 in Hg), air inlet temperature 25 °C (77 °F).
3. Data taken with 50% Glycol.
4. According to ISO 3046/1 with tolerance of +5% -0%.
5. Production variation/tolerance ±5%.
6. At electrical output of 1.0 power factor, 97% alternator efficiency.
7. Tested using pipeline natural gas with LHV of 33.44 mJ/Nm<sup>3</sup> (905 BTU/ft<sup>3</sup>) using Dungs DMV 5080 solenoid valve.
8. Outlet temperature controlled by thermostat. Inlet temperature for reference only.
9. Inlet temperature controlled by thermostat. Outlet temperature for reference only.
10. With engine driven coolant pumps.
11. Standby (S), Prime (P), Continuous (C) ratings.
12. Alternator model and data sheet information available on [www.powersuite.cummins.com](http://www.powersuite.cummins.com).
13. Tolerance +/- 15%.
14. Exhaust system back pressure is a rated load and decreases at lower loads. Consult factory when using variable back pressure exhaust.
15. Tolerance +/- 10%.
16. At exhaust temperature and standard atmospheric pressure.

For more information contact your local Cummins distributor  
or visit [power.cummins.com](http://power.cummins.com)

Our energy working for you.™





***ATTACHMENT 7***  
***EMISSIONS SPECIFICATIONS***

**Kuehne Delaware  
Engine Specifications**

Engine Model	Cummins C2000	
Fuel	Natural Gas	
Output	2000 kW	2 MW
	2764 hp	
Heat Input Capacity (HHV)	20.62 MMBtu/hr	
Exhaust Flow	7952 scfm	
Exhaust Temperature	854 °F	
Exhaust Flow	15045 acfm	
Natural Gas Sulfur Content	2000 gr/scf	
Hours of Operation per Yea	2500 hr/yr	
No. Engines	3	

Hours/day 24 8

**Potential Emissions**

	Vendor Supplied Emissions (g/hp-hr)*	AP-42 Section 3.2 Emission Factors (lb/MMBtu)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
PM	0.06		<b>1.10</b>	<b>1.37</b>
PM10	0.06		<b>1.10</b>	<b>1.37</b>
PM2.5	0.06		<b>1.10</b>	<b>1.37</b>
SO2		0.000588	<b>0.036</b>	<b>0.05</b>
NOx*	0.59		<b>3.55</b>	<b>4.43</b>
CO*	2.00		<b>11.97</b>	<b>14.97</b>
NMHC (VOC)	0.16		<b>2.92</b>	<b>3.66</b>
CO2		116.9	<b>7,230</b>	<b>9,037</b>
CH4		1.45	<b>89.68</b>	<b>112.10</b>
N2O		0.00022	<b>0.014</b>	<b>0.017</b>
GHG (CO2e)		147.4	<b>9,117</b>	<b>11,396</b>
Total HAP			<b>4.37</b>	<b>5.46</b>

\*NOx=lb/MWh

\*CO=lb/MWh

	Worst Case Potential Emissions (lb/day)	Typical Potential Emissions (lb/day)
PM	26.32	8.77
PM10	26.32	8.77
PM2.5	26.32	8.77
SO2	0.87	0.29
NOx	85.14	28.38
CO	287.36	95.79
NMHC (VOC)	70.20	23.40
CO2*	86.76	28.92
CH4	1.08	0.36
N2O	0.0002	0.00
GHG (CO2e)	109.41	36.47
Total HAP	104.78	34.93

\*Tons per day

***ATTACHMENT 8***  
***PRODUCT SOUND DATASHEET***



PLEASE NOTE, THESE DATA APPLY ONLY TO ENGINE NOISE. TOTAL ACTUAL NOISE LEVELS WILL BE LOWERED BY THE SURROUNDING ENCLOSURE.

**Sound Data**  
**C2000 N6CB**  
**QSV91-G4 60Hz**  
**Lean Burn Natural Gas**

**A-weighted Sound Pressure Level @ 7 meters, dB(A)**

See notes 2, 5 and 7-11 listed below

Configuration	Exhaust	Applied Load	Position (Note 2)								8 Position Average
			1	2	3	4	5	6	7	8	
Standard - Unhoused (Remote Cooling, No Muffler)	Infinite Exhaust	0 % Load	87.0	90.3	92.0	91.4	85.7	91.9	91.3	91.7	90.6
		50 % Load	92.6	95.9	94.1	94.1	87.5	95.2	94.9	93.9	94.1
		75 % Load	94.4	97.6	94.8	95.5	88.0	95.6	95.8	94.7	95.1
		100 % Load	94.4	98.4	95.8	97.6	89.1	96.6	97.0	96.3	96.3

