

HEARING OFFICER'S REPORT

TO: The Honorable Shawn M. Garvin
Cabinet Secretary, Department of Natural Resources and Environmental Control

FROM: Lisa A. Vest *LAV*
Public Hearing Officer, Office of the Secretary
Department of Natural Resources and Environmental Control

RE: Permit Applications of Diamond State Generating Partners, LLC/Bloom Energy, pursuant to 7 DE Admin. Code 1102, to upgrade the fuel cell units at both its Brookside and Red Lion facilities, located in Newark, Delaware, and New Castle, Delaware, respectively.

DATE: April 8, 2019

I. BACKGROUND AND PROCEDURAL HISTORY:

A public hearing was held on Thursday, January 10, 2019, at 6:00 p.m. by the Department of Natural Resources and Environmental Control (“DNREC,” “Department”) at its offices located at 391 Lukens Drive, New Castle, Delaware, to receive comments on two permit applications submitted to the Department’s Division of Air Quality (“DAQ”) by Diamond State Generating Partners, LLC/Bloom Energy (“Bloom,” “Applicant”), which are currently pending before the Department at this time. The Applicant seeks permission to upgrade the fuel cell units at both the Brookside facility (located at 512 E. Chestnut Hill Road, Newark, Delaware) and the Red Lion facility (located at 1593 River Road, New Castle, Delaware). The Applicant’s proposal to perform this maintenance upgrade at each of the aforementioned sites is subject to various state and federal regulatory requirements, including, but not limited to, Delaware’s air quality regulations, as set forth in 7 DE Admin. Code 1100, *Air Quality Management Section*.

Bloom Energy is a fuel cell manufacturing company headquartered in Sunnyvale, California. The Bloom fuel cells utilize solid oxide fuel cell technology to chemically convert natural gas to electrical power in a non-combustion process. Bloom is currently permitted by the Department's DAQ for three fuel cell sites in Delaware: the Bloom Manufacturing Center (located in Newark, Delaware), and the Brookside and Red Lion sites, as referenced above.

The permit applications submitted to the Department by Bloom seek approval for the following proposed projects at this time:

(1) Pursuant to 7 DE Admin. Code 1102, Applicant has applied for a construction permit for a 2.6 megawatt ("MW") Fuel Cell Electric Generation Plant, consisting of 13 Bloom Energy ES5-BABAAA fuel cells at its Brookside facility.

(2) Pursuant to 7 DE Admin. Code 1102, Applicant has applied for a construction permit for a 24.9 MW Fuel Cell Electric Generation Plant, consisting of 52 Bloom Energy ES5-BABAAA 200 kilowatt ("kW") fuel cells and 58 ES5-AACAAA 250 kW fuel cells at its Red Lion facility.

It should be noted that the Applicant's Red Lion facility is geographically located in the Coastal Zone of the State of Delaware. Pursuant to the Department's Coastal Zone Act ("CZA") Regulations, a CZA Permit Application was received by the Department from Bloom on November 17, 2011, seeking permission to operate its business within Delaware's Coastal Zone, specifically, at 1593 River Road, New Castle, Delaware. That location is now known as Bloom's Red Lion facility, as previously described herein.

The Department provided public notice of Bloom's CZA application at that time, pursuant to the mandatory legal noticing requirements, and, accordingly, a public hearing was held regarding that matter at DNREC's Lukens Drive office in New Castle, Delaware, on March 6, 2012. Then-Secretary Collin P. O'Mara subsequently issued Secretary's Order No. 2012-CZ-0013 (April 30, 2012), which ordered that a CZA Permit be issued by the Department to Bloom, effective April 30, 2012. No additional permitting approval is required by the Department's CZA Program for the projects currently proposed by Bloom at this time, as this Applicant has already met all CZA permitting requirements under the CZA Regulations that govern business operations within Delaware's Coastal Zone.

The permit applications submitted by Bloom, as detailed above, request permission to perform maintenance upgrades by replacing the existing fuel cells at each facility with new fuel cells, representing Bloom's latest technology ("Applications"). Bloom contends that, once these maintenance upgrades have been completed, the new cell sites will have a smaller footprint, a lowered energy capacity and lower emissions.

The aforementioned Applications were initially received by the Department on October 24, 2018. Thereafter, the Applications were placed on public notice on November 11, 2018 to open the fifteen day public comment period. During the public notice period, the Department's DAQ received a request for a public hearing regarding this matter.

The Department held its public hearing concerning this matter on January 10, 2019, which was attended not only by Department staff and representatives of the Applicant, but also by members of the public. Comment was received from the public at that hearing, and will be discussed in further detail below. Proper notice of the hearing was provided as required by law.

II. SUMMARY OF THE PUBLIC HEARING RECORD:

The public hearing record consists of the following documents:

- (1) The official verbatim Transcript of Proceedings from Wilcox & Fetzer, Ltd., generated from the public hearing of January 10, 2019;
- (2) Six folders containing the Department's Exhibits in this matter, introduced by responsible DAQ staff at the aforementioned hearing, and marked accordingly by this Hearing Officer as "Dept. Exh. 1-6";
- (3) Written statement from David T. Stevenson, Director, Center for Energy Competitiveness, Caesar Rodney Institute, offered at the aforementioned public hearing and marked accordingly as "Stevenson Exh. #1";
- (4) Written statement from Amy Roe, which included written comments submitted by Lindsey Leveen (a resident of the State of California, who was unable to attend the hearing on January 10, 2019), offered at said hearing and marked accordingly as "Roe Exh. #1";
- (5) Copies of two manifests provided by John Nichols as a supplement to his verbal comment offered at said hearing, marked as "Nichols Exh. #1";
- (6) Copy of Department email from Marjorie A. Crofts to John Nichols, dated April 30, 2018, provided by John Nichols as a supplement to his verbal comment offered at said hearing, marked as "Nichols Exh. #2";
- (7) Copy of article published by the *Delaware News Journal*, dated November 21, 2018, provided by John Nichols as a supplement to his verbal comment offered at said hearing, marked as "Nichols Exh. #3";
- (8) Written statement from Wayne Mulford as a supplement to his verbal comment offered at said hearing and marked accordingly as "Mulford Exh. #1";

(9) Technical Response Memorandum (“TRM”), with attachments, from Angela D. Marconi, P.E., BCEE, Branch Manager, Engineering and Compliance Section, DNREC DAQ, received by this Hearing Officer on April 1, 2019.

The Department’s person primarily responsible for reviewing this application, Ms. Marconi, as referenced above, developed the record with the relevant documents in the Department’s files.

The hearing record generated in this matter indicates that six members of the public offered comments regarding Bloom’s pending Applications at the time of the January 10, 2019 public hearing. Additional written comments were received by the Department from members of the public, both prior to and subsequent to the aforementioned hearing, during the time period in which the hearing record was open to receive public comment.

The public comment period closed on Friday, January 25, 2019. Pursuant to 7 DE Admin. Code 1102 (specifically, Section 12.3.5), the Applicant was then afforded an opportunity to submit responses to the public comments received in this matter. The Applicant’s responses are included in DAQ’s TRM package (see No. 9 above).

At the request of this Hearing Officer, the technical experts in the Department’s DAQ prepared the aforementioned TRM to (1) specifically address the concerns associated with these pending Applications, as set forth in the public comment received by the Department; and (2) offer DAQ’s conclusions and recommendations with regard to these Applications for the benefit of the hearing record generated in this matter. In its TRM, the DAQ provides a summary of the public comment received in this matter, and provides specific responses to the same.

It should be noted that many of the comments contained in this hearing record were reiterated by more than one commenter. Those repeated concerns were consolidated by the DAQ during its review of the hearing record, and then summarized within its TRM for both clarity and brevity. Additional comments received by the Department voiced concerns about various aspects of the Applicant's business operations, many of which fell outside of the DAQ's permitting authority. Further comments voiced personal opinions regarding the Applicant's business in general, which are also beyond the scope of DAQ's authority in permitting matters such as this.

The TRM provides the DAQ's formal responses to the public comment received by the Department regarding matters specifically associated with the Applications currently pending before the Secretary at this time. This TRM does not, however, address comments that pertain to matters outside the permitting authority of the DAQ, nor is it responsive to any comments that are not specifically related to these pending Applications, which was the subject matter of the public hearing held by the Department on January 10, 2019.

I find that the DAQ's TRM offers a detailed review of all aspects of the Applicant's pending Applications, addresses those concerns germane to the subject matter of the aforementioned public hearing, and responds to them in a balanced manner, accurately reflecting the information contained in the formal hearing record. Thus, the aforementioned TRM, with attachments, is attached hereto as Appendix "A" and expressly incorporated herein as such.

III. RECOMMENDED FINDINGS AND CONCLUSIONS:

The pending Applications submitted to the Department by the Applicant in this matter are for DAQ construction permits to perform maintenance upgrades of its existing fuel cell units at the Brookside facility (located at 512 E. Chestnut Hill Road, Newark, Delaware) and the Red Lion facility (located at 1593 River Road, New Castle, Delaware), as set forth above. I find that this proposed project requires the Applicant to obtain DAQ Construction permits for the aforementioned upgrades to be performed at each location noted above. I further find that the Applicant's proposed project is subject to various state and federal regulatory requirements, including, but not limited to, Delaware's air quality regulations as set forth in 7 DE Admin. Code 1100, *Air Quality Management Section*.

In reviewing the applicable statutes and regulations, as well as weighing public benefits of this project against potential detriments, the Department's experts in the DAQ have concluded that the Applicant's proposed maintenance upgrade complies with all federal and state air pollution control laws and regulations. Should the Secretary approve these Applications, the DAQ Construction permits that would be issued by the Department would be similar to the existing DAQ permits for these Bloom facilities. The new permits would be reflective of the Applications submitted, and would contain requirements that include, but are not limited to, removal of the existing fuel cell units as the upgraded units are installed. The new permits would also contain limits on natural gas consumption and carbon dioxide emissions.

Among the many comments received by the Department in this matter were those that questioned how the emissions associated with the Applicant's project will be monitored, and what actions will be taken by the Department should emissions exceed the permit limits. In response to those comments, DAQ notes in its TRM that natural gas usage is monitored and used to calculate emissions. Monthly reports are submitted to the Department showing natural gas usage, monthly and rolling 12-month emissions, and maintenance performed. If permitted emissions are exceeded, enforcement actions such as a Notice of Violation (and enforcement fines) may be pursued by the Department at that time.

Comments were also received from the public which questioned the Applicant's need to "decoke" the fuel cell units. Specifically, concerns were raised that, while the process of "decoking" creates air emissions, such emissions are not quantified in these Applications. In response, the Department has verified in its TRM that the decoking process will not be required for the units installed as proposed in these Applications.

The Department also realizes that it will not be possible for the new units to be installed without removing the old units. The TRM also addresses this issue, noting that Construction-to-Operation inspections by the DAQ will be required as the proposed construction proceeds. Furthermore, Bloom will be required to submit supplemental documentation related to any type of process similar to the aforementioned "decoking" process, and disclose any associated emissions related to the same, prior to being permitted to implement such process onsite.

I find and conclude that the Applicant has adequately demonstrated its compliance with all requirements of the statutes and regulations, as noted herein, and that the record supports approval of the Applications submitted by Diamond State Generation Partners, LLC/Bloom Energy. In conclusion, I recommend that all permits required for the Applicant to perform the proposed maintenance upgrade of its existing fuel cell units at both the Brookside facility (located at 512 E. Chestnut Hill Road, Newark, Delaware) and the Red Lion facility (located at 1593 River Road, New Castle, Delaware), consistent with the record developed in this matter, be issued by the Department in the customary form, and with appropriate conditions.

Further, I recommend the Secretary adopt the following findings and conclusions:

1. The Department has jurisdiction under 7 *Del. C.* §§6003, 6004, 6006(4), and all other relevant statutory authority, to make a final determination on the Applications after holding a public hearing, considering the public comments, and reviewing all information contained in the Record generated in this matter;
2. The Department provided proper public notice of the Applications submitted by this Applicant, and of the public hearing regarding these Applications held on January 10, 2019, and held said hearing in a manner required by the law and regulations;
3. The Department considered all timely and relevant public comments in the Record, as established in the TRM provided by the Department's DAQ, which has now been expressly incorporated into the hearing record generated in this matter;
4. The Department has carefully considered the factors required to be weighed in issuing all permits required by the Applicant's proposed maintenance upgrade at both its Brookside and Red Lion facilities, and finds that the Record supports approval of these Applications and the issuance of all required permits associated with same;

5. The Department shall issue all necessary Construction permits to Diamond State Generation Partners, LLC/Bloom Energy to perform its proposed maintenance upgrade of the existing fuel cell units at both its Brookside facility (located at 512 E. Chestnut Hill Road, Newark, Delaware) and its Red Lion facility (located at 1593 River Road, New Castle, Delaware). Furthermore, said permits shall include all conditions as set forth in the Department's draft permits, to ensure that Delaware's environment and public health will be protected from harm;
6. The Department has an adequate Record for its decision, and no further public hearing is appropriate or necessary; and
7. The Department shall serve and publish its Order on its internet site, and shall provide legal notice of the Order in the same manner that the Department provided legal notice of the Applications.



LISA A. VEST
Public Hearing Officer

APPENDIX "A"



MEMORANDUM

TO: Lisa Vest
Hearing Officer

THROUGH: David F. Fees, P.E.
Division Director *DF*

FROM: Angela D. Marconi, P.E., BOEED *ADM*
Program Manager

Karen Mattio, P.E. *KAM*
Managing Engineer



SUBJECT: Technical Response Memorandum for Diamond State Generating Partners (Bloom Energy) applications to upgrade servers at the Brookside and Red Lion Facilities

DATE: February 22, 2019

BACKGROUND

Lisa Vest, Public Hearing Officer, requested a Technical Response Memorandum (TRM) to provide expert technical assistance for the Hearing Officer's Report and recommendations to the Secretary with regard to the pending Division of Air Quality (DAQ) applications for the replacement of existing fuel cell units at Diamond State Generating Partners (Bloom Energy) Brookside and Red Lion facilities. The TRM includes a thorough investigation of issues raised in public comments received at the hearing conducted on January 10, 2019 as well as public comments submitted in writing prior to, during and after the hearing. I hope this information will assist you in reviewing the issues and making your recommendations to the Secretary of the Department of Natural Resources and Environmental Control.

Diamond State Generating Partners/Bloom Energy (Bloom) is a fuel cell manufacturing company headquartered in Sunnyvale, California. The Bloom fuel cells utilize solid oxide fuel cell (SOFC) technology to chemically convert natural gas to electrical power in a non-combustion process. Bloom is currently permitted for three fuel cell sites in Delaware. The sites are the Bloom Manufacturing Center, Brookside and Red Lion. The Red Lion site is located in the coastal zone.

On October 24, 2018, Bloom submitted two applications to upgrade the fuel cells at both the Brookside and Red Lion sites. Based on the applications, the new cell sites will have a smaller footprint, a lowered energy capacity and lower emissions. The new fuel cells will replace/upgrade the fuel cells currently installed at these locations. The new Brookside site will consist of 13 cells with capacity to generate 2.6 MW. The new Red Lion site will consist of 110 fuel cells with capacity to produce 24.9 MW.

DAQ ENFORCEMENT HISTORY

None.

REVIEW OF APPLICATION AND PUBLIC HEARING

The Division of Air Quality (DAQ) issued a public notice that it had received the permit applications for

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the Brookside and Red Lion facilities. The legal notice was published in the Sunday News Journal and the Delaware State News on November 11, 2018. A public hearing was requested and held on January 10, 2019 in the meeting room at DNREC's Lukens Drive Facility, located at 391 Lukens Drive, New Castle, DE 19720 to receive comments on the applications. The record remained open until the close of business on January 25, 2019.

On behalf of DNREC, Hearing Officer Ms. Lisa Vest, conducted the public hearing. Ms. Vest opened the hearing with procedural information. Following the information that Ms. Vest presented, the company, Bloom Energy, gave a presentation on the project. Mr. Arnie Ballantine, Vice President – Systems Engineering at Bloom Energy spoke on behalf of the company. Then, the DAQ Program Manager for Engineering and Compliance, Ms. Angela D. Marconi presented the information on the air permitting process and about these applications specifically. Following these presentations, comments were offered by the public.

A transcript of the public hearing was prepared by Wilcox & Fetzer, Ltd and was submitted to the Department on January 21, 2019.

COMMENTS AND DAQ RESPONSES

Six members of the public offered spoken and/or written comments at the hearing. In addition to the comments received at the hearing, many comments were received in writing both prior to and after the hearing. DAQ reviewed all comments received and provides a response herein to all comments that are germane to air quality permitting. It should be noted that many repeat comments were received. These comments have been consolidated where appropriate in this response document.

The DAQ does not have authority to approve or deny permits based on rules outside of our purview. Therefore DAQ has prepared responses to comments that are pertinent to air quality issues.

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The comments in the table below have been edited for clarity and brevity. Verbatim statements can be found in the Air Quality Hearing Transcript prepared by Wilcox & Fetzer, Ltd.

General Public Comment Summary	DAQ Responses
<p>David Stevenson representing the Caesar Rodney Institute:</p> <p>Oral Comments: The permit application is incomplete. There needs to be a Coastal Zone permit because the hazardous waste was never considered in the initial application.</p> <p>AQM 3.1 Line 9.1 states no by-products are produced. That needs to be changed to show the products produced by the desulfurization process.</p> <p>Line 12.13 check no boxes for pollution controls. It's clear that the desulfurization process is reducing SOX.</p> <p>There are actual limits of hazardous waste that can be removed according to the Coastal Zone Permit.</p> <p>Written Comments, submitted at the hearing and via email/post: How does this permit vary from the original permit? Will there be a cap on maximum natural gas use, or CO₂ emissions?</p>	<p>The air quality permit application is complete. A coastal zone re-application is not required for this project.</p> <p>The sulfur removal canisters are considered waste, not byproducts.</p> <p>The sulfur filter affects emissions by reducing sulfur in the fuel but its purpose is not to reduce emissions. Therefore it is not a pollution control device.</p> <p>The Coastal Zone Permit does not limit waste generation or removal. DAQ contacted Mr. Stevenson regarding this issue. He informed us that section 6.19 of the Coastal Zone Permit Application lists waste quantities associated with the project. These numbers were not transferred to the Coastal Zone Permit and are not enforceable under DAQ regulations.</p> <p>The draft permits that have been prepared following the hearing are</p>

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<p>The permit caps emissions of air pollutants SO₂, NO_x, and CO. How will emissions be monitored, and what actions will be triggered if the caps are exceeded?</p>	<p>similar to the existing air permits for the facilities. The new permits contain limits on natural gas consumption and CO₂ emissions.</p> <p>Natural gas usage is monitored and used to calculate emissions. Also, monthly reports are submitted to the Department showing natural gas usage, monthly and rolling 12-month emissions and maintenance performed. If permitted emissions are exceeded, enforcement actions such as a notice of violation and enforcement fines may be pursued.</p>
<p>Would the emissions caps be the same if Bloom replaced the fuel cell modules in the existing servers?</p>	<p>Changes to the installed equipment that change the potential to emit would require permit changes to reflect the installed equipment.</p>
<p>Given the existence of hazardous pollutants, would Bloom need a permit if the fuel cell modules were replaced in the existing servers?</p>	<p>Air permits are required based on changes to emissions, regulation applicability or construction. If these items were changing then an air permit would be required. Maintenance and replacement-in-kind does not require permitting.</p>
<p>This just the first step in replacing servers at Red Lion. The 27 Megawatt capacity generation facility at Red Lion was exempted from buying carbon dioxide emission allowances even though it exceeds the 25 megawatt maximum exclusion capacity. Will that decision be reviewed?</p>	<p>The upgrade at Red Lion will have a total capacity of 24.9 MW, which is below the RGGI applicability. Additional information regarding why the rule was not applicable to the original site (which</p>

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	<p>did have total capacity greater than 25 MW) is provided herein for your reference.</p> <p>This question can be answered via Delaware's CO2 Budget Trading Program regulation – 7 DE Admin. C. 1147. First, the Applicability provisions found in Section 1.2 of 7 DE Admin C. 1147 state:</p> <p>1.2 Applicability.</p> <p>1.2.1 <i>Units.</i> <u>Any unit that, at any time on or after January 1, 2005, serves an electricity generator with a nameplate capacity equal to or greater than 25 MWe shall be a CO₂ budget unit and any source that includes one or more such units shall be a CO₂ budget source, subject to the requirements of this regulation.</u></p> <p>From the Definitions in Section 1.3:</p> <ul style="list-style-type: none"> • <u>“Unit” means a fossil fuel-fired stationary boiler, combustion turbine, or combined cycle system.</u> • <u>“Fossil fuel-fired” means:</u> (1) With regard to a unit that commenced operation prior to January 1, 2005, the combustion of fossil fuel, alone or in combination with any other fuel, where the fossil fuel combusted comprises, or is projected to comprise, more than 50

General Public Comment Summary	DAQ Responses
	<p>percent of the annual heat input on a Btu basis during any year.</p> <p>(2) With regard to a unit that commences operation on or after January 1, 2005, <u>the combustion of fossil fuel, alone or in combination with any other fuel, where the fossil fuel combusted comprises, or is projected to comprise, more than 5 percent of the annual heat input on a Btu basis during any year.</u></p> <ul style="list-style-type: none"> • <u>"Fossil fuel"</u> means natural gas, petroleum, coal, or any form of solid, liquid, or gaseous fuel derived from such material. • <u>"CO₂ budget unit" means a unit that is subject to the CO₂ Budget Trading Program requirements under 1.2 of this regulation.</u> • <u>"CO₂ budget source" means a source that includes one or more CO₂ budget units.</u> <p>The Bloom Energy fuel cells currently installed at Red Lion in aggregate are greater than 25 MW. However, no single unit exceeds the 25 MW unit threshold.</p> <p>The second issue to consider with regards to applicability of the unit to the RGGI program is the combustion of fossil fuel. Though, the Bloom Energy fuel cell</p>

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<p>There is a decoking process used 3% to 4% of the time and there is no description of how this impacts emissions.</p> <p>Amy Roe: Oral Comments: The way that Bloom has calculated CO2 emissions per megawatt hour is not how the US EPA calculates emissions for natural gas.</p> <p>Bloom also appears to be underestimating the emissions of volatile organic compounds because it relies on statistically insignificant data points from three tests with widely varying emission levels.</p>	<p>units utilize natural gas as a component in the chemical reaction (reforming) of natural gas to hydrogen, natural gas is not combusted in the unit. The methane is converted in the fuel processor to hydrogen, and carbon dioxide.</p> <p>Therefore, the Bloom Energy fuel cells are not RGGI units as they do not exceed the individual 25 MW unit threshold nor do they combust fossil fuel. By the definitions and the applicability, Bloom Energy is not required to purchase or hold CO2 allowances for purposes of compliance with the RGGI program. Bloom Energy fuel cell units are therefore exempt from the RGGI program.</p> <p>The decoking process will not be required for the units installed as a part of these applications.</p>
	<p>Bloom addressed CO2 emission rates in their letter dated February 8, 2019. DAQ accepts Bloom's justification for this emission rate.</p> <p>The testing shows three data points. This data was accepted by the State of California (certification attached as part</p>

General Public Comment Summary	DAQ Responses
<p>Bloom seemingly ignores SO2 emissions in the application.</p> <p>Bloom uses a capacity factor of 100 percent for all the megawatts installed to calculate its natural gas consumption. 100 percent capacity factor is not possible in the real world, which raises questions about the actual consumption that the facility will need.</p> <p>As reported to Delaware's Public Service Commission, Bloom's capacity factor has been low due to their need to "decock" the units 3 to 4 percent of the time. The process of "decocking" created air emissions, yet these air emissions are not quantified in the air permit application.</p> <p>The amount of waste generated is limited by its Coastal Zone Act permit. How will the waste products generated by Bloom be categorized by DNREC and how can this be done by violating their Coastal Zone Act Permit?</p> <p>The commenter requested that the Division of Air Quality require Bloom to do the following:</p> <ul style="list-style-type: none"> • Provide statistically meaningful data on air emissions • Provide a detailed demolition plan with full disclosure of the mass of solid waste and the method of disposing of solid waste. 	<p>of Bloom's letter dated February 8, 2019). Given the previous approval and the low quantities involved, Delaware accepts this data.</p> <p>SO2 emissions are included in the applications. They are located on page 30 of 51 for the Brookside application and on page 32 of 90 for the Red Lion application.</p> <p>For air permitting purposes, use of 100% uptime is justified in order to represent the potential to emit.</p> <p>The decoking process will not be required for the units installed as a part of these applications.</p> <p>The Coastal Zone Permit does not limit waste generation or removal.</p> <p>In response to these items:</p> <ul style="list-style-type: none"> • This was addressed above. • A phased approach for transitioning from old to new equipment operation is included in the construction permit drafted following the hearing. The company is required to comply with State and

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<ul style="list-style-type: none"> • Provide public assurance that they will not claim tax credits for this maintenance. • Provide details of their agreement with Credit Suisse on how funds will be distributed. • Justify why they are installing fewer megawatts of nameplate capacity for this upgrade than were installed in 2012. <p>Written Comments, submitted at the hearing (From Lindsay Leveen): In the application Bloom shows a Flow Diagram stating the million BTUs of natural gas needed per hour per machine. The heat rate is 6.2 million BTUs per megawatt hour. The US EPA uses an emission rate of 117 pounds of CO2 per million BTUs of natural gas. Multiplying 6.2 by 117 we have Bloom in the body of the application now claiming that they emit 725.4 pounds of CO2 per megawatt hour not the 700 pounds used in the table on the first page.</p> <p>This air quality committee must require Bloom to account for these emissions (from the decoking process) in a transparent process.</p>	<p>Federal laws regarding waste disposal.</p> <ul style="list-style-type: none"> • This is not germane to air quality permitting. • This is not germane to air quality permitting. • This is not germane to air quality permitting. <p>Bloom addressed CO2 emission rates in their letter dated February 8, 2019. DAQ accepts Bloom's justification for this emission rate.</p> <p>The decoking process will not be required for the units installed as a part of these applications.</p>
<p>Ms. Britni Kriner: Ms. Kriner requested that the permits be issued. Her remaining comments were not pertinent to the air permit.</p> <p>Mr. John Nichols:</p>	<p>No Comment.</p>
<p>The Coastal Zone permit application should be a part of the record.</p> <p>What do the following words mean: replacement, repair, and upgrade.</p>	<p>The CZ application is not part of this record.</p> <p>The DAQ considers this project to be an upgrade because the existing units will be replaced with newer models. DAQ considers this project to include</p>

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<p>A new word was introduced to my lexicon is "natural minor facility". I'm not familiar with that. That could be a DNREC word, but it's not covered under the Uniform Development Code of New Castle County.</p> <p>It's pretty clear under the Uniform Development Code you may not site a major utility in S zoning classification. To the best of my knowledge, that zoning classification still exists. UDC goes on to specify that: "Any facility for the regional generation, transmission, distribution, treatment, disposal, or storage of power, water, sanitary sewer, waste management is not permitted". These are UDC Section 40.03.110, UD Sections 40.33.270 F and G. I don't know how they got their permit in the first place, but they're asking that this application be approved under the same ruling that I believe was incorrectly made by New Castle County.</p>	<p>"construction" as defined in 7 DE Admin. Code 1102: <i>"Construction" means fabrication, erection, or installation of an applicable source or a stationary source.</i></p> <p>The term "natural minor facility" is an air permitting term that describes a facility that does not have potential emissions greater than the major source threshold as defined in the Clean Air Act.</p> <p>DAQ does not make zoning determinations. Given the concern, DAQ did pull information regarding the zoning for the Brookside and Red Lion sites, which is attached. Brookside is zoned "Suburban". Prior to initial construction of the facility, New Castle County approved a "minor utility substation" on this property (see attached). Red Lion is zoned "Heavy Industrial". Any additional questions about zoning should be directed to New Castle County.</p>
<p>Mr. Clint Laird: Oral Comments: For the record, the decoking process that was referred to earlier has been changed. After DNREC was made aware of the decoking process, which they were not aware of, the decoking process was changed to be called "process improvements" which is a much better term of course.</p>	<p>The decoking process will not be required for the units installed as a part of these applications.</p>

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<p>Written Comments, submitted via email: When it was pointed out to Delaware regulators that decoking was noted in Bloom's reports, the term "decoking" was replaced by "performance enhancements" in subsequent reports. Why?</p> <p>Seven years ago, Bloom stated that the units would be operational 100% of the time. Over time the reports show a degradation in "up time". Now the reports show 85% "up time". At the January 10 hearing, Bloom's presentation for the new boxes showed 100% "up time". Really?</p>	<p>Delaware continues to refer to this process as "decoking". As noted above, this process will not be necessary for the upgraded units.</p> <p>For air permitting purposes, use of 100% uptime is justified in order to represent the potential to emit.</p>
<p>Mr. Wayne Mulford: Mr. Mulford requested that the permits be issued. His remaining comments were not pertinent to the air permit.</p>	<p>No Comment.</p>
<p>Lindsay Leveen: Written Comments, submitted via email:</p> <p>Questions regarding the VOC emission data were submitted several times.</p> <p>Questions regarding the decoking process were submitted several times.</p> <p>Questions regarding the classification of the facilities as "natural minor" were submitted several times.</p>	<p>The testing shows three data points. This data was accepted by the State of California (certification attached as part of Bloom's letter dated February 8, 2019). Given the previous approval and the low quantities involved, Delaware accept this data.</p> <p>The decoking process will not be required for the units installed as a part of these applications.</p> <p>The term "natural minor facility" is an air permitting term that describes a facility that does not have potential emissions greater than the major source threshold</p>

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Diamond State Generating Partners, LLC (Bloom Energy)
DAQ's Response Document for the Public Hearing on January 10, 2019
 February 22, 2019
 Page 12

General Public Comment Summary	DAQ Responses
<p>Questions regarding the coastal zone approval, including waste generation and disposal, were submitted several times.</p> <p>Questions regarding the currently installed capacity at the Red Lion site were submitted several times.</p> <p>Questions regarding the carbon dioxide emission were submitted several times.</p>	<p>as defined in the Clean Air Act.</p> <p>The Coastal Zone Permit does not limit the waste generation or removal.</p> <p>There was an error in the cover letter to Bloom's Red Lion application dated October 23, 2019. On December 7, 2018, Bloom submitted a letter correcting this error. The information in the letter regarding the equipment installed concurs with DAQ inspection records. There is currently 27 MW installed at Red Lion.</p> <p>Bloom addressed CO2 emission rates in their letter dated February 8, 2019. DAQ accepts Bloom's justification for this emission rate.</p>
<p>James E. Brown: Written Comments, submitted via email: What is Bloom doing with a charging / storage energy producing sites in / around homes / living areas? I remember keeping them out of Newark because of air / noise pollution. They took their "act" to Middletown? With all the new power lines being installed around the southern Newark Del. area I assume the A M radio signals will have more "static" then before. It would be nice to know what is going on / future ideas in some type of report to relate to the ongoing in and around Delaware.</p>	<p>Bloom energy has operated the Brookside site (in Newark) since 2012. The Bloom sites are not "data centers". The Bloom fuel cells utilize solid oxide fuel cell (SOFC) technology to chemically convert the natural gas to electrical power in a non-combustion process. DAQ construction permits are advertised in the newspaper and on our website (www.dnrec.delaware.gov).</p>

MEMORANDUM

Diamond State Generating Partners, LLC (Bloom Energy)

DAQ's Response Document for the Public Hearing on January 10, 2019

February 22, 2019

Page 13

General Public Comment Summary	DAQ Responses
<p>William Whipple III Written Comments, submitted via email/post: Air emissions during the periodic decoking of fuel cells should be included in the air quality data that are shown, and also sulfur and other contamination that will eventually be returned to the atmosphere via incineration of hazardous solid waste taken from the desulfurization units.</p>	<p>The decoking process will not be required for the units installed as a part of these applications.</p> <p>Emissions associated with processes that occur offsite (such as incineration of waste) cannot be included in an air quality permit. These emissions need to be permitted for the location of the actual incineration process.</p>

MEMORANDUM

Diamond State Generating Partners, LLC (Bloom Energy)

DAQ's Response Document for the Public Hearing on January 10, 2019

February 22, 2019

Page 14

COMMENTS

In response to the Public Hearing comments, the Facility submitted the attached letter dated February 8, 2019.

The Department drafted the attached construction permits. These permits are reflective of the applications that were submitted and they contain requirements that require removal of existing units as upgraded units are installed. It will not be possible for the new units to be installed without removing the old units. Construction to Operation inspection(s) are required as construction proceeds. Additionally, Bloom will continue to submit monthly reports showing natural gas usage and maintenance performed. If Bloom finds a need to implement any type of process similar to the currently used "decoking" process, they will need to submit documentation regarding the process and disclose any associated emissions prior to implementing the process onsite.

RECOMMENDATIONS

DAQ has prepared construction Permits: **APC-2019/0032-CONSTRUCTION** and **APC-2019/0031-CONSTRUCTION**. DAQ recommends submitting the attached permit and technical memorandum as part of the hearing record.

I hope this information will assist you in reviewing the issues and making your recommendations to the Secretary of the Department of Natural Resources and Environmental Control. If you have any questions, please contact the Division at (302) 323-4542.

AM:ADM

F:\EngAndCompliance\ADM\adm19003

pc: Dover File

Attachments to DAQ TRM:

- New Castle County Zoning documentation
- Correspondence from Bloom (02/08/19 and 02/22/19)
- DNREC Presentation from 01/10/19 public hearing
- Bloom Presentation from 01/10/19 public hearing
- Revised modeling documentation from Bloom (03/08/19)
- Memo from DAQ regarding Bloom's Brookside site with associated draft permit (03/19/19)
- Memo from DAQ regarding Bloom's Red Lion site with associated draft permit (03/19/19)

Parcel # 1005400001

Property Address: 1593 RIVER RD
 NEW CASTLE, DE 19720-
 Subdivision:
 Owner: DELMARVA POWER & LIGHT CO
 630 MARTIN LUTHER KING JR BLVD
 Owner Address: P O BOX 231
 WILMINGTON, DE 19899-0231
 Municipal Info: Unincorporated

Lot #:	Property Class: UTILITY
Location:	Lot Size: 294.01
Map Grid: 09203260	Lot Depth: 0
Block:	Lot Frontage: 0
Census Tract: 163.05	Street Finish:
Street Type:	
Water:	
Microfilm #: 000000	

Related Project Plans

	A/P No.	Project Name	Work Type	Status
Details	20001224	CONECTIV RED LION SUBSTATION	GRADING PLAN	COMPLETE
Details	20070468	RED LION SUBSTATION	SITE PLAN	Complete
Details	20140615	DPL INSULATOR REPLACEMENT	GENERAL PERMIT	COMPLETE
Details	20150406	RED LION TO CEDAR CREEK TRANSMISSION LINE REPLACEMENT	GRADING PLAN	COMPLETE
Details	20150467	DP & L REPLACEMENT LINE FROM RED LION TO CEDAR CREEK SUBSTATION	FLOODPLAIN APPLICATION	COMPLETE
Details	20170411	RED LION SUBSTATION	GENERAL PERMIT	ACTIVE
Details	20170656	1593 RIVER ROAD	AREA VARIANCE REQUEST	ACTIVE

Permit History (July 1998 – present)

	A/P No.	Permit Type	Status
Details	201807626	COMMERCIAL BUILDING PERMIT	Open
Details	200800778	COMMERCIAL BUILDING PERMIT	Closed

District & Zoning Info

Districts

- [COUNCIL 12 - JAMES W BELL](#)
- [FIRE/RESCUE - DELAWARE CITY](#)
- [COLONIAL SCHOOL DIST-TRES](#)
- DE REP 17-MELISSA MINOR-BROWN
- NORTH OF C&D CANAL
- FLOODPLAIN-LU
- COASTAL ZONE DISTRICT-ASMT
- WETLANDS-LU
- PLANNING 2 - NEW CASTLE
- TRAFFIC ZONE T165 (YR2000)
- DE SEN 12-NICOLE POORE

Zoning

- HI - UDC - HEAVY INDUSTRIAL

Deed History

Grantee(s)	Deed	Multi?	Sale Date	Sale Amount
DELMARVA POWER & LIGHT CO	X77 502	N	Not Available	\$0.00

Tax/Assessment Info

Assessment

Land: 458500
 Structure: 76100
 Homesite: 0
 Total: 534600
 County Taxable: 534600
 School Taxable: 534600

Tax Bills as of 1/14/2019 3:00:02 AM

Tax Year	County			School		
	Principal Due	Penalty Due	Amt Paid	Principal Due	Penalty Due	Amt Paid
2010A	\$0.00	\$0.00	\$3,829.71	\$0.00	\$0.00	\$8,195.42
2011A	\$0.00	\$0.00	\$3,862.06	\$0.00	\$0.00	\$8,056.43
2012A	\$0.00	\$0.00	\$3,846.24	\$0.00	\$0.00	\$7,890.70
2013A	\$0.00	\$0.00	\$3,845.91	\$0.00	\$0.00	\$9,922.18
2014A	\$0.00	\$0.00	\$3,860.72	\$0.00	\$0.00	\$10,100.20
2015A	\$0.00	\$0.00	\$3,844.58	\$0.00	\$0.00	\$10,109.29
2016A	\$0.00	\$0.00	\$3,822.71	\$0.00	\$0.00	\$10,126.93

New Castle County, DE - Parcel # 1005400001

2017A	\$0.00	\$0.00	\$3,829.56	\$0.00	\$0.00	\$11,778.84
2018A	\$0.00	\$0.00	\$4,118.26	\$0.00	\$0.00	\$12,595.18

Tax Payments as of 1/14/2019 3:00:02 AM

Date Paid	Amt Paid
9/27/2010	\$12,025.13
10/3/2011	\$11,918.49
10/2/2012	\$11,736.94
9/24/2013	\$13,768.09
10/1/2014	\$13,960.92
9/30/2015	\$13,953.87
9/28/2016	\$13,949.64
9/29/2017	\$15,608.40
9/26/2018	\$16,713.44

County Balance Due: \$0.00

School Balance Due: \$0.00

These amounts are valid through the last day of the month. For accounts with delinquent balances, statutory penalty will accrue on the first day of next month.

Commercial Structure Characteristics

Building #:

Occupancy: # of Stories: 0 Year Built: 0
 Struct Class: Quality: Condition:
 Floor Level: Grnd Flr Area: 0 Total Flr Area: 0
 Ext Wall Type: Wall Height: 0 Perimeter: 0
 AC %: 0 Heat %: 0 Rentable Units: 0
 Bsmt: 0 Bsmt Util:
 Year Renov: 0 Renov Rtng: Eff. Yr Built: 0

Project # 20110641

Parcel(s): 1100330027 - 512 E CHESTNUT HILL RD ▾
 Project Type: SUBDIVISION LAND DEVELOPMENT
 Description: North side of East Chestnut Hill Road, 561 feet east of Malvern Avenue. Show proposed minor utility substation and associated improvements. S Zoning. CD 5. Pencader Hundred
 Contact: STATE OF DELAWARE
 Status: Complete
 Plan Reviewer: Michael J. Bennett
 Engineering Reviewer: JOHN GYSLING

+ Applicant's Submissions and Correspondence

+ Other Agency Comments, Reviews & Approvals

+ Planning Review Reports

+ Studies, Reports and Data

+ Plans

Subdivision Land Development

Planning
 Old Code Plan?: No
 Received: 11/2/2011
 Recorded: Not Available
 PB/PH Hearing req'd?:
 Ground Floor Area
 Footprint (Sq Ft): 0
 Existing Gr. Floor Area: 0
 Proposed Gr. Floor Area: 0
 Total Ground Floor Area: 0
 Acres
 Paved Acres: 0
 Open Acres: 0
 Total Acres: 0
 Rezoned Acres: 0
 Wetland Acres: 0

Inspections

Inspection #	Inspection Type	Scheduled Date	Status	Completion Date
1197686	RECORD COMPLIANCE INSPECTION	Not Available	Incomplete	Not Available
1197687	RELEASE OF BONDS	Not Available	Incomplete	Not Available
1197688	FIELD INSPECTION OF FACILITIES	Not Available	Incomplete	Not Available

Fees

Date Applied	Description	Status	Amount
11/2/2011	SITE PLAN FEE	Paid	\$1,500.00

Conditions

Application Date	Description	Action Date	Action Description
11/2/2011	REQ PER SEC 10.3.4.4 OF DSSR	11/16/2011	APPROVED
11/2/2011	FIRE MARSHAL APPROVAL RCV'D	12/20/2011	RECEIVED
11/2/2011	DELDOT APPROVAL LETTER	12/20/2011	RECEIVED
11/17/2011	NOI CONFIRMATION RECEIVED	12/20/2011	NOT APPLICABLE
1/9/2012	OUTFALL DATA SHEET RECEIVED	Not Available	
1/9/2012	SANITARY SEWER	Not Available	

Reviews

Review Type	Status
ENGINEERING CONSTRUCTION PLAN	Conditional
ENG: EXPLORATORY REVIEW	Approval
ENVIRONMENTAL IMPACT ASSESSMNT	Approved
EXPLORATORY REVIEW BY PLANNING	Approved
OS REVIEW AT EXPLOR SPEC SERV	Approved
SEWER CAPACITY AT EXPLORATORY	Approved
HISTORIC REVIEW EXPLORATORY	Approved
PRELIMINARY TRAFFIC ANALYSIS	Approved
LANDSCAPE PLAN REVIEW	Approved
PLANNING CONSTRUCTION PLAN RVW	Approved
ENGINEERING CONSTRUCTION PLAN	Conditional
RECORD PLAN SUBMISSION	Approval
TRAFFIC REVIEW AT RECORDATION	Approved
	Approved

RECORD PLAN REVIEW
AS-BUILT FOR STORM WATER MNGMT

Approved
Incomplete

Parcel # 1100330027

Property Address: 512 E CHESTNUT HILL RD
NEWARK, DE 19713-
Subdivision:
Owner: STATE OF DELAWARE
BOX 8
Owner Address:
BEAR, DE 19701
Municipal Info: Unincorporated

Lot #:	Property Class: EXEMPT RESIDENTIAL
Location:	Lot Size: 5.29
Map Grid: 06803401	Lot Depth: 0
Block:	Lot Frontage: 0
Census Tract: 147.03	Street Finish:
Street Type: ARTERIAL	
Water: PUBLIC	
Microfilm #: 000000	

Related Project Plans

	A/P No.	Project Name	Work Type	Status
Details	20110641	BROOKSIDE ENERGY CENTER	SITE PLAN	Complete
Details	20120183	512 E CHESTNUT HILL RD	ZONING VERIFICATION PROCESS	COMPLETE
Details	20120414	BLOOM POWER CELLS	ZONING VERIFICATION PROCESS	COMPLETE
Details	20180690	512 E. CHESTNUT HILL ROAD	ZONING VERIFICATION PROCESS	COMPLETE

Permit History (July 1998 - present)

	A/P No.	Permit Type	Status
Details	201204095	PLUMBING PERMIT	Closed

District & Zoning Info

Districts

- **FIRE/RESCUE - AETNA H H & L**
- **CHRISTINA SCHOOL DIST-TRES**
- PLANNING 3 - GREATER NEWARK
- NORTH OF C&D CANAL
- ADD REQ PER SEC 10.3.4.4 DSSR
- COUNCIL 5 - ELISA C DILLER
- SEWER DISTRICT NORTHERN-ASMT
- DE REP 24-EDWARD S OSIENSKI
- DE SEN 11-BRYAN TOWNSEND
- TRAFFIC ZONE T158 (YR2000)

Zoning

- S - UDC - SUBURBAN

Deed History

Grantee(s)	Deed	Multi?	Sale Date	Sale Amount
STATE OF DELAWARE	F115 242	N	Not Available	\$40,000.00

Tax/Assessment Info

Assessment

Land: 54800
Structure: 21600
Homesite: 0
Total: 76400
County Taxable: 0
School Taxable: 0

Exemptions

Description	Amount
STATE OF DELAWARE	76400

Bloomenergy



February 8, 2019

Ms. Angela Marconi
Program Manager, Engineering & Compliance Branch
Division of Air Quality
Delaware Department of Natural Resources and Environmental Control
New Castle Air Quality Office
715 Grantham Lane
New Castle, DE 19720

Dear Ms. Marconi:

This letter is in connection with the Department of Natural Resources and Environmental Control's (DNREC) review of the pending permit applications that Bloom Energy Corporation ("Bloom") filed on behalf of Diamond State Generation Partners, LLC ("Diamond State").¹ The pending permits will enable Diamond State to upgrade Bloom Energy Servers at the Brookside and Red Lion Energy Centers ("Brookside" or "Red Lion" and collectively "the Facilities") with Bloom's latest and more efficient technology. The Brookside and Red Lion upgrade will enable the Facilities to generate electric energy more efficiently and with lower air emissions than at present. When the upgrade is complete, the Facilities will have fewer but more efficient Energy Servers, less overall electric generation capacity on site than today, and lower air emissions. This letter provides additional information on the issues highlighted below.

Efficiency of Energy Servers and Consumption of Natural Gas – As outlined at the hearing on January 10 (See especially pp. 15-17), the Facilities will consume less natural gas, resulting in lower air emissions. Compare Form AQM 3.1, Line 7.1 for each Application *with* current operating permits. Each of the Energy Servers installed as part of the

¹ It also constitutes Diamond State's post-hearing submission pursuant to DNREC Regulation No. 1102, Section 12.4.5

upgrade will generate more electric power from less natural gas than the units currently deployed. After the upgrade and with fewer units deployed than at present, each site will deliver approximately the same amount of electricity. Both factors – the efficiency of the upgrade on a unit basis and the overall fewer number of units installed – lower the total emissions. Each factor contributes to the fact that a lower volume of natural gas will be consumed at the Facilities. Lower natural gas consumption translates to lower emissions.

CO2 Emissions – Although CO2 emissions are not currently regulated, the Product Data Sheet for Energy Server 5 supplied as Attachment II to the Applications provides a range of CO2 emissions stating as follows: “CO2 @ stated efficiency 679-833 lbs. /MWH on natural gas.” A reasonable projection within that range for CO2 emissions after the upgrade at Brookside and Red Lion is approximately 700 lbs. /MWH. Because the installations at Red Lion and Brookside are at utility scale with many Energy Servers deployed a projection of CO2 emissions near the low end of the range expressed on the Product Data Sheet is warranted. Although the emissions rates may fluctuate, the CO2 emissions represent a reduction from the currently-installed systems. If different conversion factors for CO2 emissions from natural gas are applied the projected differences for CO2 emissions are comparatively small and the absolute CO2 emissions values are still low.

Number of Units to be Deployed and Natural Gas Consumption of Each Server – The number of units listed in the Applications (13 for Brookside to generate 2.6 MW and 110 for Red Lion to generate 24.9 MW; see Form AQM 3.1, Line 3 for each Application) is the number currently intended to be deployed at each site over the course of the Project. The natural gas projected to be consumed is 137 MMscf per year at Brookside and 1312 MMscf per year at Red Lion. See Form AQM 3.1, Line 7 for each Application. This calculation of natural gas consumption is based on a direct calculation of natural gas required to generate the power capacity of the site – at a nominal projected efficiency.

VOC Emissions – Attachment III to each Application contains the test results required by and submitted to the California Air Resources Board (“CARB”) with respect to the current Distributed Generation Test required by CARB. The tests were conducted by an accredited independent third-party lab. The test results are the basis for the currently-effective Distributed Generation Certification of Bloom Energy Corporation ES-5 Fuel Cell Power Generation System awarded by CARB. See the attached Certificate. These results are the best available independent analysis of VOC emissions.

We respectfully renew our request that DNREC accept these results for purposes of its review of the Applications.

No Construction Site-work at the Sites – We confirm that the upgrade for Brookside and Red Lion will proceed as described in the Applications. See, e.g., the Site Layout Drawing (Attachment 1 to each Application). In the attached media report that can be found at the following link, <https://www.delawarepublic.org/post/bloom-energy-seeks-replace-all-fuel-cells-delaware-plants>, a Bloom Energy spokesman said there would be “no construction as such” at the facilities. This is correct as there will be no “site-work” at the sites. The original site construction required activities such as trenching for electrical cables and natural gas plumbing and pouring concrete to build concrete pads to support the Bloom Energy Servers. The upgrade will make use of existing site infrastructure, such as the existing underground electrical cables and natural gas plumbing, thereby obviating the need for trenching and construction of new runs. Further, the new generation of Bloom Energy Servers is physically smaller than the generation installed originally at Red Lion and Brookside. Therefore, the original concrete pads will be utilized, placing the smaller units onto each of the larger pads.

Concerns re “De-coking”— In 2017, DNREC investigated and resolved questions involving so-called “de-coking.” Please refer to Bloom’s correspondence with the Division of Air Quality dated May 12, 2017 (“May 2017 Correspondence”) that responded to the Division’s prior extensive questions about this issue. Although the May 2017 Correspondence contains confidential information subject to trade secret protection under Delaware law, DNREC has access to the un-redacted correspondence and its explanation of issues related to “de-coking.”

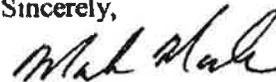
In summary, earlier generations of Bloom Energy Servers required a Performance Improvement Process from time to time as described in the May 2017 Correspondence. The generation of Energy Server to be installed assuming the permit is granted will not require any such Performance Improvement Process. Subject again to confidential treatment of the answers, if DNREC has remaining questions about this issue, we will be pleased to answer them.

Power Generation Performance of Bloom Energy Servers Currently Installed – There are now years of reported data showing the reliable performance of the Bloom Energy Servers at the Facilities. The reported data shows that the units currently deployed are operating within the permit limits. The units to be deployed after the upgrade will have lower emissions.

As demonstrated by the Applications and the hearing record and as un rebutted by any commenter, the upgrade will result in emissions lower (and certainly no higher) than currently permitted at the Facilities.

Thank you for your consideration. We respectfully request the permits be granted so that the upgrade may proceed.

Sincerely,



Mark Mesler
Vice President
Diamond State
Generation Partners, LLC

**State of California
AIR RESOURCES BOARD**

Executive Order DG-044

Distributed Generation Certification of

Bloom Energy Corporation

ES-5 Fuel Cell Power Generation System

WHEREAS, the Air Resources Board (ARB) was given the authority under California Health and Safety Code section 41514.9 to establish a statewide Distributed Generation (DG) Certification Program to certify electrical generation technologies that are exempt from the permit requirements of air pollution control or air quality management districts;

WHEREAS, this DG Certification does not constitute an air pollution permit or eliminate the responsibility of the end user to comply with all federal, state, and local laws, rules and regulations;

WHEREAS, on May 4, 2015, Bloom Energy Corporation applied for a DG Certification of its ES-5 Fuel Cell Power Generation System and whose application was deemed complete on October 8, 2015;

WHEREAS, Bloom Energy Corporation has demonstrated, according to test methods specified in California Code of Regulations (CCR), title 17, section 94207, that its natural gas-fueled ES-5 Fuel Cell Power Generation System has complied with the following emission standards:

1. Emissions of oxides of nitrogen no greater than 0.07 pounds per megawatt-hour.
2. Emissions of carbon monoxide no greater than 0.10 pounds per megawatt-hour.
3. Emissions of volatile organic compounds no greater than 0.02 pounds per megawatt-hour.

WHEREAS, Bloom Energy Corporation has demonstrated that the ES-5 Fuel Cell Power Generation System complies with the emissions durability requirements in CCR, title 17, section 94207(d); and

WHEREAS, I find that the Applicant, Bloom Energy Corporation, has met the requirements specified in CCR, title 17, article 3, Distributed Generation Certification Program and has satisfactorily demonstrated that the ES-5 Fuel Cell

Power Generation System meets the DG Certification Regulation 2007 fossil fuel emission standards.

NOW THEREFORE, IT IS HEREBY ORDERED, that a DG Certification DG-044 is hereby granted.

This DG Certification:

- 1) Is subject to all conditions and requirements of CCR, title 17, article 3, Distributed Generation Certification Program, including the provisions relating to inspection, denial, suspension, and revocation.
- 2) Shall be void if any manufacturer's modification results in an increase in emissions or changes the efficiency or operating conditions of a model, such that the model no longer meets the DG Certification Regulation 2007 fossil fuel emission standards.
- 3) Shall expire on the 26 day of January 2021.

Executed at Sacramento, California, this 26 day of January 2016.

/S/

Floyd V. Vergara, Esq., P.E.
Chief, Industrial Strategies Division



▶ Delaware Public Media
Here and Now

Bloom Energy seeks to replace all fuel cells at Delaware plants

By SOPHIA SCHMIDT (/PEOPLE/SOPHIA-SCHMIDT) • JAN 1, 2019

🐦 [Tweet \(http://twitter.com/intent/tweet?\)](http://twitter.com/intent/tweet?)