**Average A-weighted Sound Pressure Level @ 1 meter, dB(A)**

See notes 1, 5 and 7-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)										Overall Sound Pressure Level	
			16	31.5	63	125	250	500	1000	2000	4000	8000		16000
Standard - Unhoused (Remote Cooling, No Muffler)	Infinite Exhaust	0 % Load	N/A	43.4	59.7	73.2	84.9	92.5	92.6	91.0	84.8	76.6	63.3	97.4
		50 % Load	N/A	43.3	60.5	78.0	87.4	92.8	99.1	92.2	88.5	85.8	74.7	101.3
		75 % Load	N/A	43.5	59.9	80.5	87.9	92.8	100.0	93.2	91.1	89.4	78.5	102.3
		100 % Load	N/A	43.8	60.8	82.6	88.4	93.6	100.3	95.3	94.5	94.4	82.5	103.6

**A-weighted Sound Pressure Level @ Operator Location, dB(A)**

See notes 1, 3, 5 and 7-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)										Overall Sound Pressure Level	
			16	31.5	63	125	250	500	1000	2000	4000	8000		16000
Standard - Unhoused (Remote Cooling, No Muffler)	Infinite Exhaust	75 % Load	N/A	43.8	60.5	81.8	88.6	93.1	101.2	93.3	87.6	86.4	69.4	102.9
		100 % Load	N/A	44.1	61.5	84.7	90.5	93.9	101.6	94.2	88.5	92.7	72.6	103.7

**A-weighted Sound Power Level, dB(A)**

See notes 1, 3 and 6-14 listed below

Configuration	Exhaust	Applied Load	Octave Band Center Frequency (Hz)										Overall Sound Power Level	
			16	31.5	63	125	250	500	1000	2000	4000	8000		16000
Standard - Unhoused (Remote Cooling, No Muffler)	Infinite Exhaust	0 % Load	N/A	64.6	81.0	94.5	106.2	113.7	113.8	112.3	106.1	97.9	84.6	118.7
		50 % Load	N/A	64.6	81.7	99.3	108.6	114.1	120.3	113.4	109.7	107.1	96.0	122.5
		75 % Load	N/A	64.7	81.2	101.7	109.2	114.1	121.2	114.5	112.3	110.6	99.8	123.5
		100 % Load	N/A	65.1	82.1	103.9	109.7	114.8	121.6	116.5	115.7	115.7	103.8	124.9



# Sound Data

## C2000 N6CB

### QSV91-G4 60Hz

#### Lean Burn Natural Gas

### Exhaust Sound Power Level, dB(A)

See notes 4 and 6-14 listed below

Configuration	Applied Load	Octave Band Center Frequency (Hz)											Overall Sound Power Level
		16	31.5	63	125	250	500	1000	2000	4000	8000	16000	
Open Exhaust (with Tail Pipe)	0 % Load	N/A	68.3	84.4	97.9	102.3	98.7	98.0	92.6	88.5	80.7	68.6	106.1
	50 % Load	N/A	56.7	90.2	97.6	105.9	108.0	109.1	108.9	108.2	101.0	90.9	115.4
	75 % Load	N/A	56.7	91.1	98.8	107.7	110.0	110.4	112.5	112.0	105.2	95.3	118.2
	100 % Load	N/A	56.1	91.0	100.2	110.9	115.5	116.9	117.7	116.7	111.1	99.6	123.4

Global Notes:

1. Sound pressure levels at 1 meter are measured per the requirements of ISO 3744, ISO 8528-10, ANSI S1.13, ANSI S12.1 and European Communities Directive 2000/14/EC as applicable. The microphone measurement locations are 1 meter from a reference parallelepiped just enclosing the generator set (enclosed or unenclosed).
2. Seven-meter measurement location 1 is 7 meters (23 feet) from the generator (alternator) end of the generator set, and the locations proceed counter-clockwise around the generator set at 45° angles at a height of 1.2 meters (48 inches) above the ground surface.
3. Sound Power Levels are calculated according to ISO 3744, ISO 8528-10, and or CE (European Union) requirements.
4. Exhaust Sound Levels are measured and calculated per ISO 6798, Annex A.
5. Reference Sound Pressure Level is 20 µPa.
6. Reference Sound Power Level is 1 pW (10<sup>-12</sup> Watt).
7. Sound data for remote-cooled generator sets are based on rated loads without cooling fan noise.
8. Sound data for the generator set with infinite exhaust do not include the exhaust noise contribution.
9. Published sound levels are measured at CE certified test site and are subject to instrumentation, measurement, installation and manufacturing variability.
10. Unhoused/Open configuration generator sets refers to generator sets with no sound enclosures of any kind.
11. Housed/Enclosed/Closed/Canopy configuration generator sets refer to generator sets that have noise reduction sound enclosures installed over the generator set and usually integrally attached to the skid base/base frame/fuel container base of the generator set.
12. Published sound levels meet the requirements India's Central Pollution Control Board (Ministry of Environment & Forests), vide GSR 371 (E), which states the A-weighted sound level at 1 meter from any diesel generator set up to a power output rating of 1000kVA shall not exceed 75dB(A)
13. For updated noise pollution information for India see website: <http://www.envfor.nic.in/legis/legis.html>
14. Sound levels must meet India's Ambient Air Noise Quality Standards detailed for Daytime/Night-time operation in Noise Pollution (Regulation and Control) Rules, 2000