[url=http%3A%2F%2Fwww.tinyurl.com%2Fyd7dd2b6&text=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20](http://www.tinyurl.com/2Fyd7dd2b6&text=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20)

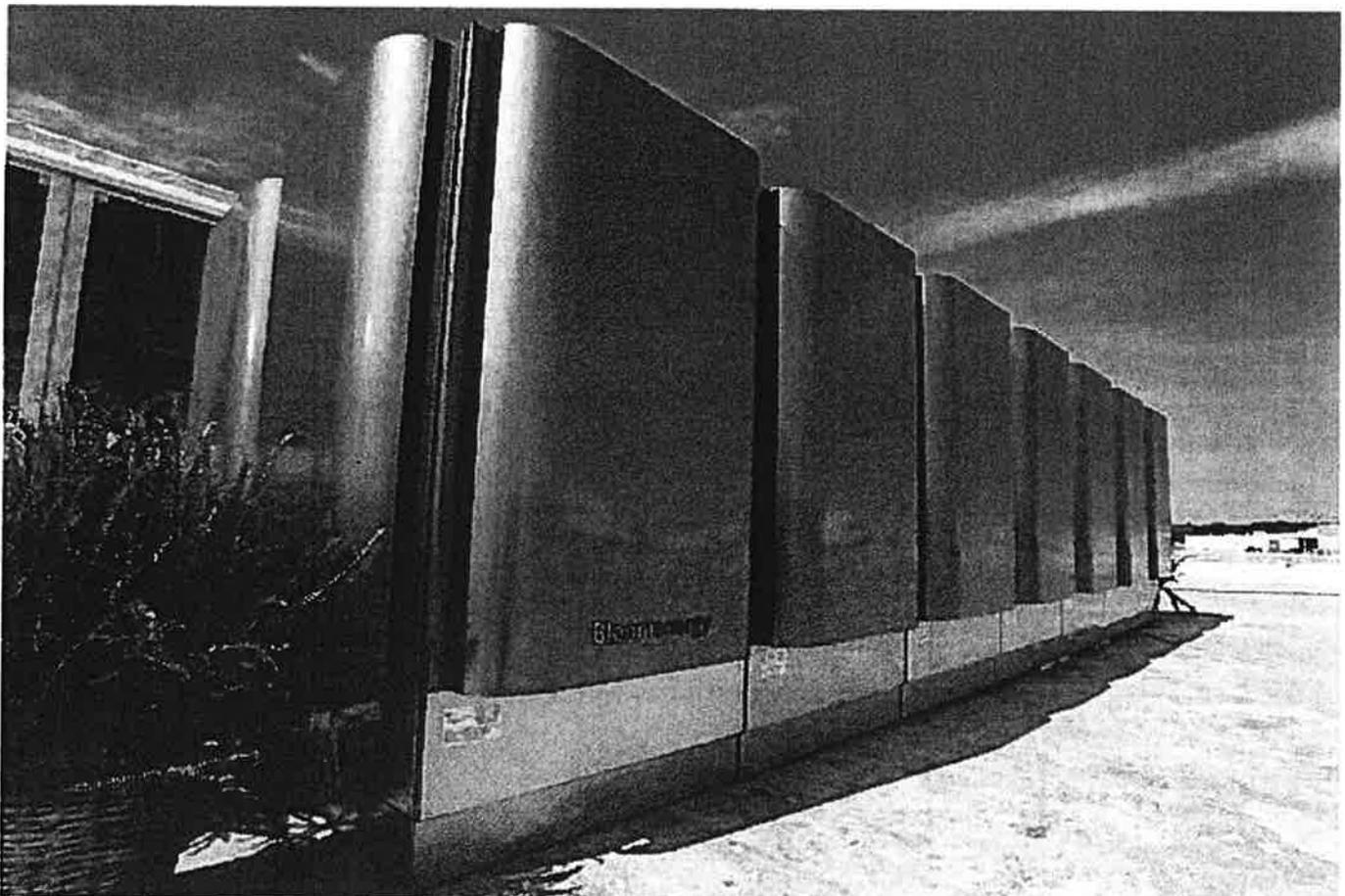
f [Share \(http://facebook.com/sharer.php?\)](http://facebook.com/sharer.php?)

[u=http%3A%2F%2Fwww.tinyurl.com%2Fyd7dd2b6&t=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20](http://www.tinyurl.com/2Fyd7dd2b6&t=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20)

🍌 [Google+ \(https://plus.google.com/share?url=http%3A%2F%2Fwww.tinyurl.com/2Fyd7dd2b6\)](https://plus.google.com/share?url=http%3A%2F%2Fwww.tinyurl.com/2Fyd7dd2b6)

✉ [Email \(mailto:?\)](mailto:)

subject=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20at%20Delaware%20plants&body=http%3A%2F%2F



(//www.delawarepublic.org/sites/wdde/files/styles/x_large/public/201710/BloomBox.jpg)

Listen to this story

The company uses natural gas to make electricity, which it sells to Delmarva Power under a long-term contract. Delmarva rate payers see a roughly \$5 surcharge to Bloom on their monthly energy bills.

Bloom spokesperson David McCulloch says the scheduled maintenance would replace aging fuel cells with newer models.

"The systems are performing exactly as they planned to do, we've been meeting all the targets that were set for their performance. What happens with our technology is the fuel cells just degrade in performance over time," said McCulloch.

"It's an upgrade that will generate the same amount of electricity only more efficiently, using less fuel," he added.

McCulloch says the work would not involve any digging at the two sites— one of which is in the Coastal Zone.

"The way our systems work you just kind of slide the power module out through an open door, and you slide in the new ones ... so there's no construction as such."

McCulloch says the cost of the upgrade has been built into Bloom's business plans, and the work would take place over a year and a half or more. He says there will be no cost increase to ratepayers.

A public hearing about the permits is scheduled for January 10 in New Castle.

TAGS: [BLOOM ENERGY \(/TERM/BLOOM-ENERGY\)](#)

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[url=http%3A%2F%2Fwww.tinyurl.com%2Fyd7dd2b6&text=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20](http://www.tinyurl.com/2Fyd7dd2b6&text=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20)

 [Share \(http://facebook.com/sharer.php?\)](http://facebook.com/sharer.php?)

[u=http%3A%2F%2Fwww.tinyurl.com%2Fyd7dd2b6&t=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20](http://www.tinyurl.com/2Fyd7dd2b6&t=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20)

 [Google+ \(https://plus.google.com/share?url=http%3A%2F%2Fwww.tinyurl.com/2Fyd7dd2b6\)](https://plus.google.com/share?url=http%3A%2F%2Fwww.tinyurl.com/2Fyd7dd2b6)

 [Email \(mailto:?\)](mailto:)

[subject=Bloom%20Energy%20seeks%20to%20replace%20all%20fuel%20cells%20at%20Delaware%20plants&body=http%3A%2F%2F](mailto:)

Bloomenergy

February 22, 2019

Ms. Angela Marconi
Program Manager, Engineering & Compliance Branch
Division of Air Quality
Delaware Department of Natural Resources and Environmental Control
New Castle Air Quality Office
715 Grantham Lane
New Castle, DE 19720

Dear Ms. Marconi:

This letter addresses the sequence of the proposed deployment by Diamond State Generation Partners, LLC (“Diamond State”) of the upgrade of Bloom Energy Servers at the Brookside and Red Lion Energy Centers (“Brookside” or “Red Lion” and collectively “the Facilities”) with Bloom Energy Corporation’s latest and more efficient technology assuming the Department of Natural Resources and Environmental Control (“DNREC”) grants the pending permit applications.

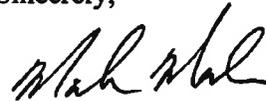
At no time during the deployment of the upgrade will the currently-permitted cap on natural gas consumption at Brookside or Red Lion be exceeded. As currently planned, the upgrade, which requires no construction site-work at the Facilities, would be installed in a phased approach. During the deployment, currently-in service Energy Servers will be taken out of service and removed to make space for new Energy Servers to be placed on the existing foundations and then put in service. The nameplate capacity of each Facility will not exceed its currently-permitted nameplate capacity. As the upgrade progresses, natural gas consumption and thus emissions will decline. Lower natural gas consumption translates to lower emissions.

As previously noted, when the upgrade is complete, the Facilities will have a total lower nameplate capacity and more efficient Energy Servers. These two changes will reduce gas consumption and resulting air emissions. When the upgrade is complete, lower emission levels will be achieved as expressed in the permit applications DNREC has under review.

Diamond State's goal would be to deploy the upgrade as quickly as possible after the applied-for permits are granted. However, factors beyond Diamond State's control may require a longer interval for deployment for an upgrade period not longer than four calendar quarters.

We respectfully request the permits be granted, with permit conditions if and as necessary, to reflect that deployment may proceed as promptly as possible but in the manner outlined above. Thank you for your consideration.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark Mesler".

Mark Mesler
Vice President
Diamond State
Generation Partners, LLC

Diamond State Generating Partners, LLC (Bloom Energy) – Public Hearing



January 10, 2019

Blue Skies Delaware; Clean Air for Life

Application Timeline

- Two facilities:
 - Red Lion – 1593 River Road
(located within the Coastal Zone)
 - Brookside – 512 E. Chestnut Hill Road
- Received Applications – October 24, 2018
- Public Notice – November 11, 2018
- Public Hearing – January 10, 2019



Blue Skies Delaware; Clean Air for Life



Project Summary

3

- The facilities are existing.
- The proposed construction will replace existing units with upgraded units at the Red Lion and Brookside facilities.
- The emissions will decrease from current levels for all pollutants.
- Generation capacity is also proposed to decrease.



Blue Skies Delaware; Clean Air for Life



Project Summary

4

- Emissions – The emissions from the fuel cells include:
 - Nitrogen Oxides, NO_x
 - Carbon Monoxide, CO
 - Sulfur Dioxide, SO₂
 - Volatile Organic Compounds, VOC
 - Carbon Dioxide, CO₂



Blue Skies Delaware; Clean Air for Life

Current Installations Versus Application

Red Lion

- Currently Installed
 - 134 units
 - 27.0 MW

- Application
 - 110 units
 - 24.9 MW

Brookside

- Currently Installed
 - 15 units
 - 3.0 MW

- Application
 - 13 units
 - 2.6 MW



Blue Skies Delaware; Clean Air for Life

Natural Minor Facility Status

- The Brookside and Red Lion facilities are considered Natural Minor facilities because their potential to emit is below the major source threshold in New Castle County Delaware.

MAJOR SOURCE THRESHOLD (TONS)							
	NOx	CO	VOC	SO ₂	PM ₁₀	HAPs	Other Air Pollutants
New Castle County	25	100	25	100	100	10/25	100



Blue Skies Delaware; Clean Air for Life

Potential To Emit (PTE)

Pollutant	Red Lion – Current (ton/yr)	Red Lion – Application (ton/yr)	Brookside – Current (ton/yr)	Brookside– Application (ton/yr)
NO _x	0.248	0.19	0.028	0.019
CO	11.82	3.71	1.31	0.387
VOC	2.37	1.73	0.26	0.181
SO ₂	0.1236	0.011	0.0138	0.0012
CO ₂	91,415	76,343	Not in current permit	7,972

- The emissions are calculated based on fuel usage.
- Natural Gas is the fuel for these units.



Blue Skies Delaware; Clean Air for Life

Public Hearing

- Public comments are received in writing and in person at the hearing.
- Comments are entered into the formal record.
- The Division of Air Quality (DAQ) will draft a technical response memo to address comments that are pertinent to the air quality considerations related to the proposed changes at the facilities.
- The technical response memo may also recommend issuance of a construction permit, if so, the construction permit will be submitted to the Hearing Officer.
- The Hearing Officer will draft a report and an Order for the Secretary's consideration.



Blue Skies Delaware; Clean Air for Life

DAQ Permitting

- If Secretary approves the permit, then DAQ will issue construction permits that:
 - Will meet strict air quality standards required by the Federal and Delaware State regulations.
 - Are supported by a detailed technical review.
 - May contain permit conditions that address concerns raised during the public hearing process.



Blue Skies Delaware; Clean Air for Life

DAQ Permitting

- If the construction permit is issued, DAQ will conduct a Construction-to-Operation inspection following the completion of construction.
- Following a successful C to O inspection, the company would receive an operating permit.
- DAQ performs periodic compliance inspections after issuing operating permits.

- If no construction permit is issued, the facilities can continue to operate existing equipment in accordance with the existing operating permits.



Blue Skies Delaware; Clean Air for Life

DAQ Permitting

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- Normal permit conditions include:
 - Recordkeeping and record retention for a minimum of 5 years
 - Reporting of all deviations from permitted conditions
 - Additional reporting as required or deemed necessary

- DAQ issues permits for the construction and operation of equipment which has the potential to discharge air contaminants into the atmosphere. These permits contain operational limits that ensure proper operation of the equipment. These permits do not contain requirements that are not pertinent to air emissions.



Blue Skies Delaware; Clean Air for Life

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Thank You



Blue Skies Delaware; Clean Air for Life

Natural Minor Source Air Permits for Maintenance Upgrades of Red Lion and Brookside Energy Centers

Public Hearing – January 10, 2019



Bloom Energy Manufacturing Center

Establishing a Global Industry
in Newark, DE

Significant Economic Contributor

- \$85M+ paid in wages to date

Developing New Workforce Skills

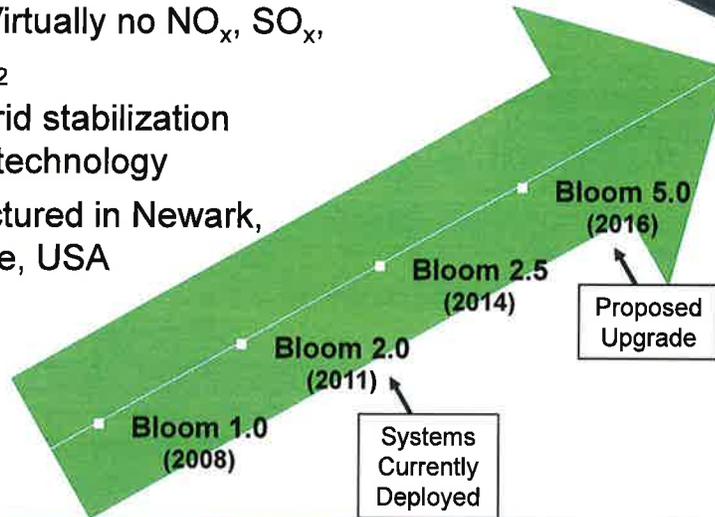
- DelTech and University of Delaware
- Jobs for Delaware Graduates program

Delivering Cleaner Air for Delaware



The Bloom Energy Server

- Delivers Always-On Power
- Converts Gas to Electricity without Combustion
- Increased high efficiency
- Clean: Virtually no NO_x, SO_x, Low CO₂
- Latest grid stabilization inverter technology
- Manufactured in Newark, Delaware, USA



Upgrade Delivers Key Benefits to Delaware

- Upgrade delivers lower emissions and uses less gas
- Delivering the same amount of electric power at each site
- The air permit will enable Bloom to move forward with the upgrade and enable Delawareans to realize the benefits
- Upgrade does not involve any new sites or new pads
- Because there is a reduction in emissions while maintaining the same general operations, there is no legal basis for denying the permit

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Bloomenergy

March 08, 2019

Ms. Angela Marconi
Program Manager, Engineering & Compliance Branch
Division of Air Quality
Delaware Department of Natural Resources and Environmental Control
New Castle Air Quality Office
715 Grantham Lane
New Castle, DE 19720

Dear Ms. Marconi:

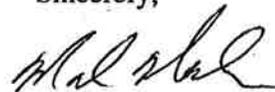
This letter transmits certain revisions to AERSCREEN modeling for CO and one hour NOx for the proposed upgrade by Diamond State Generation Partners, LLC of Bloom Energy Servers at the Brookside and Red Lion Energy Centers ("Brookside" or "Red Lion" and collectively "the Facilities").

The respective modeling reports submitted as Attachment IX to the permit application for each Facility now take fully into account the final project configuration that is reflected in the applications. We adjusted certain inputs and repeated the AERSCREEN analysis in order to comprehensively address technical issues associated with the modeled data. The changes in inputs and results are set forth in attached reports for each Facility, and clearly demonstrate compliance with the short-term CO and NO2 National Ambient Air Quality Standards (NAAQS) for Brookside and Red Lion.

When the upgrade is complete, the Facilities will have a total lower nameplate capacity with more efficient Energy Servers. These two changes, or either one alone, will reduce gas consumption and resulting air emissions, achieving the lower emission levels expressed in the permit applications DNREC has under review.

Thank you for your consideration.

Sincerely,



Mark Mesler
Vice President
Diamond State
Generation Partners, LLC

**AERSCREEN MODELING REPORT
CO AND 1-HOUR NO_x**

**BROOKSIDE UPGRADE PROJECT
7 - MAR - 2019**

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1.0 Purpose of Study

This modeling study was performed at the request of the Delaware Department of Natural Resources and Environmental Control (DNREC) for the purpose of predicting the 1-hour/8-hour CO and 1-hour NO₂ impacts from Diamond State Generation Partners, LLC proposed upgrade of the existing Brookside Project. The Brookside Upgrade Project consists of removing 15 natural gas fueled ES-5700 Energy Servers and installing 13 latest generation ES5-BABAAA Energy servers, each with an output capacity of 200kW.

DNREC is seeking assurance that the CO and NO_x emissions from this proposed facility can demonstrate compliance with the short-term CO and NO₂ National Ambient Air Quality Standards (NAAQS).

The following sections of this report provide the details for the AERSCREEN analysis used to determine compliance with the short-term CO and NO₂ standards. Section 2 provides a detailed description of the modeling methodology used for this study, Section 3 provides the results from this study documenting that AERSCREEN shows compliance with the short-term CO and NO₂ standards.

2.0 Modeling Methodology

The modeling performed for this study is a screening level analysis of 1-hour/8-hour CO and 1-hour NO₂ impacts, as requested by DNREC. This modeling was conducted following current USEPA modeling guidance. The following subsections 2.1 through 2.5 contain the detailed information regarding site characterization, meteorological and background monitored data, and model options used for this study. The majority of the assumptions from the original modeling work in 2012 have been retained.

On March 1, 2011 EPA released a clarification memo regarding various aspects of modeling for demonstration of compliance with the 1-hour NO₂ NAAQS.¹ Included within this memo is a discussion regarding the three-tier approach that can be employed for modeling of 1-hour NO₂, as well as a clarification on what is appropriate to use for the assumption of background NO₂ concentrations. In 2012, all NO₂ modeling for this analysis was performed in a manner consistent with this memo including use of the 3-year average of monitored annual 98th percentile daily 1-hour maximum NO₂ concentration as the background concentration for NAAQS comparison (see Section 2.4).

The tiered approach to modeling 1-hour NO₂ is a hierarchical structure, with Tier 1 the most conservative, while Tier 3 is the least conservative. The assumptions for each tier are as follows:

- Tier 1 – Model the facility assuming that all NO_x emitted from a facility is emitted as NO₂.
- Tier 2 – Use a default ambient ratio of 0.80 for conversion of NO_x to NO₂. This allows for a facility to subtract 20% from the total NO_x impact predicted in Tier 1.
- Tier 3 – Use the AERSCREEN model, utilizing the PVMRM and/or OLM approaches.

For the upgrade project, Tier 1 was assumed, as this is the most conservative.

¹ *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO₂ National Ambient Air Quality Standard*, USEPA-OAQPS memo, Tyler Fox, March 1, 2011.

Model Used

Short-range transport dispersion model predictions (within 10 km of the facility) are required for this analysis to determine project-alone impacts for comparison to the short-term CO and NO₂ NAAQS.

For the original project, the AERSCREEN model (Ver. 11126) was the EPA's "preferred/recommended" screening model for use in modeling analyses with plume transport distances of less than 50 km. In March 2011, the U.S. EPA released AERSCREEN, a screening model based on the AERMOD dispersion algorithms, which is expected generally to yield more realistic concentrations than the existing SCREEN3 model, while maintaining conservatism over more refined analyses. Use of AERSCREEN for the screening analysis of this Project conforms to both EPA and DNREC recommendations. The upgrade project used AERSCREEN version 16216 released 1/17/2017.

2.1 Source Parameters

The original Brookside Project consists of 15 individual fuel cells as depicted in Figure 2-1. Each individual fuel cell is approximately 25.5'L x 8.5'W x 6.75'H and utilizes approximately 1.32 MMBtu/hr of natural gas at full load to produce 200 kW of net power output. After the upgrade, the fuel cell will consume 1.24 MMBtu/hr of natural gas for the same output of 200kW.

As part of the chemical reaction within the fuel cell, NO_x is formed and emitted at rate shown in the following table. **Note that after the upgrade, the total amount of NO_x emitted from the site will have decreased.**

NO_x Emission Rates

Original Project	0.0021 lb/MW-hr	0.0063 lb/hr site total
Upgrade Project	0.0017 lb/MW-hr	0.0044 lb/hr site total

Likewise CO is also formed as part of this chemical reaction and emitted at a rate shown in the following table. **Note that after the upgrade, the total amount of CO emitted from the site will have decreased.**

CO Emission Rates

Original Project	0.10 lb/MW-hr	0.30 lb/hr site total
Upgrade Project	0.034 lb/MW-hr	0.09 lb/hr site total

AERSCREEN contains algorithms for modeling of several different types of emissions sources including volume sources. Volume source algorithms are valid for modeling releases from multiple vents and given the source characteristics of the fuel cell emissions, coupled with the fact that they are arranged in blocks, the fuel cells were modeled as volume type sources. Calculations for the upgrade project are also based on the Volume Source algorithm.

The AERSCREEN model is, by design, a conservative screening model and only allows the modeling of a single source for each run. In order to model the combined emissions from the concurrent operations

of all 15 fuel cells (original) / 13 fuel cells (upgrade project) within AERSCREEN a single source was utilized and located at the center point of the southeastern fuel cell block.

Volume sources require the user to input an emission rate, release height, and both the initial lateral (sigma-y) and vertical (sigma-z) dimensions of the volume source. These last two parameters were calculated pursuant to the methodology detailed in Table 3-1 of the AERMOD Users Guide² and all volume source parameters utilized for AERSCREEN are summarized in Table 2-1. These values have been updated to reflect the new fuel cell geometry and the revised number of fuel cell systems for the upgrade project.

2.2 AERSCREEN Inputs

In addition to the source parameters described in Section 2.2 AERSCREEN requires site specific information regarding land use and topography. AERSCREEN utilizes USGS Land Use/Land Classification (LULC) and USGS National Elevation Dataset (NED) for the required land use and topography information, respectively. Given the use of surface characteristics and terrain, it was important that the exact coordinate of the source, i.e., stack or center location of volume, be input into the model. Based upon the drawings provided by the Project it was determined that the approximate center of the facility is located at UTM coordinate 438667m, 4391163m based upon NAD83 projection, located within UTM Zone 18.

AERSCREEN requires the user to input a minimum and maximum receptor distance for impact prediction. The minimum receptor distance was set to the distance from the edge of the fuel cell block to the nearest physical fenceline. EPA considers all locations that the public is not precluded access to via a physical barrier as ambient air. As a result the physical fenceline and not the property line was used for the determination of the nearest modeling receptor which is consistent with current EPA guidance. The maximum modeling receptor distance was set to 2 km from the source. Figure 2-1 depicts the proposed facility fenceline in relation to the fuel cell locations.

AERSCREEN calculated the appropriate receptor elevations utilizing a 1 arc second resolution USGS NED file download from the USGS Seamless Server website (<http://seamless.usgs.gov/>). This NED file covered the area well beyond 2 km in all directions from the proposed facility location.

The meteorological data utilized by AERSCREEN is inherently built into the model and represents a calculated range of site-specific conditions designed to determine a conservative worst-case impact. AERSCREEN provides three options for surface characteristics inputs for generating this screening meteorology.

One option allows for user-specified surface characteristics – albedo, Bowen ratio, and surface roughness (no spatial or temporal variation), the second option is to use seasonally varying surface characteristics for generic land use classifications. The third option is to input the name of an external file such as an AERSURFACE output file. Monthly, seasonal, and annual output for one sector or multiple sectors is allowed with the third option.

² Users Guide for the AMS/EPA Regulatory Model – AERMOD, EPA-454/B-03-001, September 2004.

For this analysis the third option of utilizing a site specific AERSURFACE file was chosen. AERSURFACE was run based on the following:

- UTM coordinate of 438667m, 4391163m (Zone 18, NAD 83)
- 1992 USGS Land Use Data
- 1 Sector
- 4 seasons with winter assumed to not have continuous snow cover
- 1 km radius for surface roughness, 10km domain for Bowen Ratio and Albedo

The original AERSURFACE file was also used for the upgrade project. Table 2-2 summarizes the surface parameters calculated by AERSURFACE for each season and subsequently was used as input to AERSCREEN for creating the site-specific screening meteorological data.

2.3 Background Data

In order to define the existing overall air quality setting for proper CO and NO₂ comparison with the NAAQS, monitored background concentrations from the EPA monitoring network are provided in Table 2-3. This table shows the monitored 98th-percentile 1-hour NO₂ levels as well as the maximum monitored 1-hour and 8-hour CO levels from the nearest EPA monitoring station for the most recent 3-year period available (2015 – 2017). The nearest EPA site for both pollutants is located at a distance of approximately 9.7 miles northeast of the project site.

**Table 2-1
Parameters for Modeling Brookside Project within AERSCREEN**

Volume Source Configuration

Parameter	Original Value	Upgrade Project Value	Notes
Source Height (ft)	6.75 ft	6.75 ft	Top of Fuel Cell
Initial Sigma-Z (ft)	3.14 ft	3.14 ft	Source height divided by 2.15
Source Length (ft)	51.0 ft	n.a.	n.a. – source area used instead
Source Width (ft)	8.5 ft	n.a.	n.a. – source area used instead
Source Area (ft²)	433.5 ft ²	54.35 ft ²	Total Site Area for fuel cell exhaust
Volume Source Length (ft)	20.8 ft	7.35 ft	Assumes all sides equal
Initial Sigma-Y (ft)	4.8 ft	1.715 ft	Volume Source length divided by 4.3
Distance to Fence (ft)	20ft	20ft	
NOx Emission Rate			
	0.0021 lb/MW-hr 0.0063 lb/hr (total)	0.0017 lb/MW-hr 0.0044 lb/hr (total)	Vendor Provided Data
CO Emission Rate			
	0.010 lb/MW-hr 0.30 lb/hr (total)	0.034 lb/MW-hr 0.09 lb/hr (total)	Vendor Provided Data

Table 2-2
AERSURFACE Parameters for Modeling Brookside Project
Original and Upgrade Project

Season	Albedo	Bowen Ratio	Surface Roughness (m)
Winter (Dec-Feb)	0.17	0.96	0.341
Spring (Mar-May)	0.16	0.69	0.407
Summer (Jun-Aug)	0.17	0.56	0.567
Autumn (Sep-Nov)	0.17	0.96	0.567

Notes:

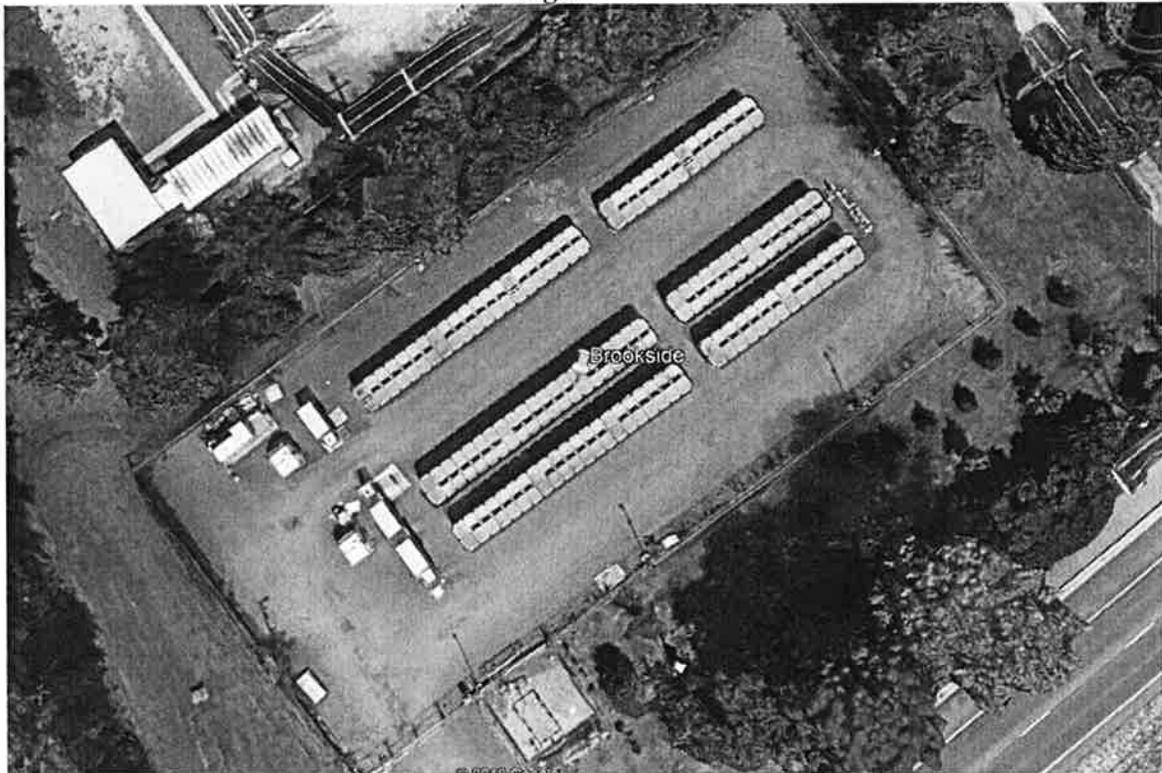
- Winter season assumes after frost and no continuous snow cover
- Spring season assumes transitional spring (partial green coverage, short annuals)
- Summer season assumes mid-summer with lush vegetation
- Autumn season assumes unharvested cropland

**Table 2-3
Background (in $\mu\text{g}/\text{m}^3$) Concentrations For NAAQS Comparison (Wilmington, DE)**

Pollutant	Avg Period	Monitoring Station Location	Dist. (mi)	Dir. (deg)	2015	2016	2017	Ambient Standard
NO ₂	1-Hour	MLK Blvd & Justison St	9.7	60	88.9 ppb 167 $\mu\text{g}/\text{m}^3$	90.6 ppb 170 $\mu\text{g}/\text{m}^3$	79.0 ppb 149 $\mu\text{g}/\text{m}^3$	188 ^a
CO	1-Hour	MLK Blvd & Justison St	9.7	60	1750 $\mu\text{g}/\text{m}^3$	1810 $\mu\text{g}/\text{m}^3$	1570 $\mu\text{g}/\text{m}^3$	40,000
	8-Hour				1400 $\mu\text{g}/\text{m}^3$	1600 $\mu\text{g}/\text{m}^3$	1250 $\mu\text{g}/\text{m}^3$	10,000
^a The promulgated NAAQS one-hour NO ₂ value is 100 ppb (188 $\mu\text{g}/\text{m}^3$). The NAAQS standard is statistical, based on the 3-year rolling average of the 98th-percentile of daily maximum 1-hour averages for each year. * Indicates background value used in analysis.								

Note: Direction indicated is from Brookside Project site to monitor.

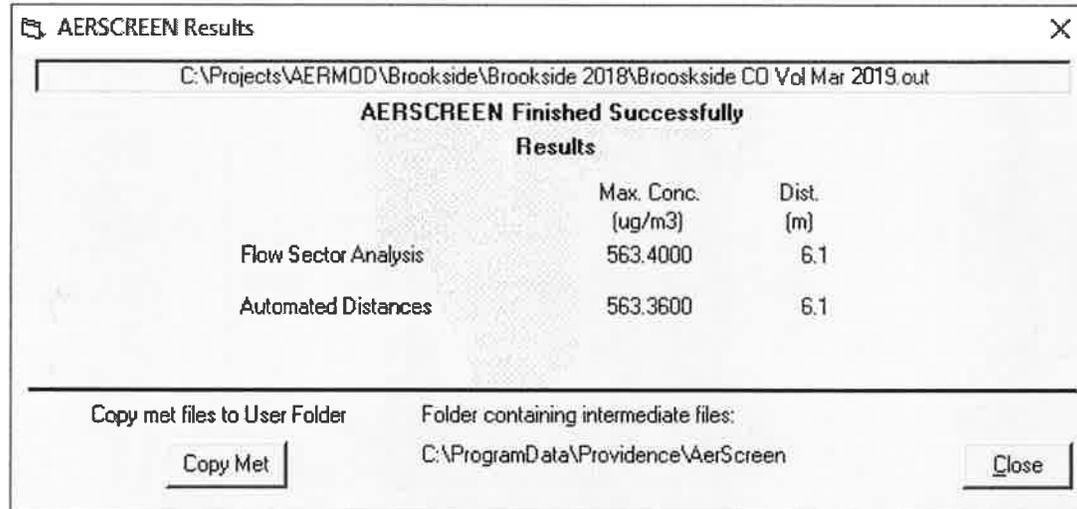
Figure 2-1



3.0 Modeling Results

The following sections present screenshots of the AERSCREEN modeling results for 1-hour NO₂, 1-hour CO and 8-hour CO for the Brookside Upgrade Project. All of the AERSCREEN modeling input and output files necessary to reproduce the upgrade project modeling results are included in the attached zip file.

CO – 1 hour max



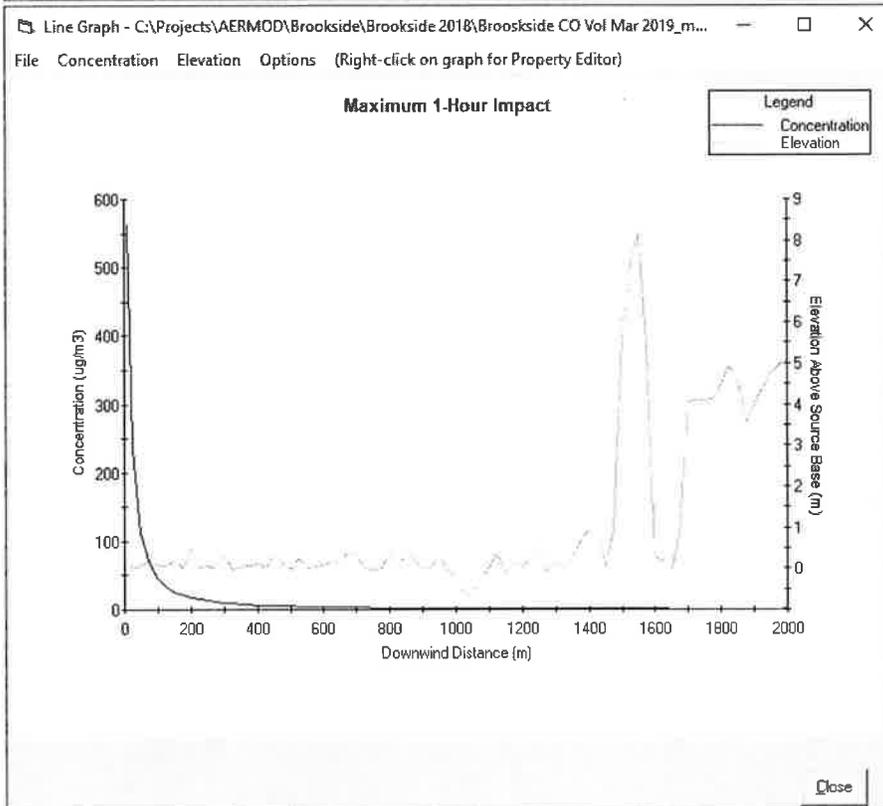
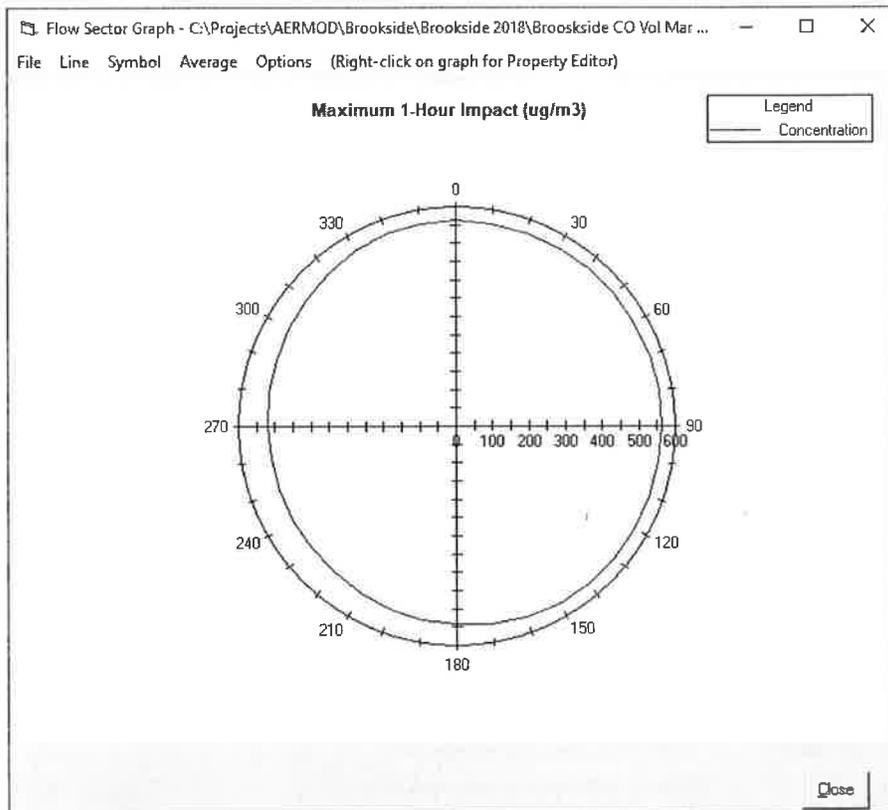
The screenshot shows a window titled "AERSCREEN Results" with a close button (X) in the top right corner. The window contains the following text and table:

C:\Projects\AERMOD\Brookside\Brookside 2018\Brookside CO Vol Mar 2019.out

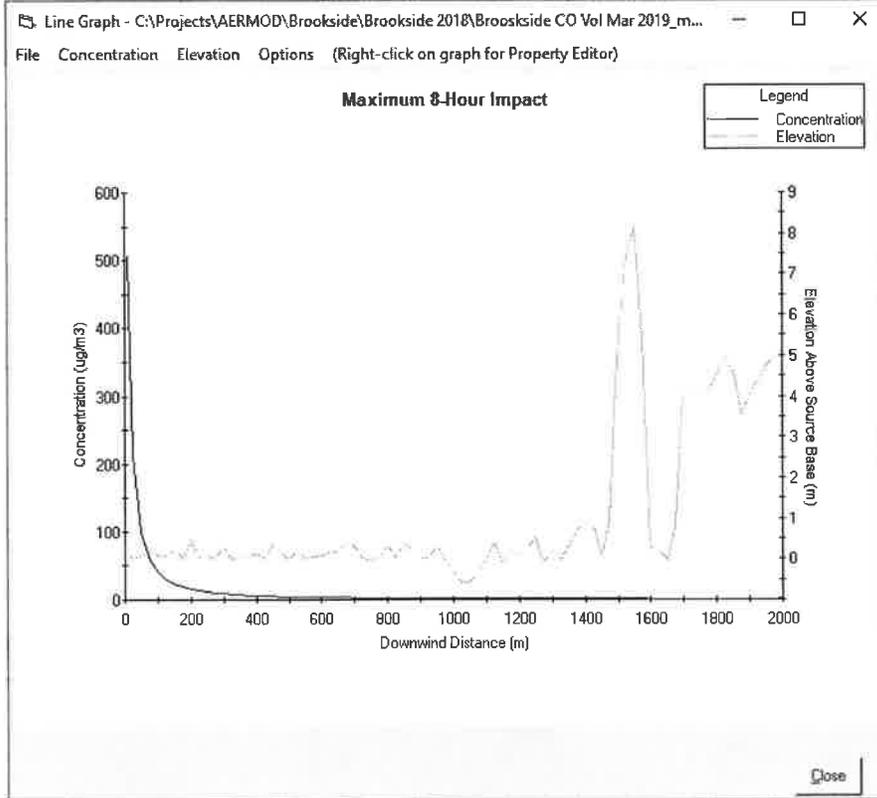
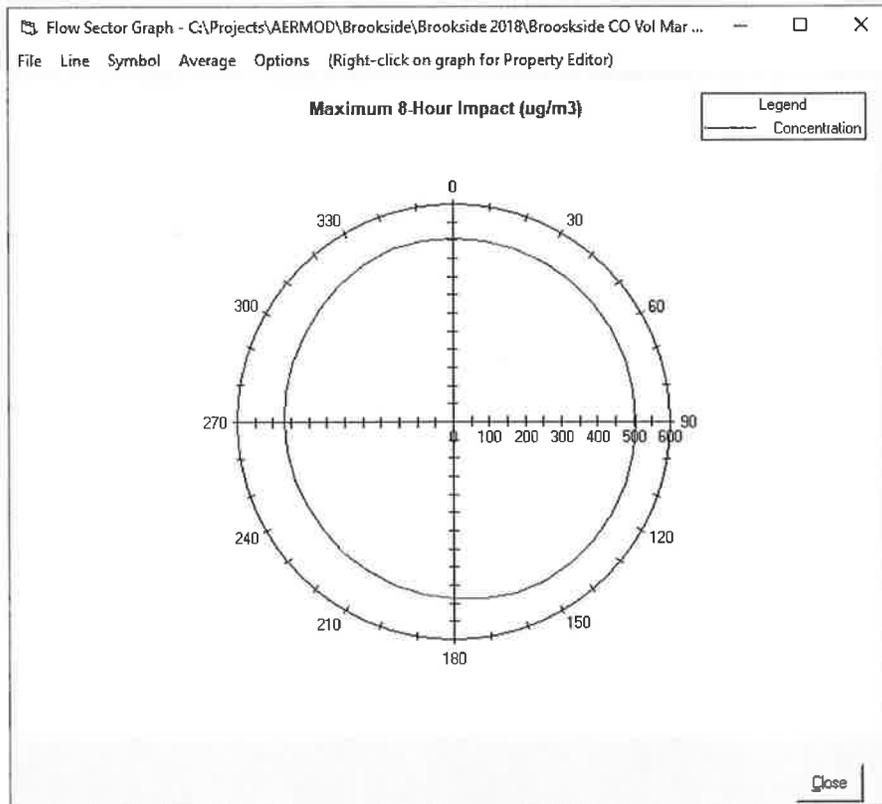
AERSCREEN Finished Successfully
Results

	Max. Conc. (ug/m3)	Dist. (m)
Flow Sector Analysis	563.4000	6.1
Automated Distances	563.3600	6.1

Copy met files to User Folder Folder containing intermediate files:
C:\ProgramData\Providence\AerScreen



CO – 8 hour max



NOx – 1 hour max

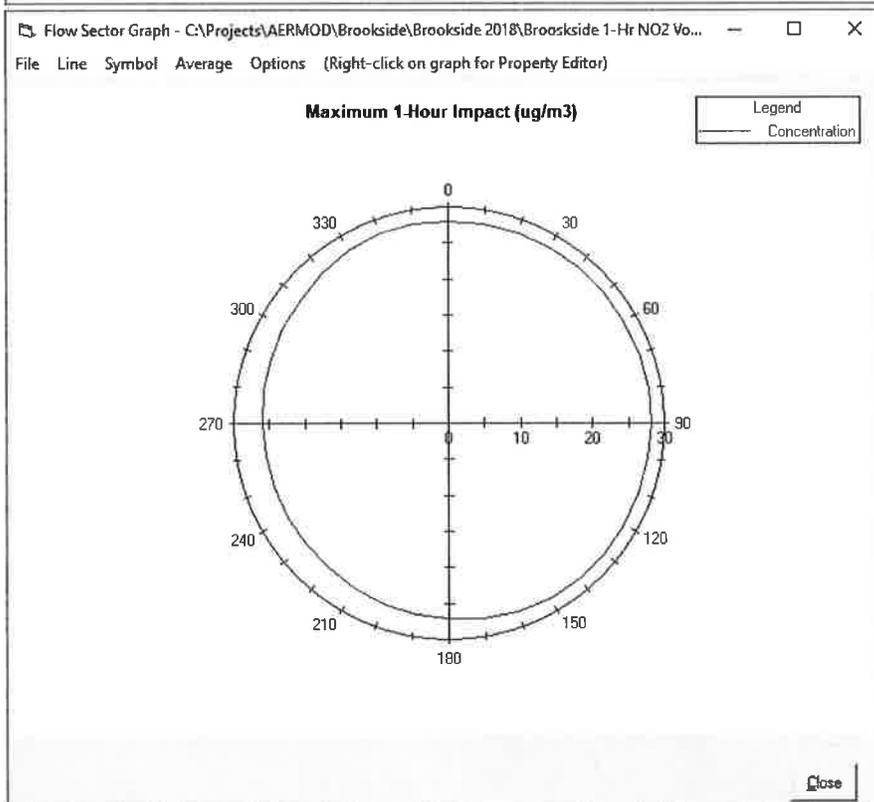
AERSCREEN Results

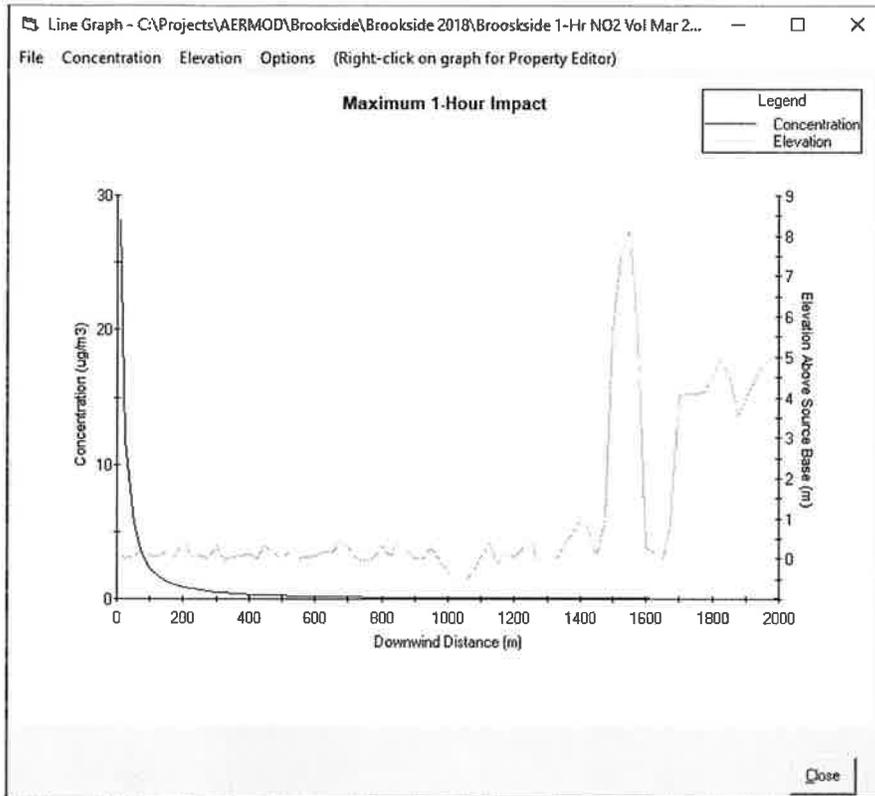
C:\Projects\AERMOD\Brookside\Brookside 2018\Brookside 1-Hr NO2 Vol Mar 2019.out

AERSCREEN Finished Successfully
Results

	Max. Conc. (ug/m3)	Dist. (m)
Flow Sector Analysis	28.1600	6.1
Automated Distances	28.1630	6.1

Copy met files to User Folder Folder containing intermediate files:
 C:\ProgramData\Providence\AerScreen





**AERSCREEN MODELING REPORT
CO AND 1-HOUR NO_x EMISSIONS
7 – MAR - 2019**

RED LION UPGRADE PROJECT

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1.0 Purpose of Study

This modeling study was performed at the request of the Delaware Department of Natural Resources and Environmental Control (DNREC) for the purpose of predicting the 1-hour/8-hour CO and 1-hour NO₂ impacts from Diamond State Generation Partners, LLC proposed upgrade of the existing Red Lion Project. The Red Lion upgrade project consists of removing 134 natural gas fueled Energy Server fuel cells and installing 52 latest generation ES5-BABAAA Energy servers, each with an output capacity of 200kW and 58 latest generation ES5-AACAAA Energy servers, each with an output capacity of 250kW. The Red Lion Power Project is located just east of Route 9 (River Road) approximately 1.5 north of the Delaware City Refinery in city of New Castle, Delaware. DNREC is seeking assurance that the CO and NO_x emissions from this proposed facility can demonstrate compliance with the short-term CO and NO₂ National Ambient Air Quality Standard (NAAQS).

The following sections of this report provide the details for the AERSCREEN analysis used to determine compliance with the short-term CO and NO₂ standards. Section 2 provides a detailed description of the modeling methodology used for this study, Section 3 provides the results from this study documenting that AERSCREEN shows compliance with the short-term CO and NO₂ standards.

2.0 Modeling Methodology

The modeling performed for this study is a screening level analysis of 1-hour/8-hour CO and 1-hour NO₂ impacts, as requested by DNREC. This modeling was conducted following current USEPA modeling guidance. The following subsections 2.1 through 2.5 contain the detailed information regarding site characterization, meteorological and background monitored data, and model options used for this study. The majority of the assumptions from the original modeling work in 2012 have been retained.

On March 1, 2011 EPA released a clarification memo regarding various aspects of modeling for demonstration of compliance with the 1-hour NO₂ NAAQS.¹ Included within this memo is a discussion regarding the three-tier approach that can be employed for modeling of 1-hour NO₂, as well as a clarification on what is appropriate to use for the assumption of background NO₂ concentrations. In 2012, all modeling for this analysis was performed in a manner consistent with this memo including use of the 3-year average of monitored annual 98th percentile daily 1-hour maximum NO₂ concentration as the background concentration for NAAQS comparison (see Section 2.4).

The tiered approach to modeling 1-hour NO₂ is a hierarchical structure, with Tier 1 the most conservative, while Tier 3 is the least conservative. The assumptions for each tier are as follows:

- Tier 1 – Model the facility assuming that all NO_x emitted from a facility is emitted as NO₂.
- Tier 2 – Use a default ambient ratio of 0.80 for conversion of NO_x to NO₂. This allows for a facility to subtract 20% from the total NO_x impact predicted in Tier 1.
- Tier 3 – Use the AERSCREEN model, utilizing the PVMRM and/or OLM approaches.

For the upgrade project, Tier 1 was assumed, as this is the most conservative.

¹ *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO₂ National Ambient Air Quality Standard*, USEPA-OAQPS memo, Tyler Fox, March 1, 2011.

2.1 Model Used

Short-range transport dispersion model predictions (within 10 km of the facility) are required for this analysis to determine project-alone impacts for comparison to the short-term CO and NO₂ NAAQS.

For the original project, the AERSCREEN model (Ver. 11126) was the EPA's "preferred/recommended" screening model for use in modeling analyses with plume transport distances of less than 50 km. In March 2011, the U.S. EPA released AERSCREEN, a screening model based on the AERMOD dispersion algorithms, which is expected generally to yield more realistic concentrations than the existing SCREEN3 model, while maintaining conservatism over more refined analyses. Use of AERSCREEN for the screening analysis of this Project conforms to both EPA and DNREC recommendations. The upgrade project used AERSCREEN version 16216 released 1/17/2017.

2.2 Source Parameters

The existing Red Lion Power Project consists of 134 individual fuel cells arranged in two distinct areas as depicted in Figure 2-1. After the upgrade, the eastern area (Block 1) will contain eight 10 cell blocks and one 5 cell block while the western area (Block 2) will contain the remaining five 10 cell blocks. Each original individual fuel cell is approximately 25.5'L x 8.5'W x 6.75'H. The upgrade fuel cells are of similar dimensions. Block 1 is approximately 400'L x 132'W x 6.75'H and Block 2 is approximately 218'L x 132'W x 6.75'H. Each individual 200kW fuel cell utilizes approximately 1.24 MMBtu/hr of natural gas at full load to produce 200 kW of net power output. Each individual 250 kW fuel cell utilizes approximately 1.55 MMBtu/hr of natural gas at full load to produce 250kW of net power output. As part of the chemical reaction within the fuel cell, NO_x is formed and emitted at rate shown in the following table. **Note that after the upgrade, the total amount of NO_x emitted from the site will have decreased.**

NO_x Emission Rates

Original Project	0.0021 lb/MW-hr	0.0567 lb/hr site total
Upgrade Project	0.0017 lb/MW-hr	0.0425 lb/hr site total

Likewise CO is also formed as part of this chemical reaction and emitted at a rate shown in the following table. **Note that after the upgrade, the total amount of CO emitted from the site will have decreased.**

CO Emission Rates

Original Project	0.10 lb/MW-hr	2.70 lb/hr site total
Upgrade Project	0.034 lb/MW-hr	0.85 lb/hr site total

AERSCREEN contains algorithms for modeling of several different types of emissions sources including volume sources. Volume source algorithms are valid for modeling releases from multiple vents and given the source characteristics of the fuel cell emissions, coupled with the fact that they are arranged in blocks, the fuel cells were modeled as volume type sources. Calculations for the upgrade project are also based on the Volume Source algorithm.

The AERSCREEN model is, by design, a conservative screening model and only allows the modeling of a single source for each run. In order to model the combined emissions from the concurrent operations of all of the fuel cells within AERSCREEN each of the two fuel cell blocks was modeled individually utilizing the center point of the site. Based on the physical alignment of the fuel cells the worst case wind direction will be one that blows parallel to the axis of the center points of the fuel cells such that the emissions from each are additive, the red line on original Figure 2-1 depicts these worst-case wind directions (generally NW - SE axis). Both wind direction conditions were modeled for each fuel cell block with distances from the center of the fuel cell block to the fenceline adjusted based on the wind direction. For each wind direction the maximum predicted AERSCREEN short-term CO and NO₂ impacts, regardless of location, can be added together for a total impact that is used for comparison with the NAAQS.

Volume sources require the user to input an emission rate, release height, and both the initial lateral (sigma-y) and vertical (sigma-z) dimensions of the volume source. These last two parameters were calculated pursuant to the methodology detailed in Table 3-1 of the AERMOD Users Guide² and all volume source parameters utilized for AERSCREEN are summarized in Table 2-1. These values have been updated to reflect the new fuel cell geometry and the revised number of fuel cell systems for the upgrade project.

2.3 AERSCREEN Inputs

In addition to the source parameters described in Section 2.2 AERSCREEN requires site specific information regarding land use and topography. AERSCREEN utilizes USGS Land Use/Land Classification (LULC) and USGS National Elevation Dataset (NED) for the required land use and topography information, respectively. Given the use of surface characteristics and terrain, it was important that the exact coordinate of the source, i.e., stack or center location of volume, be input into the model. Based upon the drawings provided by the original project it was determined that the approximate center of the facility is located at UTM coordinate 446225m, 4384873m based upon NAD83 projection, located within UTM Zone 18. This geometry was not modified for the upgrade project.

AERSCREEN requires the user to input a minimum and maximum receptor distance for impact prediction. The minimum receptor distance for each modeled case was set to the distance from the center of the fuel cell block to the nearest physical fenceline for the wind direction being analyzed. EPA considers all locations that the public is not precluded access to via a physical barrier as ambient air. As a result the physical fenceline and not the property line was used for the determination of the nearest modeling receptor which is consistent with current EPA guidance.

² Users Guide for the AMS/EPA Regulatory Model – AERMOD, EPA-454/B-03-001, September 2004.

The maximum modeling receptor distance was set to 5 km from the source. Figure 2-1 depicts the facility fence line in relation to the fuel cell locations.

AERSCREEN calculated the appropriate receptor elevations utilizing the following 7.5 minute NED files:

- Saint Georges, DE
- Delaware City, DE
- Wilmington South, DE
- Newark East, DE

The meteorological data utilized by AERSCREEN is inherently built into the model and represents a calculated range of site-specific conditions designed to determine a conservative worst-case impact. AERSCREEN provides three options for surface characteristics inputs for generating this screening meteorology.

One option allows for user-specified surface characteristics – albedo, Bowen ratio, and surface roughness (no spatial or temporal variation), the second option is to use seasonally varying surface characteristics for generic land use classifications. The third option is to input the name of an external file such as an AERSURFACE output file. Monthly, seasonal, and annual output for one sector or multiple sectors is allowed with the third option.

For this analysis the third option of utilizing a site specific AERSURFACE file was chosen. AERSURFACE was run based on the following:

- UTM coordinate of 446225m, 4384873m (Zone 18, NAD 83)
- 1992 USGS Land Use Data
- 4 Sectors (0-90 deg, 90-180 deg, 180-270 deg, 270-360 deg)
- 4 seasons with winter assumed to not have continuous snow cover
- 1 km radius for surface roughness, 10km domain for Bowen Ratio and Albedo

The original AERSURFACE file was also used for the upgrade project. Table 2-2 summarizes the surface parameters calculated by AERSURFACE for each sector/season and subsequently was used as input to AERSCREEN for creating the site-specific screening meteorological data.

AERSCREEN also allows the option to include NO_x to NO₂ conversion by using the Ozone Limiting Method (OLM). The OLM utilizes a chemical transformation algorithm in order to estimate the conversion of emitted NO_x to NO₂ based on an assumed background ozone concentration. Use of the OLM option requires the user to input two items:

1. The NO₂/NO_x in-stack ratio, which is the ratio of NO₂ to total NO_x in the exhaust flow of the source being modeled. EPA guidance suggests the use of a default ratio of 0.5 unless source specific information is available. For this analysis, an in-stack ratio of 0.5 was used for the OLM option since source specific information was not available.

2. A representative ozone background concentration. 1-hour monitored ozone data from the nearest EPA monitoring station (Lums Pond State Park) was reviewed for the then most recent 3-year period available (2008 – 2010). This monitoring site located at a distance of approximately 7.0 miles southwest of the project site. The average hourly ozone concentration over the 2008-2010 3-year period was calculated to be 0.05262 ppm. This value was used as the representative ozone background concentration for the OLM option.

Although the original project used the Ozone Limiting Method, the more conservative approach of Tier 1 (assuming all NO_x is emitted as NO₂) was selected for the upgrade project, since the overall NO_x emissions are significantly decreased. Consequently, the discussion of representative ozone background concentrations above was not updated.

2.4 Background Data

In order to define the existing overall air quality setting for proper CO and NO₂ comparison with the NAAQS, monitored background concentrations from the EPA monitoring network for the original project are provided in Table 2-3. This table shows the monitored 98th-percentile 1-hour NO₂ levels as well as the maximum monitored 1-hour and 8-hour CO levels from the nearest EPA monitoring station for the most recent 3-year period available (2015 – 2017). The nearest EPA site for both pollutants was located at a distance of approximately 9.5 miles north of the project site.

**Table 2-1
Parameters for Modeling Red Lion Project within AERSCREEN**

**Volume Source Configuration – Block 1 (66 Fuel Cells)
32 ES5-BABAAA 200 kW Systems
34 ES5-AACAAA 250 kW Systems**

Parameter	Original Value	Upgrade Project Value	Notes
Source Height (ft)	6.75 ft	6.75 ft	Top of Fuel Cell
Initial Sigma-Z (ft)	3.14 ft	3.14 ft	Source Height divided by 2.15
Source Length (ft)	400.0 ft	n.a.	n.a. – source area used instead
Source Width (ft)	132.0 ft	n.a.	n.a. – source area used instead
Source Area (ft²)	52,800 ft ²	311.47 ft ²	Total Block Area for fuel cell exhaust
Volume Source Length (ft)	229.8 ft	17.65 ft	Assumes all sides equal
Initial Sigma-Y (ft)	53.4 ft	4.1 ft	Volume Source length divided by 4.3
Distance to Fence (NW Wind)	242 ft	242 ft	From center of volume source
Distance to Fence (SE Wind)	688 ft	688 ft	
NOx Emission Rate			
	0.0021 lb/MW-hr 0.036 lb/hr (total)	0.0017 lb/MW-hr 0.0255 lb/hr (total)	Vendor Provided Data
CO Emission Rate			
	0.010 lb/MW-hr 1.7 lb/hr (total)	0.034 lb/MW-hr 0.51 lb/hr (total)	Vendor Provided Data

Table 2-1 (continued)
Parameters for Modeling Red Lion Project within AERSCREEN

Volume Source Configuration – Block 2 (44 Fuel Cells)
20 ES5-BABAAA 200 kW Systems
24 ES5-AACAAA 250 kW Systems

Parameter	Original Value	Upgrade Project Value	Notes
Source Height (ft)	6.75 ft	6.75 ft	Top of Fuel Cell
Initial Sigma-Z (ft)	3.14 ft	3.14 ft	Source Height divided by 2.15
Source Length (ft)	218.0 ft	n.a.	n.a. – source area used instead
Source Width (ft)	132.0 ft	n.a.	n.a. – source area used instead
Source Area (ft²)	28,776 ft ²	209.04 ft ²	Total Block Area for fuel cell exhaust
Volume Source Length (ft)	169.6 ft	14.46 ft	Assumes all sides equal
Initial Sigma-Y (ft)	39.4 ft	3.36 ft	Volume Source length divided by 4.3
Distance to Fence (NW Wind)	735 ft	735 ft	From center of volume source
Distance to Fence (SE Wind)	193 ft	193 ft	
1-Hour NOx Emission Rate			
	0.00021lb/MW-hr	0.0017 lb/MW-hr	Vendor Provided Data
	0.021 lb/hr (total)	0.017 lb/hr (total)	
CO Emission Rate			
	0.010 lb/MW-hr	0.034 lb/MW-hr	Vendor Provided Data
	1.00 lb/hr (total)	0.34 lb/hr (total)	

Table 2-2
AERSURFACE Parameters for Modeling Red Lion Project
Used for both the Original Project and the Upgrade Project

Sector	Season	Albedo	Bowen Ratio	Surface Roughness (m)
0 - 90 degrees	Winter (Dec-Feb)	0.15	0.42	0.072
	Spring (Mar-May)	0.14	0.29	0.088
	Summer (Jun-Aug)	0.15	0.30	0.182
	Autumn (Sep-Nov)	0.15	0.41	0.182
90 - 180 degrees	Winter (Dec-Feb)	0.15	0.42	0.037
	Spring (Mar-May)	0.14	0.29	0.046
	Summer (Jun-Aug)	0.15	0.30	0.083
	Autumn (Sep-Nov)	0.15	0.41	0.083
180 - 270 degrees	Winter (Dec-Feb)	0.15	0.42	0.019
	Spring (Mar-May)	0.14	0.29	0.026
	Summer (Jun-Aug)	0.15	0.30	0.095
	Autumn (Sep-Nov)	0.15	0.41	0.095
270 - 360 degrees	Winter (Dec-Feb)	0.15	0.42	0.026
	Spring (Mar-May)	0.14	0.29	0.039
	Summer (Jun-Aug)	0.15	0.30	0.216
	Autumn (Sep-Nov)	0.15	0.41	0.216

Notes:

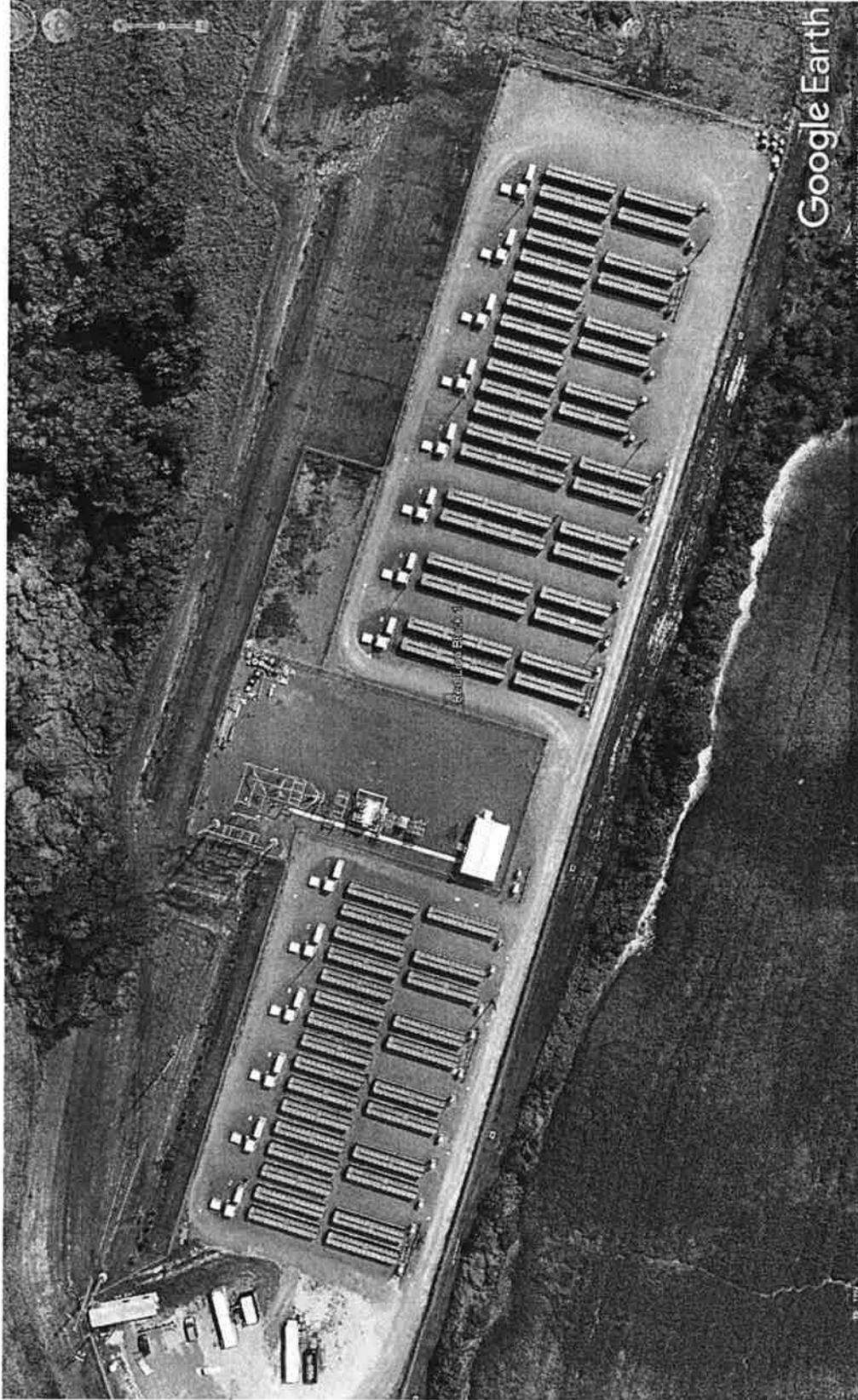
- Winter season assumes after frost and no continuous snow cover
- Spring season assumes transitional spring (partial green coverage, short annuals)
- Summer season assumes mid-summer with lush vegetation
- Autumn season assumes unharvested cropland

**Table 2-3
Background (in $\mu\text{g}/\text{m}^3$) Concentrations For NAAQS Comparison (Wilmington, DE)**

Pollutant	Avg Period	Monitoring Station Location	Dist. (mi)	Dir. (deg)	2015	2016	2017	Ambient Standard
NO ₂	1-Hour	MLK Blvd & Justison St	9.5	355	88.9 ppb 167 $\mu\text{g}/\text{m}^3$	90.6 ppb 170 $\mu\text{g}/\text{m}^3$	79.0 ppb 149 $\mu\text{g}/\text{m}^3$	188 ^a
CO	1-Hour	MLK Blvd & Justison St	9.5	355	1750 $\mu\text{g}/\text{m}^3$	1810 $\mu\text{g}/\text{m}^3$	1570 $\mu\text{g}/\text{m}^3$	40,000
	8-Hour				1400 $\mu\text{g}/\text{m}^3$	1600 $\mu\text{g}/\text{m}^3$	1250 $\mu\text{g}/\text{m}^3$	10,000
^a The promulgated NAAQS one-hour NO ₂ value is 100 ppb (188 $\mu\text{g}/\text{m}^3$). The NAAQS standard is statistical, based on the 3-year rolling average of the 98th-percentile of daily maximum 1-hour averages for each year. * Indicates background value used in analysis.								

Note: Direction indicated is from Red Lion Project site to monitor.

Figure 2-1
Red Lion Project – Existing Site Layout

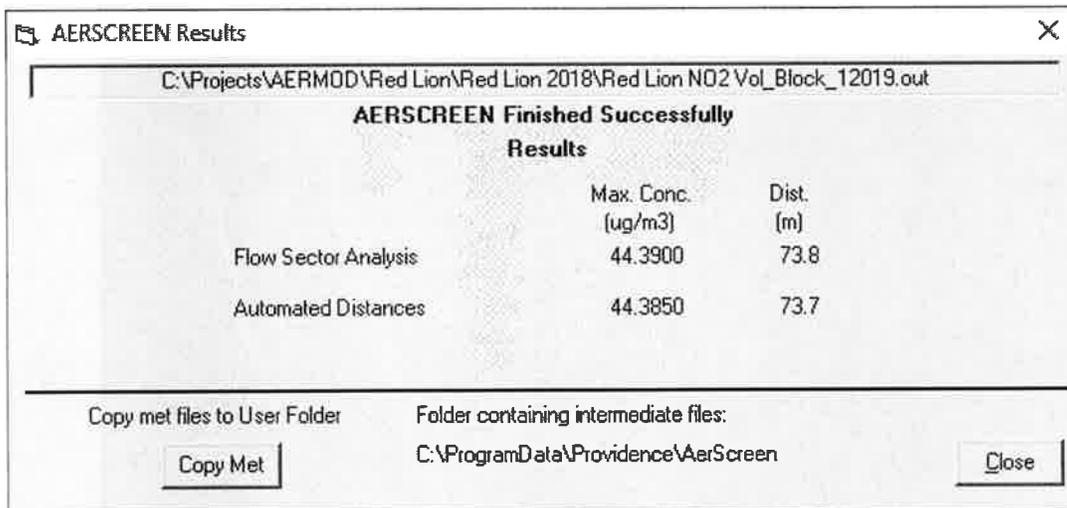


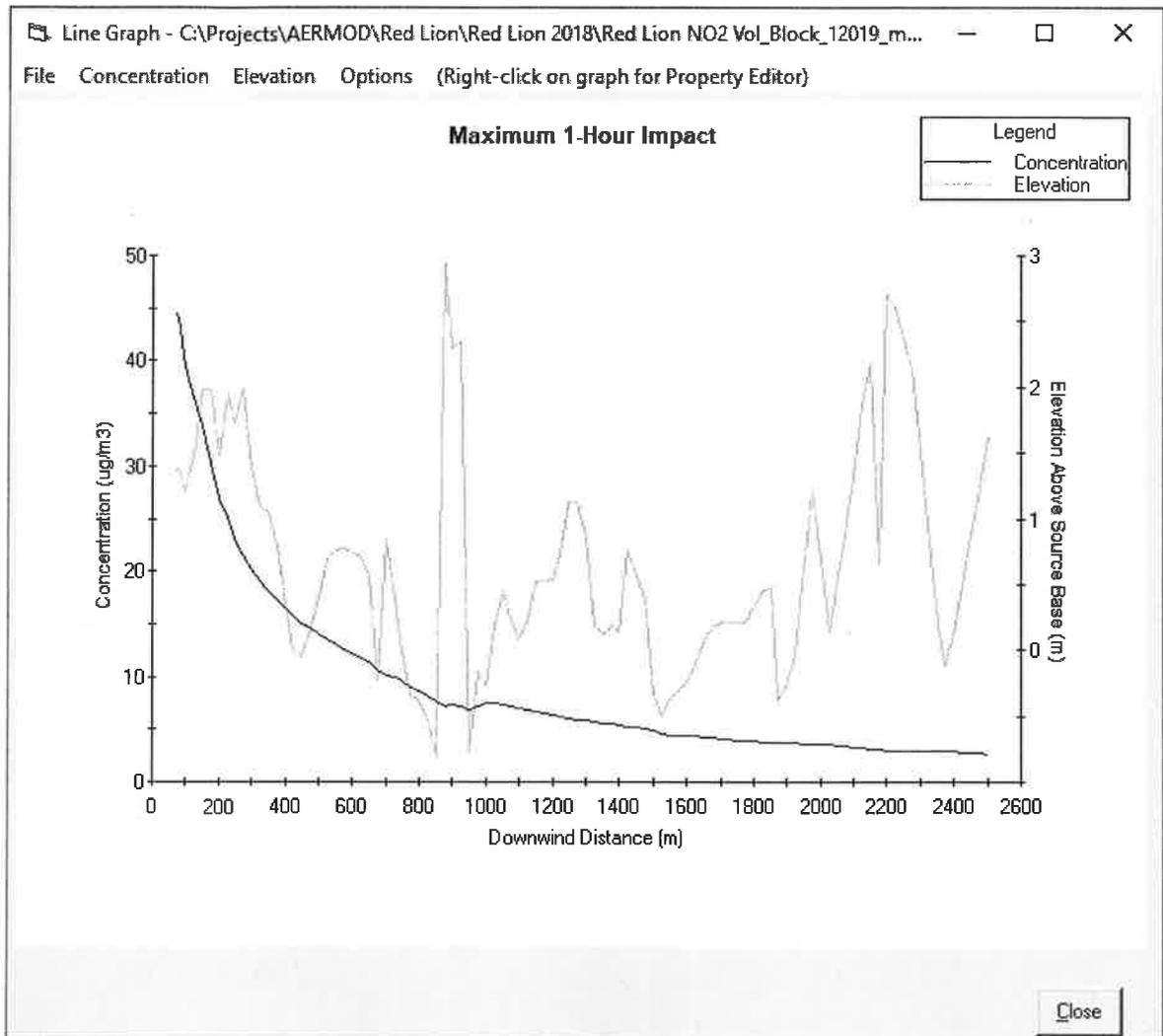
3.0 Modeling Results – Upgrade Project

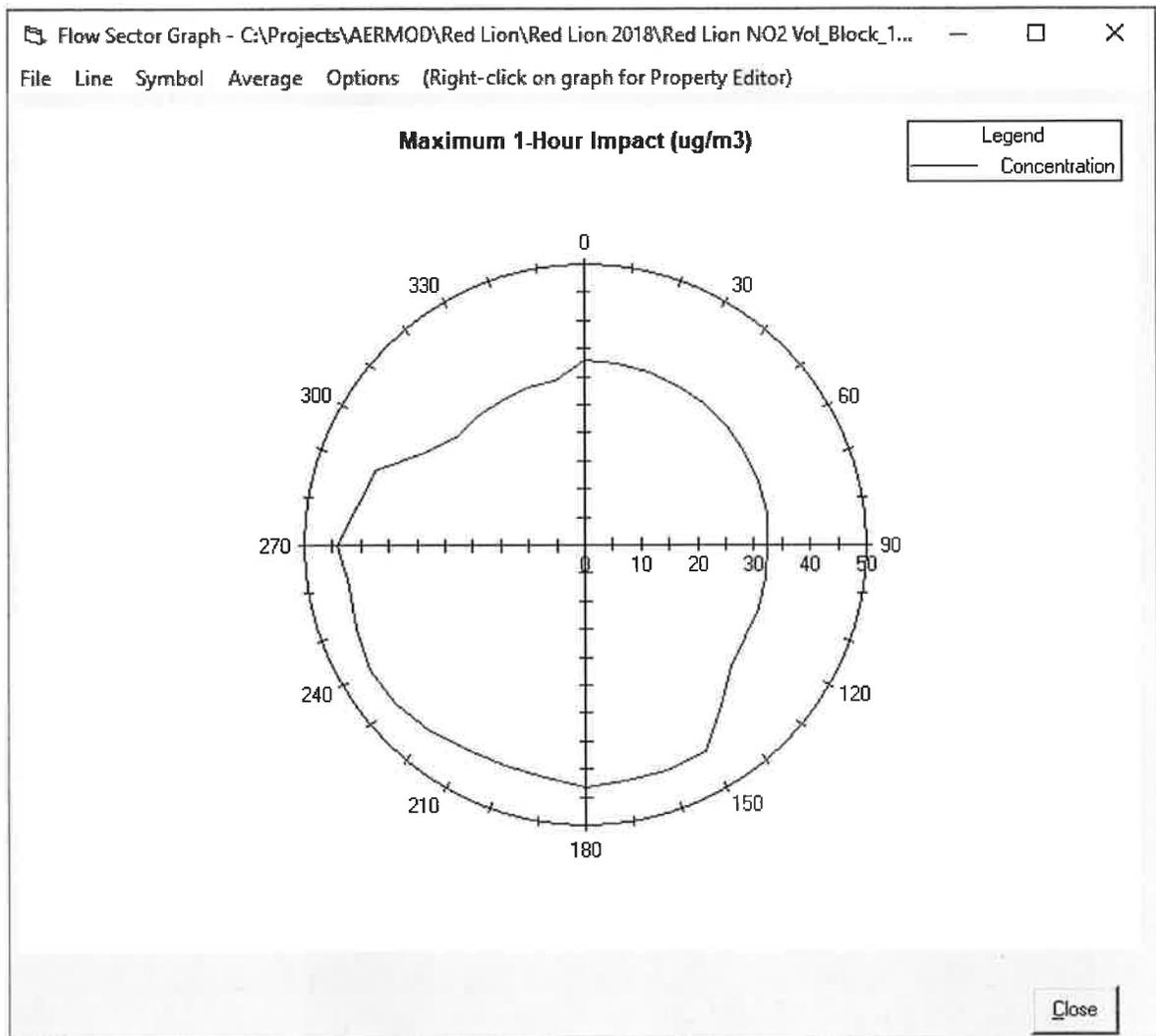
The following sections present screenshots of the AERSCREEN modeling results for 1-hour NO₂, 1-hour CO and 8-hour CO for the Red Lion Upgrade Project. All of the AERSCREEN modeling input and output files necessary to reproduce the upgrade project modeling results are included in the attached zip file.

3.1 1-Hour NO₂

Block 1







Block 2

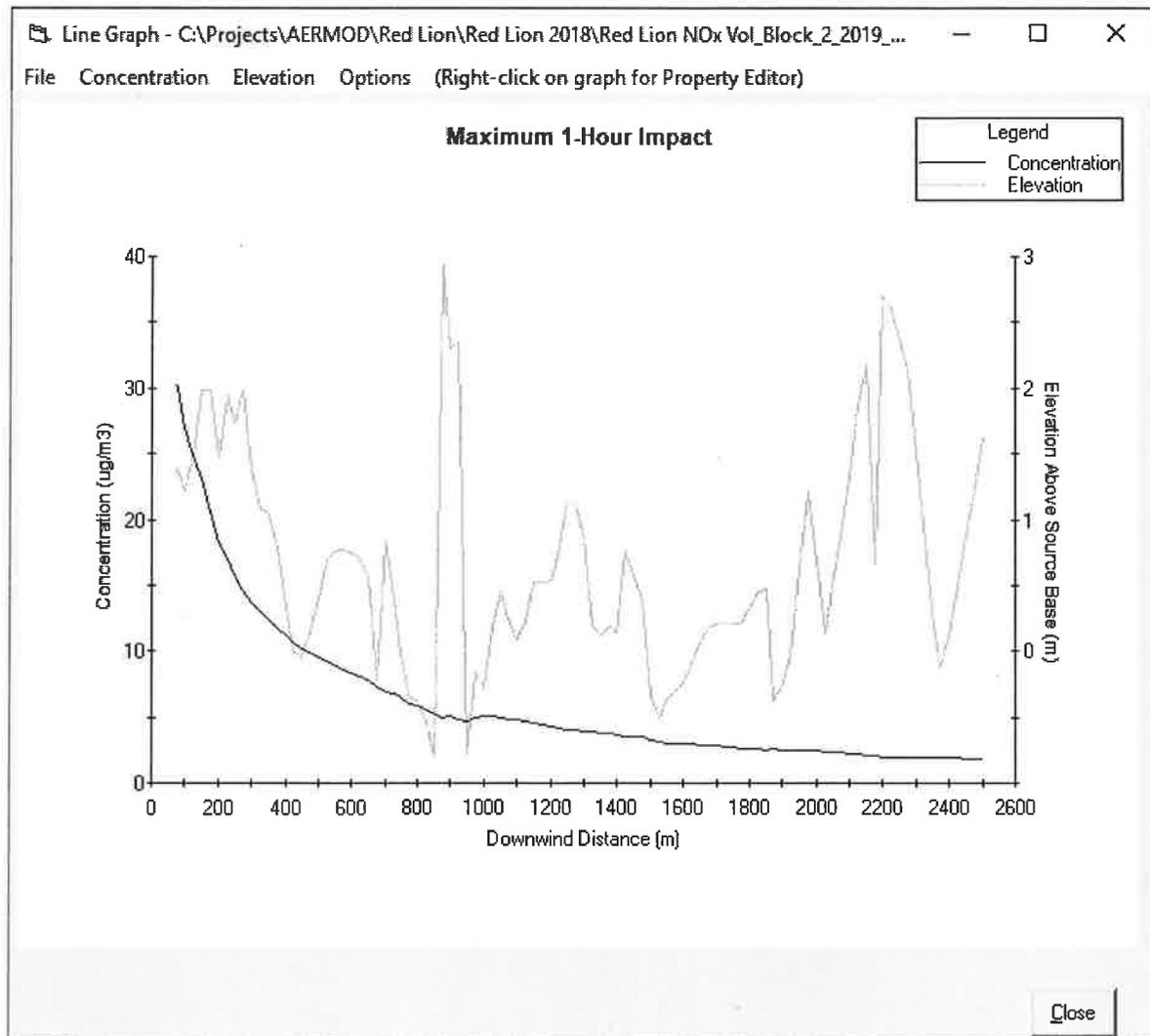
AERSCREEN Results

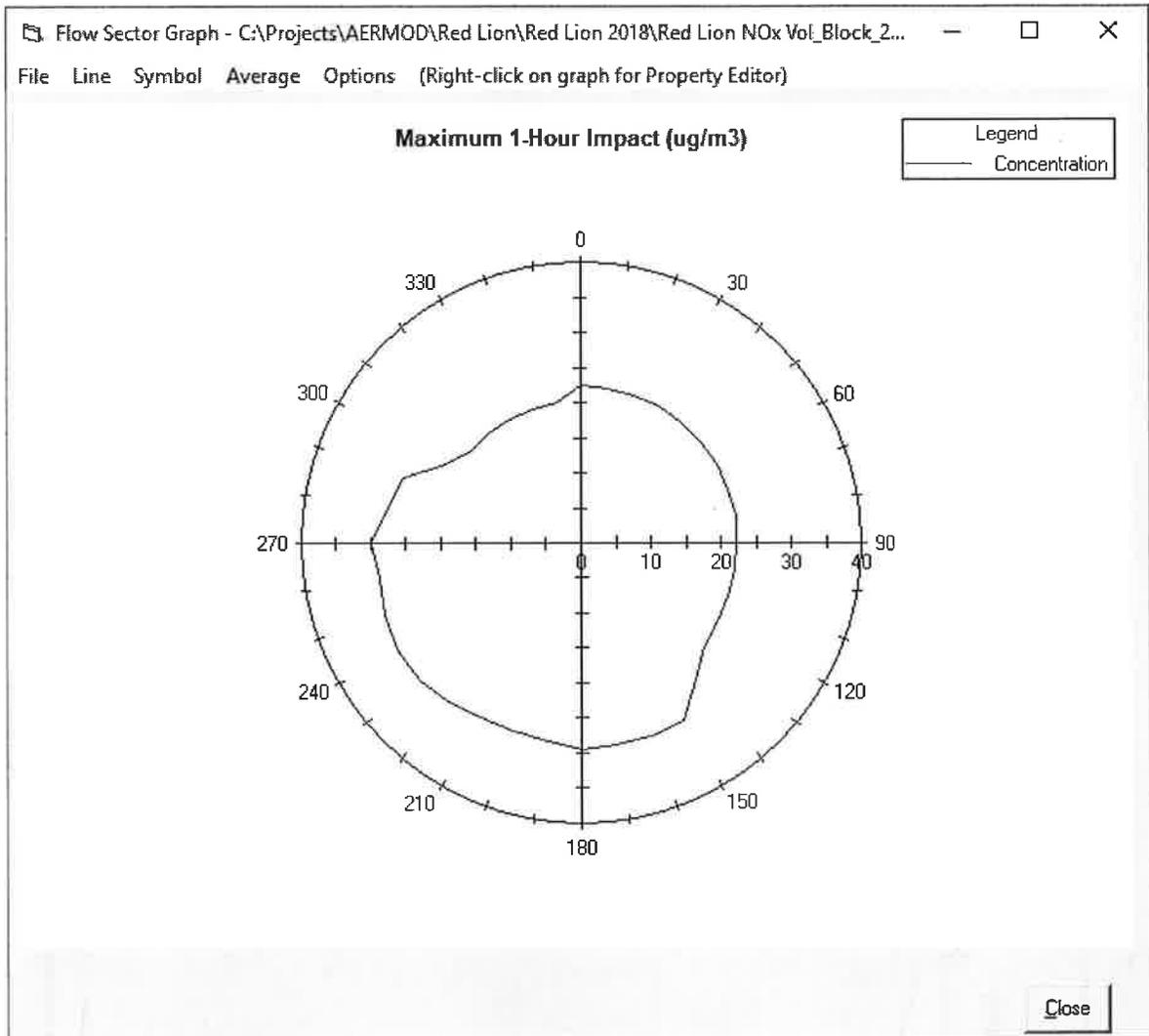
C:\Projects\AERMOD\Red Lion\Red Lion 2018\Red Lion NOx Vol_Block_2_2019.out

AERSCREEN Finished Successfully
Results

	Max. Conc. (ug/m3)	Dist. (m)
Flow Sector Analysis	30.2800	73.8
Automated Distances	30.2800	73.7

Copy met files to User Folder Folder containing intermediate files:
 C:\ProgramData\Providence\AerScreen





If the results for block 1 and block 2 are added together, the maximum 1 hour NO_x concentration is $44.39 + 30.28 = 74.67$ micrograms/m³, at a distance of 73.7 meters. Note that direct addition from different source locations inherently overestimates the maximum concentration.

3.2 1-Hour CO

Block 1

AERSCREEN Results [Close]

C:\Projects\AERMOD\Red Lion\Red Lion 2018\Red Lion CO Vol_Block_1NW.out

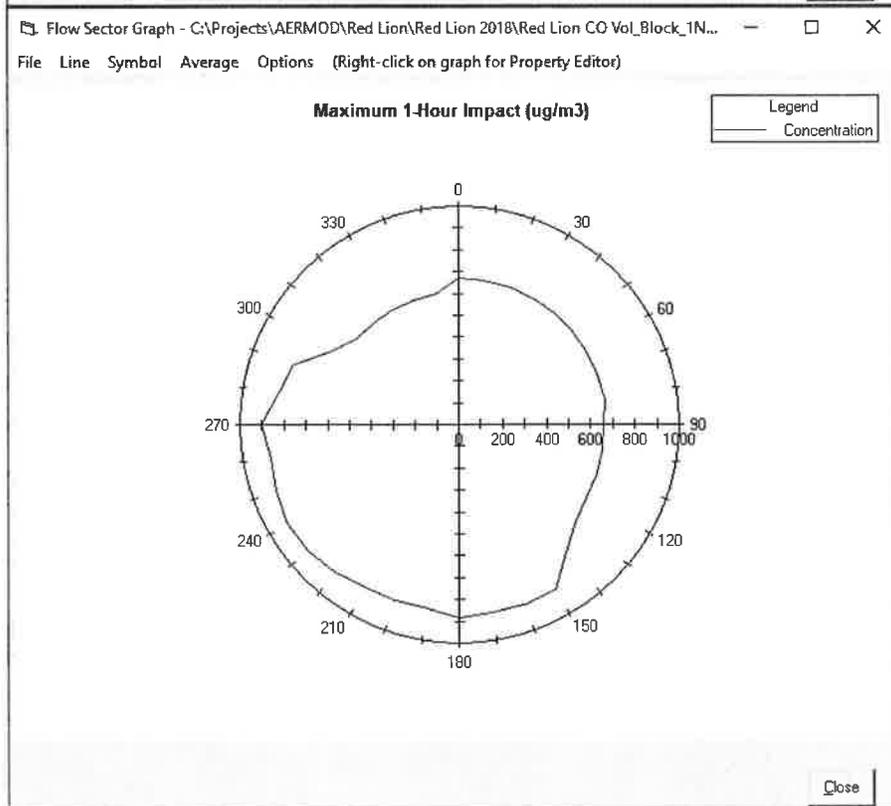
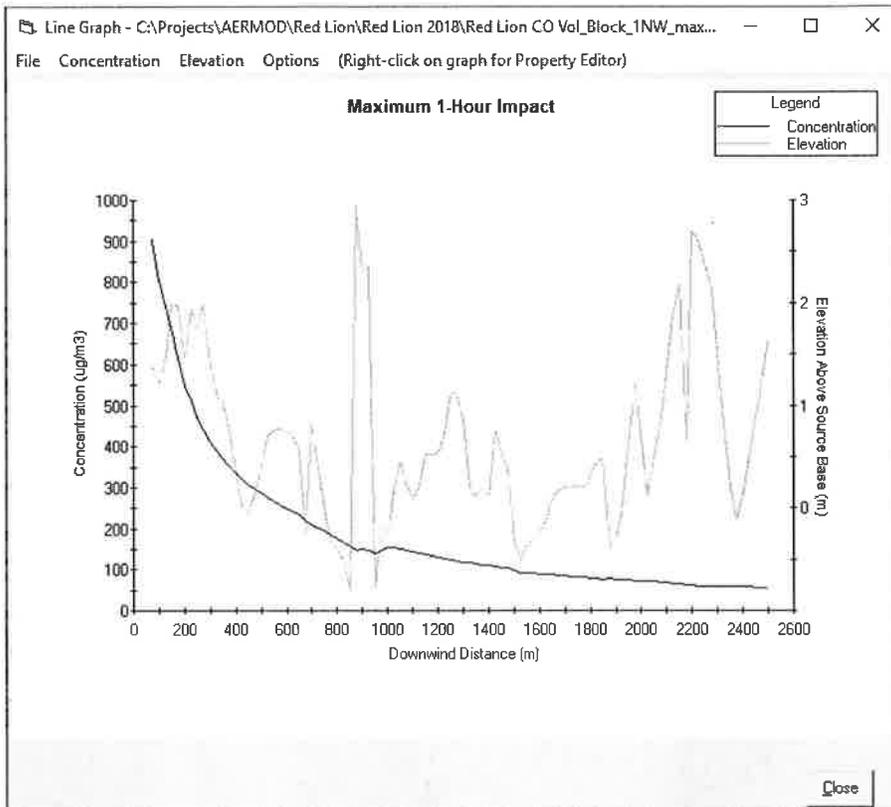
AERSCREEN Finished Successfully

Results

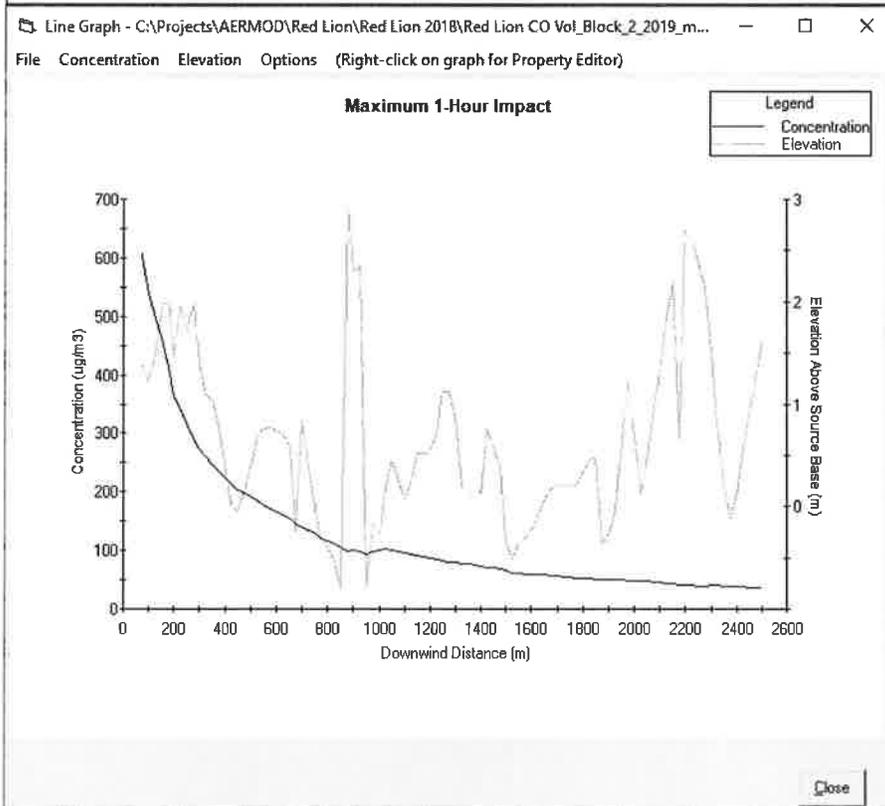
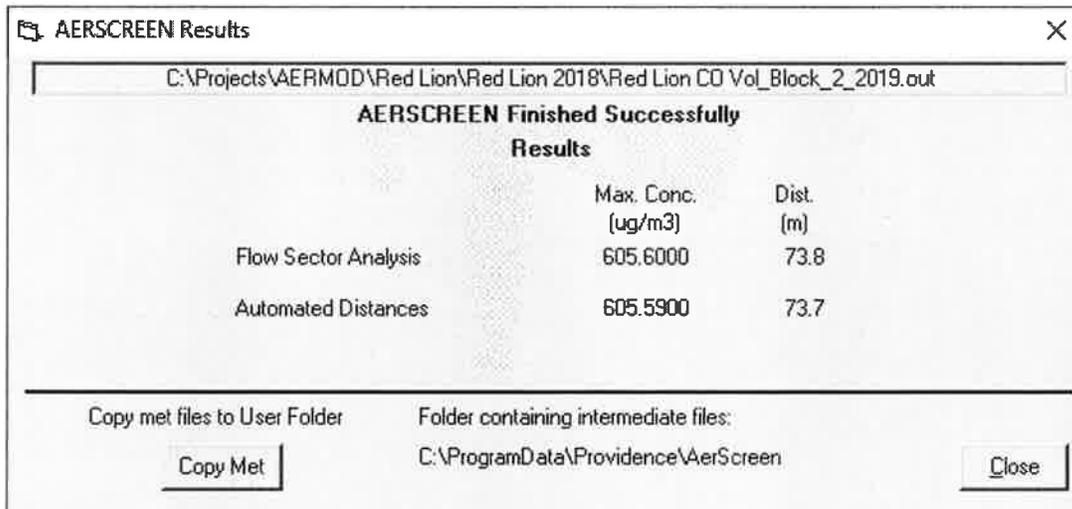
	Max. Conc. (ug/m3)	Dist. (m)
Flow Sector Analysis	905.5000	73.8
Automated Distances	905.4600	73.7

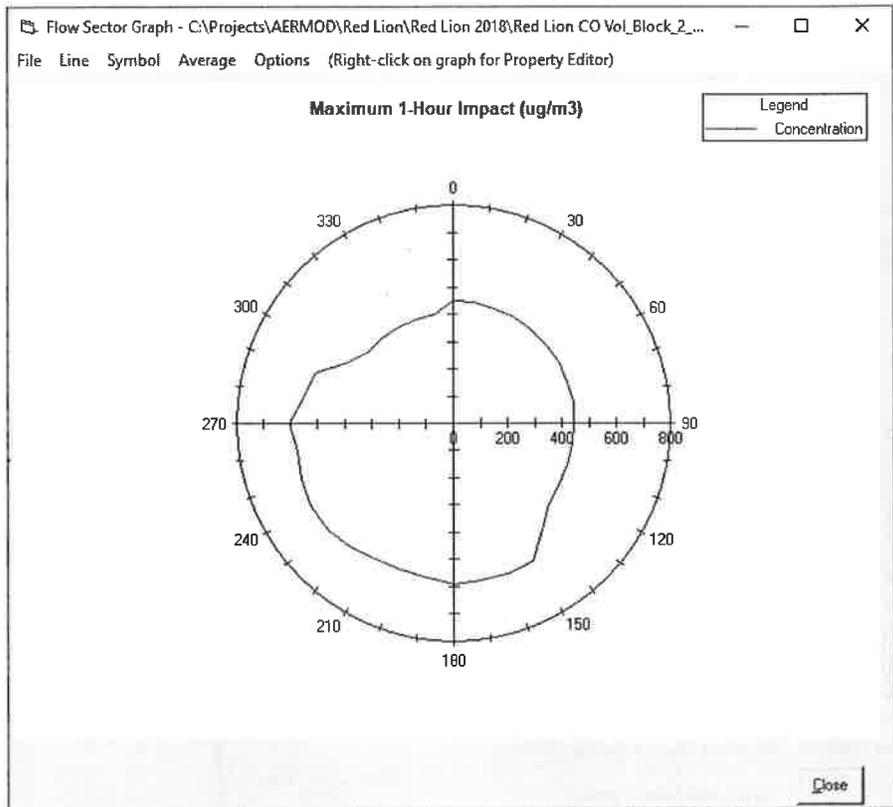
Copy met files to User Folder

Folder containing intermediate files:
C:\ProgramData\Providence\AerScreen



Block 2

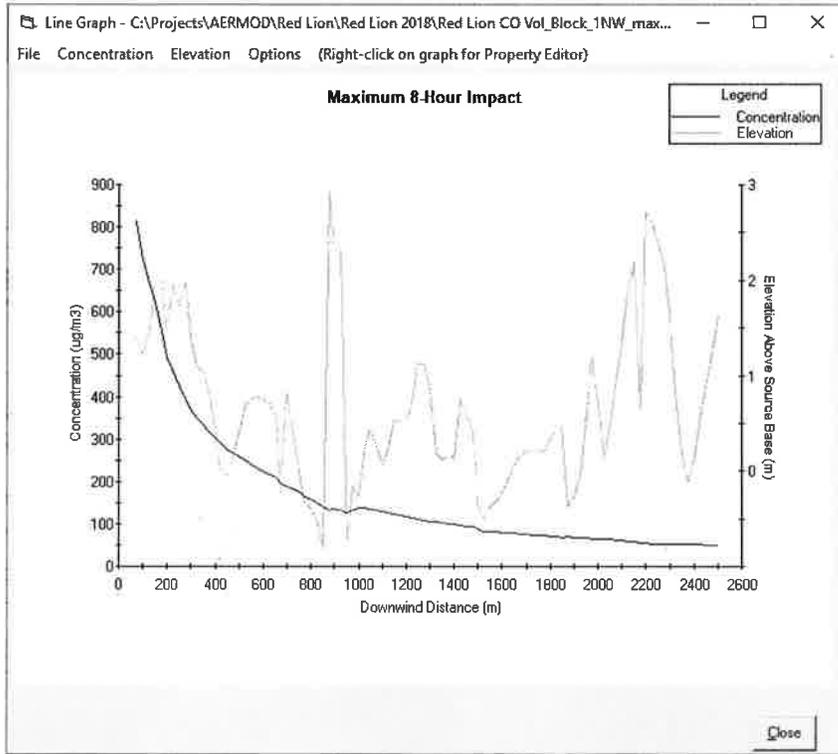


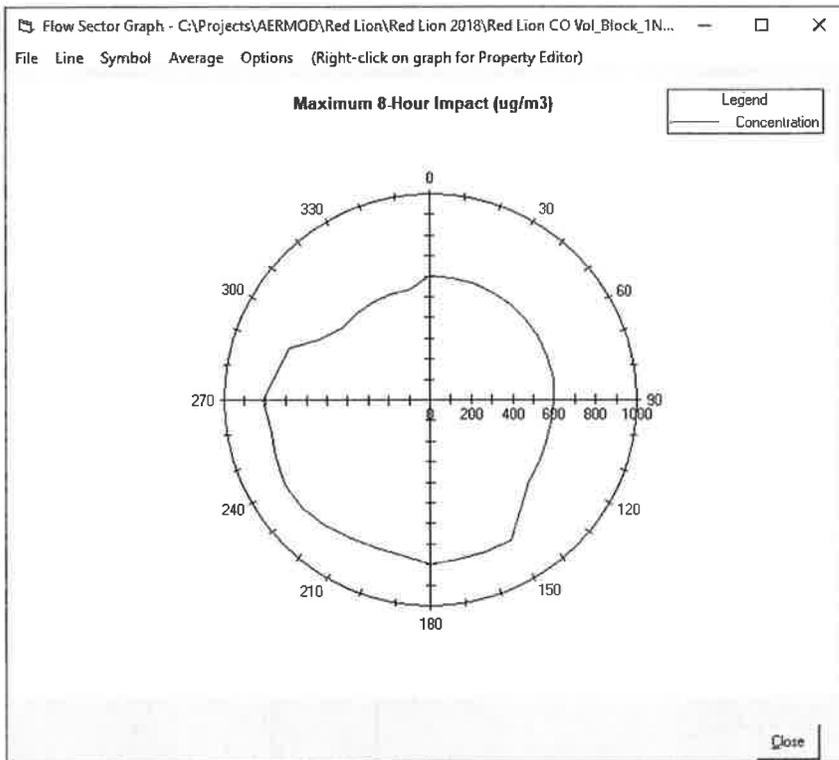


If the results for block 1 and block 2 are added together, the maximum 1 hour CO concentration is $905.5 + 605.6 = 1511$ micrograms/m³, at a distance of 73.7 meters. Note that direct addition from different source locations inherently overestimates the maximum concentration.

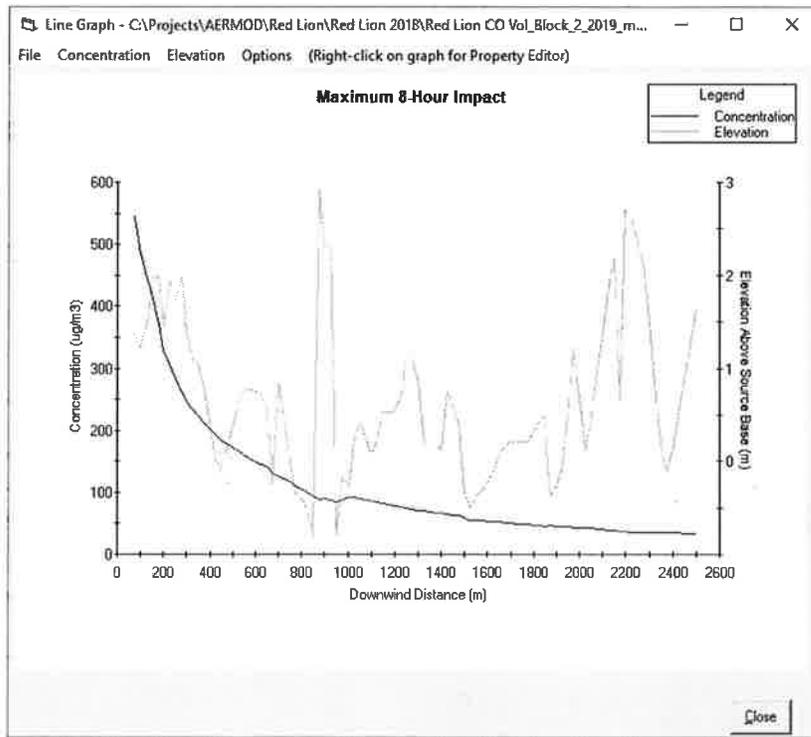
3.3 8-Hour CO

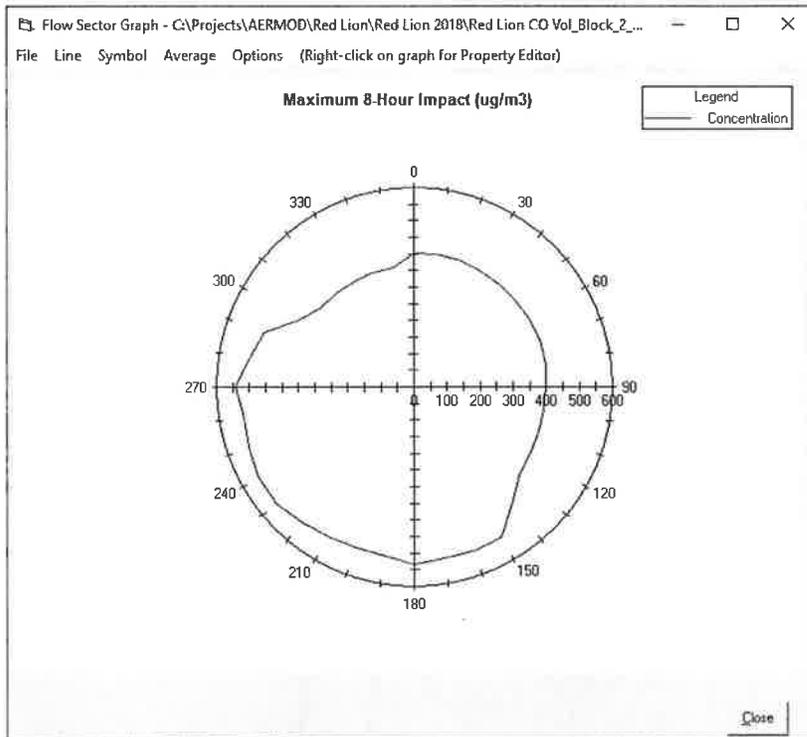
Block 1





Block 2





As expected from AERSCREEN, the 8 hour max result for CO is 90 % of the 1 hour max result for CO.

MEMORANDUM

TO: Angela D. Marconi, P.E., BCEE *ADM*

FROM: Karen A. Mattio, P.E. *KAM*

**SUBJECT: Diamond State Generating Partners, LLC/Bloom Energy
Brookside Fuel Cell Facility
Permit: APC-2019/0032-CONSTRUCTION
2.6 MW Fuel Cell Electric Generation Plant**

DATE: March 19, 2019

BACKGROUND INFORMATION

Diamond State Generating Partners, LLC/Bloom Energy requested a construction permit to install 13 model ES5-BABAAA fuel cells at an electric generating facility in Newark, New Castle County. The project will replace the 15 Bloom Energy ES-5700 Energy Saver fuel cells that are currently at the Brookside facility and will generate a total of 2.6 MW of power to the PJM electrical grid. According to the application, the fuel cells utilize solid oxide fuel cell (SOFC) technology to chemically convert the natural gas to electrical power in a non-combustion process. Each cell has a base load electrical output of 200 kW and the maximum natural gas usage for the site is 137 MMscf/yr.

- The Company has not requested confidentiality.
- The Brookside Project is not located in the Coastal Zone.
- The Company has paid appropriate construction application fees.
- The property is zoned S for Suburban.

TECHNICAL INFORMATION

In the application, the vendor (Bloom Energy) provided emissions in lbs/MWh based on stack test emission results for the same type of fuel cell unit, the ES5-200 Energy Saver Fuel Cell plus a safety margin. The emissions for the Brookside site were calculated using these values with a facility output of 2.6 MW and operating 8,760 hours per year.

Example calculation:

$$\begin{aligned} & \left(0.0017 \frac{\text{lbs}}{\text{MWh}} \text{NO}_x\right) (2.6 \text{ MW}) = 0.00442 \frac{\text{lbs}}{\text{hr}} \text{NO}_x \\ & \left(0.00442 \frac{\text{lbs}}{\text{hr}} \text{NO}_x\right) \left(\frac{8760 \text{ hr}}{1 \text{ year}}\right) \left(\frac{1 \text{ ton}}{2000 \text{ lbs}}\right) = 0.0193 \text{ TPY NO}_x \end{aligned}$$

SO₂ emissions are based on natural gas (NG) sulfur content of 0.1 ppm after each of the fuel cells desulfurization beds and are calculated as follows:

$$\left(0.01566 \frac{\text{MMft}^3}{\text{hr}} \text{NG}\right) \left(\frac{0.1 \text{ scf S}}{\text{MM ft}^3 \text{NG}}\right) \left(\frac{1 \text{ ft}^3 \text{SO}_2}{1 \text{ ft}^3 \text{S}}\right) \left(\frac{1 \text{ mol SO}_2}{385.3 \text{ ft}^3}\right) \left(\frac{64 \text{ lbs SO}_2}{1 \text{ mol SO}_2}\right) = 0.0003 \frac{\text{lbs}}{\text{hr}} \text{SO}_2$$

MEMORANDUM

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Diamond State Electric Generation Partners, LLC (Bloom Energy)

Brookside 2.6 MW Fuel Cell Electric Generation Plant

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CO_{2e} emissions were calculated as follows, with global warming potential (GWP) as defined in 7 DE Admin. Code 1125:

$$\left[\left(7,972 \frac{\text{tons CO}_2}{\text{yr}} \right) \left(\frac{2,000 \text{ tons}}{2,204.6 \text{ tons}} \right) (1 \text{ GWP}) \right] + \left[\left(0.181 \frac{\text{tons VOC (as CH}_4\text{)}}{\text{yr}} \right) \left(\frac{2,000 \text{ tons}}{2,204.6 \text{ tons}} \right) (25 \text{ GWP}) \right]$$

= 7,236 metric TPY

Table 1: Emission data for each pollutant associated with the facility.

Pollutant	Vendor Emissions (lbs/MWh)	Total Hourly Emissions (lbs/hr)	Daily Emission Facility Wide (lbs/day)	Annual Total Facility Emissions (tons/yr)	Major Source Threshold (tons/year)
NOx	0.0017	0.0044	0.1056	0.019	25
CO	0.034	0.0884	2.1216	0.387	100
VOC ^[1]	0.016	0.0413	0.9912	0.181	25
SO ₂	0.000102	0.0003	0.0072	0.0012	100
CO ₂	700	1820	43,680	7,972	100,000
CO _{2e}	700	1821	43,704	7,236 MT/yr ^[2]	100,000 ^[2]

[1] VOC emission data provided by manufacturer is modeled as Hexane.

[2] Units = metric tons per year (2204.6 lbs=MT)

AERSCREEN Modeling- NOx and CO

Since the project is for an electric generating facility, the Department requested that the Company perform air quality screening dispersion modeling to determine the ambient air quality impacts for comparison to the 1-hour 100 ppb (188 µg/m³) NO₂ NAAQS standard using the EPA’s AERSCREEN model. The Department also requested that the Company model CO using AERSCREEN and compare the results to the EPA’s NAAQS for CO. The Company performed the models for NO₂ and CO and submitted a very detailed description of the site characterization, meteorological and background monitored data, model options, input and output parameters and procedures and included in a March 8, 2019 letter. The Department required modeling submitted with the original application to be updated with recent meteorological data and an appropriate footprint.

The Company used the tiered approach regarding modeling for demonstration of compliance with the 1-hr NO₂ NAAQS. There are three tiers in the hierarchical structure with Tier 1 being the most conservative and Tier 3 the least. For this project, the Company used Tier 2, which involves using a default ambient ratio of 0.80 for conversion of NOx to NO₂.

The project consists of 13 individual fuel cells arranged in three blocks of three and two blocks of two forming five distinct areas. As a part of a chemical reaction within the fuel cell NOx is emitted at a rate of 0.00034 lb/hr per cell for a total of 0.0044 lb/hr for all 13 cells. Likewise, CO is also formed as part of this chemical reaction and is emitted at a rate of 0.034 lb/MW-hr or about 0.0068 lb/hr per fuel cell. The maximum hourly rate from all 13 fuel cells combined is 0.0884 lb/hr. Emissions are exhausted through four 0.39’ x 2.68’ power module vents at the top of each 200 kW fuel cell. The fuel cells were modeled as volume type sources.

In order to model the combined emissions from the concurrent operation of all 13 fuel cells, a single source was utilized and located at the center point of the southeastern fuel block which represents the fuel cell block located closest to the physical fence line. The Company chose to model the fuel cells as a volume

MEMORANDUM

Permit: **APC-2019/0032-CONSTRUCTION**

**Diamond State Electric Generation Partners, LLC (Bloom Energy)
Brookside 2.6 MW Fuel Cell Electric Generation Plant**

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source. Volume source algorithms are valid for modeling releases from multiple vents and given the source characteristics of the fuel cell emissions, combined with the fact that they are arranged in blocks, the fuel cells were modeled as volume sources. The following input parameters were utilized for this model.

Table 2. Parameters used as inputs into AERSCREEN for the model. The values are provided by the Company in a March 8, 2019 letter.

Parameter	Value	Notes
Source Height	6.75 ft	Top of fuel cell
Initial Sigma-Z	3.14 ft	Source height divided by 2.15
Source Area (ft ²)	54.35 ft ²	13 Cells * 4 Power Modules * 0.39 ft* 2.68 ft= 54.35 ft ²
Volume Source Length	7.35 ft	Assumes all sides equal (square root of source area)
Initial Sigma-Y	1.715 ft	Source height divided by 4.3
Distance to Fence	20 ft	
NOx emission rate	0.0017 lb/MWh 0.0044 lb/hr (total)	200 kW=0.20 MW 0.20 MW * 13= 2.6 MW 2.6 MW*0.0017 lb/MWh=0.0044 lb/hr
CO emission rate	0.034 lb/MWh 0.09 lb/hr (total)	200 kW=0.20 MW 0.20 MW * 13= 2.6 MW 2.6 MW*0.034 lb/MWh=0.09 lb/hr

Meteorological data was imported from a site specific AERSURFACE file. Both NOx and CO background concentrations were obtained from the nearest EPA monitoring station (Wilmington MLK), located approximately 9.7 miles northeast of the project site, for the most recent 3-year period available (2015-2017).

The results of the model are presented below:

Table 3. Results of the AERSCREEN model for NO₂ and CO provided in the application by the Company.

Pollutant	Averaging Period	Max Impact (µg/m ³)	Background (µg/m ³)	Total Impact (µg/m ³)	NAAQS (µg/m ³)	Exceeds NAAQS?
NO ₂	1-hr	28.2	86.24 ^[1]	114	188	No
CO	1-hr	563.4	1,710 ^[2]	2,273	40,000	No
CO	8-hr	570	1,417 ^[3]	1,984	10,000	No

[1] Average value for years 2015-2017. $[9 \mu\text{g}/\text{m}^3 + 90.7 \mu\text{g}/\text{m}^3 + 79 \mu\text{g}/\text{m}^3] / 3$

[2] Average value for years 2015-2017. $[1,750 \mu\text{g}/\text{m}^3 + 1,810 \mu\text{g}/\text{m}^3 + 1,570 \mu\text{g}/\text{m}^3] / 3$

[3] Average value for years 2015-2017. $[1,400 \mu\text{g}/\text{m}^3 + 1,600 \mu\text{g}/\text{m}^3 + 1,250 \mu\text{g}/\text{m}^3] / 3$

The model results indicate that the distance of the maximum concentration for both NOx and CO is 20 feet (at the fence line) from the edge of the nearest cellblock. Therefore, based on the conservative AERSCREEN model, there would be no exceedances of the 1-hour NO₂, 1-hr CO or 8-hr CO ambient air quality standard by the combined operation of the 13 fuel cells comprising the Brookside Project.

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**Diamond State Electric Generation Partners, LLC (Bloom Energy)
Brookside 2.6 MW Fuel Cell Electric Generation Plant**

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AERSCREEN Modeling- SO₂ and VOC

An AERSCREEN model was performed by the Department for the remaining two pollutants VOCs and SO₂. The following input parameters were utilized for the model.

Table 4. Parameters the Department used as inputs into the AERSCREEN model. These parameters were provided in the application.

Parameter	Value	Notes
Source Height	6.75 ft	Top of fuel cell
Initial Sigma-Z	3.14 ft	Source height divided by 2.15
Source Area (ft ²)	54.35 ft ²	
Volume Source Length	7.35 ft	Assumes all sides equal (square root of source area)
Initial Sigma-Y	1.715 ft	Source height divided by 4.3
Distance to Fence	20 ft	Distance from source to property line

The AERSCREEN program was used to calculate the maximum downwind concentration at 20 feet (6.1 meters) from the source, which is the same distance as the property line from the source as given in the application.

Threshold limit value (TLV) for Hexane (VOC) came from the *2018 TLVs and BEIs* published by ACGIH. The VOC emissions were modeled as Hexane because vendor data provided the VOC emission rate as Hexane. Hexane is a constituent of natural gas that has the lowest TLV provided by ACGIH. Using the lowest TLV gives a more conservative model to ensure public health, safety, and welfare. The TLV for SO₂ was obtained from the Center for Disease Control and is the time weighted average (TWA) given from the National Institute for Occupational Safety and Health (NIOSH).

The effects of permitted emissions on the public health, safety and welfare were assessed using Department criteria. The criteria assume no adverse effect when the ratio of the threshold limit value to the maximum downwind concentration (TLV:MDC) is at least 100:1 at the nearest property boundary line and beyond for each air contaminant released. The MDC of each air contaminant was computed using the AERSCREEN air dispersion model.

Table 5: AERSCREEN data for maximum downwind concentration (MDC) and results of the Department criteria for the TLV:MDC ratio. Emissions meet the 100:1 TLV:MDC ratio and are therefore presumed to not have an adverse effect on the public.

Pollutant	Emission Rate (lbs/hr)(total)	TLV (mg/m ³)	MDC (mg/m ³)	TLV:MDC
VOC- Hexane	0.0413	176.23	0.059885	2,942
SO ₂	0.0003	5	0.000435	11,494

The TLV:MDC ratios are greater than the 100:1 criteria established by the Department at the nearest property line of 20 feet (6.1 meters) from the source. Therefore, the public health, safety and welfare are presumed to not be adversely impacted by the emissions.

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REGULATORY REVIEW

- **7 DE Admin. Code 1102:** Permits
- **7 DE Admin. Code 1114:** Visible Emissions
- **7 DE Admin. Code 1119:** Control of Odorous Air Contaminants
- **7 DE Admin. Code 1120:** New Source Performance Standards
- **7 DE Admin. Code 1124:** Control of Volatile Organic Compound Emissions
- **7 DE Admin. Code 1125:** Requirements for Preconstruction Review

7 DE Admin. Code 1102, *Permits*, requires equipment that have actual emissions to the atmosphere of any air contaminant(s) in the quantity of ten (10) pounds per day or more to be permitted. Combined emissions from all 13 cells, if operated as anticipated for 24 hrs per day, will emit approximately 2.2 lbs of pollutants per day, not including CO₂. CO₂ emissions are 43,680 lbs per day. Therefore, a **7 DE Admin. Code 1102** must be issued for the operation of this equipment.

7 DE Admin. Code 1103, *Ambient Air Quality Standards*, Compliance with the Ambient Air Quality Standards in **7 DE Admin. Code 1103** is demonstrated based on the AERSCREEN model results.

7 DE Admin. Code 1114, *Visible Emissions*, Section 2.1 states: "No person shall cause or allow the emission of visible air contaminants and/or smoke from a stationary or mobile source, the shade or appearance of which is greater than twenty (20%) percent opacity for an aggregate of more than three (3) minutes in any one (1) hour or more than fifteen (15) minutes in any twenty-four (24) hour period." This appears as Condition 2.2 of the attached permit. Based on the fuel used and the emissions calculated, no visible emissions are expected from this facility; therefore, the requirement to perform VE observations and recordkeeping to show compliance with this requirement was not included in the permit.

7 DE Admin. Code 1119, *Control of Odorous Air Contaminants*, states "No person shall cause or allow the emission of an odorous air contaminant such as to cause a condition of air pollution." The following is included as Condition 2.3 of the attached permit: "Odors from this source shall not be detectable beyond the plant property line in sufficient quantities such as to cause a condition of air pollution." Compliance is based upon the Company having no contradictory knowledge of any citizen odor complaint.

7 DE Admin. Code 1120, *New Source Performance Standards*, is not applicable to the facility as it is not one of the stationary sources specified in the regulation.

7 DE Admin. Code 1124, *Control of Volatile Organic Compound Emissions*, is not applicable to the facility. This regulation only applies to facilities that emit more than 15 lbs VOC/day. Based on the emission calculations, the facility will emit a maximum of 0.9912 lb VOC/day.

7 DE Admin. Code 1125, *Requirements for Preconstruction Review, Section 3 Prevention of Significant Deterioration (PSD)*, is not applicable to the facility. Under the PSD regulations, a source is classified as a major stationary source if it falls into one of the 28 source categories identified in Section 3.1 or, if it is not one of the 28 source categories but emits 250 tons per year of any criteria pollutant and/or 100,000 metric tons of tons of carbon dioxide equivalents CO₂e. Based on potential to emit calculations, the emissions of all criteria pollutants and CO₂ are below PSD applicability thresholds and therefore the requirements to perform dispersion modeling and BACT analysis are not applicable to the Brookside project.

7 DE Admin. Code 1125, *Requirements for Preconstruction Review, Section 4 Minor New Source Review*, is not applicable to the facility since the facility does not have the potential to emit any of the following pollutants in quantities greater than or equal to 5 tons per year: volatile organic compounds (VOC's), nitrogen oxides (NO_x), sulfur dioxide (SO₂), sulfur trioxide (SO₃) or both [also termed sulfur oxides (SO_x)],

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Brookside 2.6 MW Fuel Cell Electric Generation Plant

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fine particulate matter (PM_{2.5}), or any of the hazardous air pollutants (HAP's) listed in Section 112(b) of the federal Clean Air Act in the aggregate.

RECOMMENDATIONS

The application was advertised Sunday, November 11, 2018. Comments were received and a public hearing was held on January 10, 2019.

The proposed project and attached permit comply with all applicable zoning requirements and federal and state air pollution control laws and regulations. It is recommended that the attached **Permit: APC-2019/0032-CONSTRUCTION** be issued.

ADM:KAM

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Permit: APC-2019/0032-CONSTRUCTION

Diamond State Generation Partners, LLC (Bloom Energy)
2.6 MW Fuel Cell Electric Generation Plant
Brookside Facility
1299 Orleans Drive
Sunnyvale, CA 95014

ATTENTION: Mark Mesler
Vice President

Dear Mr. Mesler:

Pursuant to 7 **DE Admin. Code** 1102, Section 2, approval of the Department of Natural Resources and Environmental Control (the Department) is hereby granted for the construction of a 2.6 MW Fuel Cell Electric Generation Plant consisting of 13 Bloom Energy ES5-BABAAA fuel cells at the Brookside site, located at 512 E Chestnut Hill Rd, Newark, Delaware, in accordance with the application submitted on Form Nos. AQM-1, AQM-2, AQM-3.1, AQM-5, and AQM-6 dated October 23, 2018 signed by Mark Mesler, Vice President.

This permit is issued subject to the following conditions:

1. General Provisions

- 1.1 This permit expires on March 19, 2020. If the equipment covered by this permit will not be constructed by March 19, 2020 a request to extend this construction permit must be submitted by February 3, 2020.
- 1.2 The project shall be constructed in accordance with the application described above. If any changes are necessary, revised plans must be submitted and supplemental approval issued prior to actual construction.
- 1.3 Representatives of the Department may, at any reasonable time, inspect this facility.
- 1.4 This permit may not be transferred to another location or to another piece of equipment or process.
- 1.5 This permit may not be transferred to another person, owner, or operator unless the transfer has been approved in advance by the Department. Approval (or disapproval) of

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Diamond State Electric Generation Partners, LLC (Bloom Energy)

Brookside 2.6 MW Fuel Cell Electric Generation Plant

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the permit transfer will be provided by the Department in writing. A request for a permit transfer shall be received by the Department at least thirty (30) days before the date of the requested permit transfer. This request shall include:

- 1.5.1 Signed letters from each person stating the permit transfer is agreeable to each person; and
 - 1.5.2 An Applicant Background Information Questionnaire pursuant to 7 Del C, Chapter 79 if the person receiving the permit has not been issued any permits by the Department in the previous five (5) years.
- 1.6 The applicant shall, upon completion of the construction, installation, or alteration, request that the Department grant approval to operate.
- 1.6.1 A separate application to operate pursuant to 7 **DE Admin. Code** 1102 does not need to be submitted to the Department for the equipment or process covered by this construction permit. Upon a satisfactory demonstration by an on-site inspection that the equipment or process complies with all of the terms and conditions of this permit, the Department shall issue a 7 **DE Admin. Code** 1102 Operating Permit for this equipment or process.
 - 1.6.2 The applicant shall notify the Department sufficiently in advance of the demonstration and shall obtain the Department's prior concurrence of the operating factors, time period, and other pertinent details relating to the demonstration.
 - 1.6.3 The provisions of 7 **DE Admin. Code** 1102 Sections 2.1 and 11.3 shall not apply to the operation of equipment or processes for the purposes of initially demonstrating satisfactory performance to the Department following construction, installation, modification, or alteration of the equipment or processes.
- 1.7 The owner or operator shall not initiate construction, install, or alter any equipment or facility or air contaminant control device which will emit or prevent the emission of an air contaminant prior to submitting an application to the Department pursuant to 7 **DE Admin. Code** 1102, and, when applicable 7 **DE Admin. Code** 1125, and receiving approval of such application from the Department; except as exempted in 7 **DE Admin. Code** 1102 Section 2.2.

2. Emission Limitations

- 2.1 Air contaminant emission levels shall not exceed those specified in 7 **DE Admin. Code** 1100 and the following:
- 2.1.1 Nitrogen Oxide (NOx) Emissions
NOx emissions shall not exceed 0.0044 pounds per hour and 0.019 tons per twelve (12) month rolling period;
 - 2.1.2 Carbon Monoxide (CO) Emissions
CO emissions shall not exceed 0.0884 pounds per hour and 0.387 tons per twelve (12) month rolling period;

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Diamond State Electric Generation Partners, LLC (Bloom Energy)

Brookside 2.6 MW Fuel Cell Electric Generation Plant

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- 2.1.3 Volatile Organic Compounds (VOC) Emissions
VOC emissions shall not exceed 0.0413 pounds per hour and 0.181 tons per twelve (12) month rolling period;
- 2.1.4 Sulfur Dioxide (SO₂) Emissions
SO₂ emissions shall not exceed 0.0003 pounds per hour and 0.0012 tons per twelve (12) month rolling period;
- 2.1.5 Carbon Dioxide (CO₂) Emissions
CO₂ emissions shall not exceed 1,820 pounds per hour and 7,972 tons per twelve (12) month rolling period;
- 2.2 No person shall cause or allow the emission of visible air contaminants and/or smoke from a stationary or mobile source, the shade or appearance of which is greater than twenty (20%) percent opacity for an aggregate of more than three (3) minutes in any one (1) hour or more than fifteen (15) minutes in any twenty-four (24) hour period.
- 2.3 Odors from this source shall not be detectable beyond the plant property line in sufficient quantities such as to cause a condition of air pollution.

3. Operational Limitations

- 3.1 The owner or operator shall comply with the following operational limits:
 - 3.1.1 No more than 13 fuel cells shall be constructed at this location.
 - 3.1.2 Only natural gas shall be used as input fuel to the cells.
 - 3.1.3 Total hourly natural gas fuel consumption shall not exceed 0.0156 MMft³ per hour, determined on a monthly average.
 - 3.1.4 Total rolling twelve month natural gas fuel consumption shall not exceed 137 MMft³.
 - 3.1.5 The sulfur content of the natural gas shall not exceed 0.1 ppm after the fuel cells desulfurization beds.
 - 3.1.6 The desulfurization beds (filters) shall be operated and maintained according to manufacturer's recommendations and good engineering practices to ensure that the rate of removal of sulfur from the fuel cells does not result in emissions in excess of the rate contained in Condition 2.1.4 of this permit.
 - 3.1.7 Each fuel cell shall be rated at a maximum of 200 kW.
 - 3.1.8 At no time during the deployment of the upgrade will the natural gas consumption nor the emission limitations in **Permit: APC-2012/0052 – OPERATION** dated June 18, 2012 be exceeded.
 - 3.1.9 At no time during the deployment of the upgrade will the nameplate capacity in **Permit: APC-2012/0052 – OPERATION** dated June 18, 2012 be exceeded.

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Brookside 2.6 MW Fuel Cell Electric Generation Plant

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- 3.2 At all times, including periods of startup, shutdown, and malfunction, the owner or operator shall, to the extent practicable, maintain and operate the facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating procedures are being used will be based on information available to the Department which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.
- 3.3 All structural and mechanical components of the equipment or process covered by this Permit shall be maintained in proper operating condition.

4. Testing and Monitoring Requirements

- 4.1 The Department reserves the right to require that the owner or operator perform emission tests using methods approved in advance by the Department.

5. Record Keeping Requirements

- 5.1 The owner or operator shall maintain all records necessary for determining compliance with this permit in a readily accessible location for five (5) years and shall make these records available to the Department upon written or verbal request.
- 5.2 The following information shall be recorded, initialed and maintained by the owner or operator:
 - 5.2.1 records of daily, monthly, and annual natural gas fuel consumption by the fuel cells;
 - 5.2.2 records of the sulfur content of the natural gas utilized to operate the fuel cells;
 - 5.2.3 documentation that the desulfurization beds (filters) are operated and maintained according to the manufacturer's recommendations and good engineering practices;
 - 5.2.4 as-built drawings of the Brookside Project showing, at a minimum, the fuel cells, fuel lines, grid connection locations and any controls and monitoring equipment;
 - 5.2.5 documentation that the equipment is utilized and maintained according to manufacturer's recommendations;
 - 5.2.6 records of all routine and non-routine maintenance to the facility; and
 - 5.2.7 records of monthly emissions.
- 5.3 The rolling twelve (12) month total emissions shall be calculated and recorded each month in a log for each of the following pollutants:
 - 5.3.1 Nitrogen Oxide (NOx) Emissions;
 - 5.3.2 Carbon Monoxide (CO) Emissions;

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5.3.3 Volatile Organic Compound (VOC) Emissions;

5.3.4 Sulfur Dioxide (SO₂) Emissions; and

5.3.5 Carbon Dioxide (CO₂) Emissions.

6. Reporting Requirements

6.1 Emissions in excess of any permit condition or emissions which create a condition of air pollution shall be reported to the Department immediately upon discovery by calling the Environmental Emergency Notification and Complaint number, (800) 662-8802.

6.2 In addition to complying with Condition 6.1 of this permit, any reporting required by 7 DE **Admin. Code** 1203 "**Reporting of a Discharge of a Pollutant or an Air Contaminant**", and any other reporting requirements mandated by the State of Delaware, the owner or operator shall, for each occurrence of excess emissions, within thirty (30) calendar days of becoming aware of such occurrence, supply the Department in writing with the following information:

6.2.1 The name and location of the facility;

6.2.2 The subject source(s) that caused the excess emissions;

6.2.3 The time and date of the first observation of the excess emissions;

6.2.4 The cause and expected duration of the excess emissions;

6.2.5 For sources subject to numerical emission limitations, the estimated rate of emissions (expressed in the units of the applicable emission limitation) and the operating data and calculations used in determining the magnitude of the excess emissions; and

6.2.6 The proposed corrective actions and schedule to correct the conditions causing the excess emissions.

6.3 One original and one copy of all required reports shall be sent to the address below:

Division of Air Quality
State Street Commons
100 W. Water Street, Suite 6A
Dover, DE 19904

6.4 A monthly permit compliance report showing average daily, monthly, and rolling twelve (12) month gas consumption and electricity output, rolling twelve (12) month emissions data, and maintenance performed shall be submitted by the end of the following month.

6.5 The owner or operator shall notify the Department a minimum of 15-days prior to the implementation of any de-coking/Process Improvement Procedures (PIP's).

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**Diamond State Electric Generation Partners, LLC (Bloom Energy)
Brookside 2.6 MW Fuel Cell Electric Generation Plant**

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7. Administrative Conditions

- 7.1 This permit shall be made available on the premises.
- 7.2 Failure to comply with the provisions of this permit may be grounds for suspension or revocation.

Sincerely,

Angela D. Marconi, P.E., BCEE
Program Manager
Engineering & Compliance Branch

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pc: Dover File
Karen Mattio

MEMORANDUM

TO: Angela D. Marconi, P.E., BCEE *ADM*

FROM: Karen A. Mattio, P.E. *KAM*

**SUBJECT: Diamond State Generating Partners, LLC/Bloom Energy
Red Lion Fuel Cell Facility
Permit: APC-2019/0031-CONSTRUCTION
24.9 MW Fuel Cell Electric Generation Plant**

DATE: March 19, 2019

BACKGROUND INFORMATION

Diamond State Energy Partners, LLC/Bloom Energy requested a construction permit to install 52 Bloom Energy ES5-BABAAA 200 kW fuel cells (10.4 MW) and 58 ES5-AACAAA 250 kW fuel cells (14.5 MW) at an electric generation facility that will provide a total of 24.9 MW of power to the PJM electrical grid. According to the application, the fuel cells utilize solid oxide fuel cell (SOFC) technology to chemically convert the natural gas to electrical power in a non-combustion process. The cells will utilize pipeline quality natural gas.

- The Company has not requested confidentiality.
- The Red Lion Project is located in the Coastal Zone. A Coastal Zone permit was issued effective date April 30, 2012.
- The Company has paid appropriate construction application fees.
- The property is zoned HI for Heavy Industrial.

TECHNICAL INFORMATION

The fuel cells will be powered by natural gas which has a heating value of 1,030 BTU/ft³. According to the application 1,314 MMft³/yr of natural gas will be used at the facility.

Total volume of natural gas input:

$$\left(1,314 \frac{\text{MMft}^3}{\text{yr}}\right) \left(\frac{\text{yr}}{8,760 \text{ hr}}\right) \left(\frac{1,030 \text{ Btu}}{\text{ft}^3}\right) = 154.26 \frac{\text{MMBtu}}{\text{hr}}$$

Total output:

$$(200 \text{ kW} \times 52 \text{ fuel cells}) + (250 \text{ kW} \times 58 \text{ fuel cells}) = 24.9 \text{ MW}$$

Since 1 MMBTU/hr = 293.07 kW, 154.5 MMBTU/hr = 45,280 kW or 45 MW.

Emission calculations

Based on the application, the vendor (Bloom Energy) provided emissions in lbs/MWh based on stack test emission results for the same type of fuel cell unit, the ES5-200 Energy Saver Fuel Cell.

Example calculation for nitrogen oxides (NO_x):

200 kW Fuel Cell:

$$\begin{aligned} \left(0.0017 \frac{\text{lbs}}{\text{MWh}} \text{NO}_x\right) (10.4 \text{ MW}) &= 0.01768 \frac{\text{lbs}}{\text{hr}} \text{NO}_x \\ \left(0.01768 \frac{\text{lbs}}{\text{hr}} \text{NO}_x\right) \left(\frac{8760 \text{ hr}}{1 \text{ year}}\right) \left(\frac{1 \text{ ton}}{2000 \text{ lbs}}\right) &= 0.077 \text{ TPY NO}_x \end{aligned}$$

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Red Lion 24.9 MW Fuel Cell Electric Generation Plant

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250 kW Fuel Cell:

$$\begin{aligned} & \left(0.0017 \frac{\text{lbs}}{\text{MWh}} \text{NO}_x\right) (14.5 \text{ MW}) = 0.02465 \frac{\text{lbs}}{\text{hr}} \text{NO}_x \\ & \left(0.02465 \frac{\text{lbs}}{\text{hr}} \text{NO}_x\right) \left(\frac{8760 \text{ hr}}{1 \text{ year}}\right) \left(\frac{1 \text{ ton}}{2000 \text{ lbs}}\right) = 0.108 \text{ TPY NO}_x \end{aligned}$$

Total NOx emissions:

$$0.077 \text{ TPY NO}_x + 0.108 \text{ TPY NO}_x = 0.19 \text{ TPY NO}_x$$

The lowest sulfur content in natural gas that can be obtained in the State of Delaware is 2.00 grains per 100 standard cubic foot. According to the October 24, 2018 application, each Bloom Energy fuel cell has a desulfurization bed (filter) included in the fuel processing module. The sulfur dioxide (SO₂) emission factor of 0.0000102 lbs/MWh was used which is based on a conservative value of 0.1 ppm of sulfur after the fuel cell desulfurization beds which are used to remove the sulfur in natural gas prior to entering the fuel cells. Based on the information included with the application, desulfurization beds typically reduce sulfur in the fuel to less than 0.1 ppm in order to protect the catalysts and electrodes used in the fuel cell and fuel processor. However, credit was only taken to reduce the sulfur content to 0.1 ppm.

SO₂ emissions are based on natural gas (NG) sulfur content of 0.1 ppm after each of the fuel cells desulfurization beds and are calculated as follows:

200 kW Fuel Cell:

$$\left(0.06264 \frac{\text{MMft}^3}{\text{hr}} \text{NG}\right) \left(\frac{0.1 \text{ scf S}}{\text{MM ft}^3 \text{NG}}\right) \left(\frac{1 \text{ ft}^3 \text{SO}_2}{1 \text{ ft}^3 \text{S}}\right) \left(\frac{1 \text{ mol SO}_2}{385.3 \text{ ft}^3}\right) \left(\frac{64 \text{ lbs SO}_2}{1 \text{ mol SO}_2}\right) = 0.0010 \frac{\text{lbs}}{\text{hr}} \text{SO}_2$$

250 kW Fuel Cell:

$$\left(0.08734 \frac{\text{MMft}^3}{\text{hr}} \text{NG}\right) \left(\frac{0.1 \text{ scf S}}{\text{MM ft}^3 \text{NG}}\right) \left(\frac{1 \text{ ft}^3 \text{SO}_2}{1 \text{ ft}^3 \text{S}}\right) \left(\frac{1 \text{ mol SO}_2}{385.3 \text{ ft}^3}\right) \left(\frac{64 \text{ lbs SO}_2}{1 \text{ mol SO}_2}\right) = 0.0015 \frac{\text{lbs}}{\text{hr}} \text{SO}_2$$

Total SO₂ emissions:

$$0.0010 \frac{\text{lbs}}{\text{hr}} \text{SO}_2 + 0.0015 \frac{\text{lbs}}{\text{hr}} \text{SO}_2 = 0.0025 \frac{\text{lbs}}{\text{hr}} \text{SO}_2$$

CO₂e emissions were calculated as follows, with global warming potential (GWP) as defined in 7 DE Admin. Code 1125:

$$\begin{aligned} & \left[\left(76,343 \frac{\text{tons CO}_2}{\text{yr}}\right) \left(\frac{2,000 \text{ tons}}{2,204.6 \text{ tons}}\right) (1 \text{ GWP})\right] + \left[\left(1.73 \frac{\text{tons VOC (as CH}_4\text{)}}{\text{yr}}\right) \left(\frac{2,000 \text{ tons}}{2,204.6 \text{ tons}}\right) (25 \text{ GWP})\right] \\ & = 69,297 \text{ Metric TPY} \end{aligned}$$

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Red Lion 24.9 MW Fuel Cell Electric Generation Plant

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Table 1: Emission data for each pollutant associated with the facility. (All 110 Fuel Cells)

Pollutant	Vendor Emissions (lbs/MWh)	Total Hourly Emissions (lbs/hr)	Daily Emission Facility Wide (lbs/day)	Annual Total Facility Emissions (tons/yr)	Major Source Threshold (tons/yr)
NO _x	0.0017	0.042	1.01	0.19	25
CO	0.034	0.85	20.4	3.71	100
VOC ^[1]	0.016	0.40	9.6	1.73	25
SO ₂	0.000102	0.0025	0.06	0.011	100
CO ₂	700	17,430	418,320	76,343	100,000
CO _{2e}	700	17,438	418,512	69,291 MT/yr ^[2]	100,000 ^[2]

[1] VOC emission data provided by manufacturer is modeled as Hexane.

[2] Units = metric tons per year (2204.6 lbs=MT)

Table 2: Emission data broken down between the different types of fuel cells.

Pollutant	200 kW Fuel Cells (52 Fuel Cells) Hourly Emissions (lbs/hr)	250 kW Fuel Cells (58 Fuel Cells) Hourly Emissions (lbs/hr)	Total Hourly Emissions (lbs/hr)
NO _x	0.018	0.025	0.042
CO	0.35	0.49	0.85
VOC ^[1]	0.17	0.23	0.40
SO ₂	0.0010	0.0015	0.0025
CO ₂	7,280	10,150	17,430
CO _{2e}	7,283	10,155	17,438 ^[2]

[1] VOC emission data provided by manufacturer is modeled as Hexane.

[2] Units = metric tons per year (2204.6 lbs=MT)

AERSCREEN Modeling- NOx and CO

The Company performed air quality screening dispersion modeling to determine the ambient air quality impacts for comparison to the 1-hour 100 ppb (188 µg/m³) NO₂ NAAQS standard using the EPA's AERSCREEN model. CO emissions were also modeled using AERSCREEN and compared to the NAAQS 1-hour and 8-hour standard. The Company performed the models for NO₂ and CO and submitted a very detailed description of the site characterization, meteorological and background monitored data, model options, input and output parameters and procedures and submitted it, via email, on March 8, 2019. The Department required modeling submitted with the original application to be updated with recent meteorological data and appropriate footprint.

The Company used the tiered approach regarding modeling for demonstration of compliance with the 1-hr NO₂ NAAQS. Of the three tiers, the Company used the least conservative Tier 3, which is running the AERSCREEN model utilizing the OLM (Ozone Limiting Method).

The Red Lion Power Project consists of 110 individual fuel cells arranged in two distinct areas, Block 1 and Block 2. The eastern area (Block 1) consist of 32 ES5-BABAAA 200 kW fuel cells and 34 ES5-AACAAA 250 kW fuel cells and the western area (Block 2) consist of 20 ES5-BABAAA 200 kW fuel cells and 24 ES5-AACAAA 250 kW fuel cells. Each individual fuel cell is approximately 25.5'L x 8.5'W x 6.75'H. Emissions are exhausted through four 0.39' x 2.68' power module vents at the top of each 200 kW fuel cell and through five 0.39' x 2.68' module vents at the top of each 250 kW fuel cell. Each individual fuel cell utilizes approximately 1.24 MMBtu/hr of natural gas at full load to produce 200 kW of net power output or 1.55

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Red Lion 24.9 MW Fuel Cell Electric Generation Plant**

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MMBtu/hr of natural gas at full load to produce 250 kW of net power output. As part of the chemical reaction within the fuel cell, NOx is formed and emitted at a rate equivalent to 0.0017 lb/MWh. The maximum total hourly NOx emission rate from all 110 fuel cells combined is 0.042 lb/hr. Likewise CO is also formed as part of this chemical reaction and emitted at a rate equivalent to 0.034 lb/MWh. The maximum total hourly CO emission rate from all 110 fuel cells combined is 0.85 lb/hr.

The Company chose to model the fuel cells as a volume source. Volume source algorithms are valid for modeling releases from multiple vents and given the source characteristics of the fuel cell emissions, combined with the fact that they are arranged in blocks, the fuel cells were modeled as volume sources.

In order to model the combined emissions from the concurrent operations of all 110 fuel cells within AERSCREEN each of the two fuel cell blocks was modeled individually utilizing the center point of each block. Block 1 emissions were modeled as 66 fuel cells with a power output of 14.9 MW and Block 2 emissions were modeled as 44 fuel cells with a power output of 10 MW. Based on the physical alignment of the fuel cells the worst case wind direction will be one that blows parallel to the axis of the center points of the fuel cells such that the emissions from each are additive, generally NW - SE axis. Both wind direction conditions were modeled for each fuel cell block with distances from the center of the fuel cell block to the fence line adjusted based on the wind direction. For each wind direction the maximum predicted AERSCREEN short-term CO and NO₂ impacts, regardless of location, were added together for a total impact that is used for comparison with the NAAQS. The following input parameters were utilized for this model.

Table 3. Parameters the Company used as inputs into the AERSCREEN model for Block 1.

Volume Source Configuration – Block 1 (32 - 200 kW Fuel Cells, 34- 250 kW Fuel Cells)		
Parameter	Value	Notes
Source Height	6.75 ft	Top of fuel cell
Initial Sigma-Z	3.14 ft	Source height divided by 2.15
Source Area (ft ²)	311.47 ft ²	[32 Cells * 4 Power Modules * 0.39 ft* 2.68 ft]+[34 Cells * 5 Power Modules * 0.39 ft* 2.68 ft] = 311.47 ft ²
Volume Source Length	17.65 ft	Assumes all sides equal (square root of source area)
Initial Sigma-Y	4.1 ft	Source height divided by 4.3
Distance to Fence (NW Wind)	242 ft	From Center of Volume Source
Distance to Fence (SE Wind)	688 ft	From Center of Volume Source
NOx Emission Rate	0.0017 lb/MW-hr	Vendor Provided Data
	0.0255 lb/hr (total)	200 kW=0.2 MW 250 kW=0.25 MW 0.20 MW * 32= 6.4 MW 0.25 MW * 34= 8.5 MW [6.4 MW*0.0017 lb/MWh] + [8.5MW *0.0017 lb/MWh] =0.0255 lb/hr
CO Emission Rate	0.034 lb/MW-hr	Vendor Provided Data
	0.51 lb/hr (total)	[6.4 MW*0.034 lb/MWh] + [8.5 MW*0.034 lb/MWh] =0.51 lb/hr

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**Diamond State Generating Partners, LLC/Bloom Energy
Red Lion 24.9 MW Fuel Cell Electric Generation Plant**

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Table 4. Parameters the Company used as inputs into the AERSCREEN model for Block 2.

Volume Source Configuration – Block 2 (20 - 200 kW Fuel Cells, 24 - 250 kW Fuel Cells)		
Parameter	Value	Notes
Source Height	6.75 ft	Top of fuel cell
Initial Sigma-Z	3.14 ft	Source height divided by 2.15
Source Area (ft ²)	209.04 ft ²	[20 Cells * 4 Power Modules * 0.39 ft* 2.68 ft]+[24 Cells * 5 Power Modules * 0.39 ft* 2.68 ft] = 209.04 ft ²
Volume Source Length	14.46 ft	Assumes all sides equal (square root of source area)
Initial Sigma-Y	3.36 ft	Source height divided by 4.3
Distance to Fence (NW Wind)	735 ft	From Center of Volume Source
Distance to Fence (SE Wind)	193 ft	From Center of Volume Source
NOx Emission Rate	0.0017 lb/MW-hr	Vendor Provided Data
	0.017 lb/hr (total)	200 kW=0.2 MW 250 kW=0.25 MW 0.20 MW * 20=4 MW 0.25 MW * 24= 6 MW [4 MW*0.0017 lb/MWh] + [6 MW *0.0017 lb/MWh] =0.017 lb/hr
CO Emission Rate	0.034 lb/MW-hr	Vendor Provided Data
	0.34 lb/hr (total)	[4 MW*0.034 lb/MWh] + [6 MW*0.034 lb/MWh] =0.34 lb/hr

Meteorological data was imported from a site specific AERSURFACE file. Both NOx and CO background concentrations were obtained from the nearest EPA monitoring station at MLK Blvd. and Justison Street in Wilmington, located approximately 9.5 miles northeast of the project site, for the most recent 3-year period available (2015-2017). The impacts from Blocks 1 and 2 were added to give the "Max Impact". The results of the model are presented in Table 5.

Table 5. Results of the AERSCREEN model for NO₂ and CO provided in the application by the Company.

Northwest Wind Scenario						
Pollutant	Averaging Period	Max (Total Project) Impact (µg/m³)^[1]	Background (µg/m³)	Total Impact (Max + Background) (µg/m³)	NAAQS (µg/m³)	Exceeds NAAQS?
NO₂	1-hr	74.7	86.24 ^[3]	161	188	No
CO	1-hr	1,511	1,710 ^[4]	3,221	40,000	No
CO	8-hr	1,360 ^[2]	1,417 ^[5]	2,777	10,000	No

[1]Results of Blocks 1 and 2 added together.

[2] 90% of the 1 hour max result for CO.

[3] Average value for years 2015-2017. [89 µg/ m³ + 90.7 µg/ m³ + 79 µg/ m³] / 3

[4] Average value for years 2015-2017. [1,750 µg/ m³ + 1,810 µg/ m³ + 1,570 µg/ m³] / 3

[5] Average value for years 2015-2017. [1,400 µg/ m³ + 1,600 µg/ m³ + 1,250 µg/ m³] / 3

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The model results indicate that, based on the conservative AERSCREEN model, there would be no exceedances of the 1-hour NO₂, 1-hr CO, or 8-hr CO ambient air quality standard by the combined operation of the 110 fuel cells comprising the Red Lion Project and therefore no adverse impact to the public health, safety and welfare.

AERSCREEN modeling- SO₂ and VOCs

An AERSCREEN model was performed by the Department for the remaining two pollutants VOCs and SO₂. The input parameters given by the Company were utilized for the model.

The program was used to calculate the maximum downwind concentration at 242 feet (73.76 meters) from the source for Block 1 and 193 feet (58.83 meters) from the source for Block 2, which is the same distance as the property line from the source as given in the application.

Threshold limit value (TLV) for Hexane (VOC) came from the *2018 TLVs and BEIs* published by ACGIH. The VOC emissions were modeled as Hexane because vendor data provided the VOC emission rate as Hexane. Hexane is a constituent of natural gas that has the lowest TLV provided by ACGIH. Using the lowest TLV gives a more conservative model to ensure public health, safety, and welfare. The TLV for SO₂ was obtained from the Center for Disease Control and is the time weighted average (TWA) given from the National Institute for Occupational Safety and Health (NIOSH).

The effects of permitted emissions on the public health, safety and welfare were assessed using Department criteria. The criteria assume no adverse effect when the ratio of the threshold limit value to the maximum downwind concentration (TLV:MDC) is at least 100:1 at the nearest property boundary line and beyond for each air contaminant released. The MDC of each air contaminant was computed using the AERSCREEN air dispersion model.

Table 8: Block 1 AERSCREEN data for maximum downwind concentration (MDC) and results of the Department criteria for the TLV:MDC ratio. Emissions meet the 100:1 TLV:MDC ratio and are therefore presumed to not have an adverse effect on the public.

Pollutant	Emission Rate (lbs/hr)^[2]	TLV (mg/m³)	MDC (mg/m³)	TLV:MDC
VOC- Hexane	0.24	176.23	0.042048	4,191
SO ₂	0.00153	5	0.000268	18,652

Table 9: Block 2 AERSCREEN data for maximum downwind concentration (MDC) and results of the Department criteria for the TLV:MDC ratio. Emissions meet the 100:1 TLV:MDC ratio and are therefore presumed to not have an adverse effect on the public.

Pollutant	Emission Rate (lbs/hr)	TLV (mg/m³)	MDC (mg/m³)	TLV:MDC
VOC- Hexane	0.16	176.23	0.035392	4,979
SO ₂	0.00102	5	0.000226	22,160

The TLV:MDC ratios are greater than the 100:1 criteria established by the Department at the nearest property line of at 242 feet (73.76 meters) from the source for Block 1 and 193 feet (58.83 meters) from the source for Block 2 from the source. Therefore, the public health, safety and welfare are presumed to not be adversely impacted by the emissions.

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REGULATORY REVIEW

- **7 DE Admin. Code 1102:** Permits
- **7 DE Admin. Code 1103:** Ambient Air Quality Standards
- **7 DE Admin. Code 1108:** Sulfur Dioxide Emissions from Fuel Burning Equipment
- **7 DE Admin. Code 1114:** Visible Emissions
- **7 DE Admin. Code 1119:** Control of Odorous Air Contaminants
- **7 DE Admin. Code 1120:** New Source Performance Standards
- **7 DE Admin. Code 1124:** Control of Volatile Organic Compound Emissions
- **7 DE Admin. Code 1125:** Requirements for Preconstruction Review

7 DE Admin. Code 1102, *Permits*, requires equipment that have actual emissions to the atmosphere of any air contaminant(s) in the quantity of ten (10) pounds per day or more to be permitted. Combined emissions from all 110 cells, if operated as anticipated for 24 hrs per day, will emit over 10 lbs of pollutants per day. Therefore, a **7 DE Admin. Code 1102** must be issued for the operation of this equipment.

7 DE Admin. Code 1103, *Ambient Air Quality Standards*, Compliance with the Ambient Air Quality Standards in **7 DE Admin. Code 1103** is demonstrated based on the AERSCREEN model results.

7 DE Admin. Code 1114, *Visible Emissions*, Section 2.1 states: "No person shall cause or allow the emission of visible air contaminants and/or smoke from a stationary or mobile source, the shade or appearance of which is greater than twenty (20%) percent opacity for an aggregate of more than three (3) minutes in any one (1) hour or more than fifteen (15) minutes in any twenty-four (24) hour period. Based on the fuel used and the emissions calculated, no visible emissions are expected from this facility; therefore, the requirement to perform VE observations and recordkeeping to show compliance with this requirement was not included in the permit.

7 DE Admin. Code 1119, *Control of Odorous Air Contaminants*, states "No person shall cause or allow the emission of an odorous air contaminant such as to cause a condition of air pollution." Compliance is based upon the Company having no contradictory knowledge of any citizen odor complaint.

7 DE Admin. Code 1120, *New Source Performance Standards*, is not applicable to the facility as it is not one of the stationary sources specified in the regulation.

7 DE Admin. Code 1124, *Control of Volatile Organic Compound Emissions*, is not applicable to the facility. This regulation only applies to facilities that emit more than 15 lbs VOC/day. Based on the emission calculations, the facility will emit a maximum of 9.6 lb VOC/day.

7 DE Admin. Code 1125, *Requirements for Preconstruction Review, Section 3 Prevention of Significant Deterioration (PSD)*, is not applicable to the facility. Under the PSD regulations, a source is classified as a major stationary source if it falls into one of the 28 source categories identified in Section 3.1 or, if it is not one of the 28 source categories but emits 250 tons per year of any criteria pollutant and/or 100,000 tons of CO₂. Based on potential to emit calculations, the emissions of all criteria pollutants, including CO₂, are below the PSD applicability threshold and therefore the requirements to perform dispersion modeling and BACT analysis are not applicable to the Red Lion project.

The CO_{2e} PTE of 69,291 metric tons is the total for all 110 cells. Although there is no specific restriction in the permit on CO₂ emissions, which is not a regulated pollutant, the permit restricts the facility to 110 cells; therefore imposing an indirect restriction on CO₂ emissions and allowing this site to remain below the 100,000 ton threshold that would trigger PSD.

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7 DE Admin. Code 1125, *Requirements for Preconstruction Review, Section 4 Minor New Source Review*, is not applicable to the facility since the facility does not have the potential to emit any of the following pollutants in quantities greater than or equal to 5 tons per year: volatile organic compounds (VOC's), nitrogen oxides (NOx), sulfur dioxide (SO₂), sulfur trioxide (SO₃) or both [also termed sulfur oxides (SOx)], fine particulate matter (PM_{2.5}), or any of the hazardous air pollutants (HAP's) listed in Section 112(b) of the federal Clean Air Act in the aggregate.

RECOMMENDATIONS

The application was advertised Sunday, November 11, 2018. Comments were received and a public hearing was held on January 10, 2019.

The proposed project and attached permit comply with all applicable zoning requirements and federal and state air pollution control laws and regulations. It is recommended that the attached **Permit: APC-2019/0031-CONSTRUCTION** be issued.

ADM:KAM

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pc: Dover File

Permit: APC-2019/0031-CONSTRUCTION

Diamond State Generating Partners, LLC (Bloom Energy)
24.9 MW Fuel Cell Electric Generation Plant
Red Lion Facility
1299 Orleans Drive
Sunnyvale, CA 95014

ATTENTION: Mark Mesler
Vice President

Dear Mr. Mesler:

Pursuant to 7 **DE Admin. Code** 1102, Section 2, approval of the Department of Natural Resources and Environmental Control (the Department) is hereby granted for the construction of a 24.9 MW Fuel Cell Electric Generation Plant consisting of 52 Bloom Energy ES5-BABAAA 200 kW fuel cells and 58 ES5-AACAAA 250 kW fuel cells located at the 1593 River Road in New Castle, Delaware, in accordance with the application submitted on Form Nos. AQM-1, AQM-2, AQM-3.1, AQM-5, and AQM-6 dated October 23, 2018 signed by Mark Mesler, Vice President.

This permit is issued subject to the following conditions:

1. General Provisions

- 1.1 This permit expires on March 19, 2020. If the equipment covered by this permit will not be constructed by March 19, 2020 a request to extend this construction permit must be submitted by February 3, 2020.
- 1.2 The project shall be constructed in accordance with the application described above. If any changes are necessary, revised plans must be submitted and supplemental approval issued prior to actual construction.
- 1.3 Representatives of the Department may, at any reasonable time, inspect this facility.
- 1.4 This permit may not be transferred to another location or to another piece of equipment or process.
- 1.5 This permit may not be transferred to another person, owner, or operator unless the transfer has been approved in advance by the Department. Approval (or disapproval) of

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the permit transfer will be provided by the Department in writing. A request for a permit transfer shall be received by the Department at least thirty (30) days before the date of the requested permit transfer. This request shall include:

- 1.5.1 Signed letters from each person stating the permit transfer is agreeable to each person; and
 - 1.5.2 An Applicant Background Information Questionnaire pursuant to 7 Del C, Chapter 79 if the person receiving the permit has not been issued any permits by the Department in the previous five (5) years.
- 1.6 The applicant shall, upon completion of the construction, installation, or alteration, request that the Department grant approval to operate.
- 1.6.1 A separate application to operate pursuant to 7 **DE Admin. Code** 1102 does not need to be submitted to the Department for the equipment or process covered by this construction permit. Upon a satisfactory demonstration by an on-site inspection that the equipment or process complies with all of the terms and conditions of this permit, the Department shall issue a 7 **DE Admin. Code** 1102 Operating Permit for this equipment or process.
 - 1.6.2 The applicant shall notify the Department sufficiently in advance of the demonstration and shall obtain the Department's prior concurrence of the operating factors, time period, and other pertinent details relating to the demonstration.
 - 1.6.3 The provisions of 7 **DE Admin. Code** 1102 Sections 2.1 and 11.3 shall not apply to the operation of equipment or processes for the purposes of initially demonstrating satisfactory performance to the Department following construction, installation, modification, or alteration of the equipment or processes.
- 1.7 The owner or operator shall not initiate construction, install, or alter any equipment or facility or air contaminant control device which will emit or prevent the emission of an air contaminant prior to submitting an application to the Department pursuant to 7 **DE Admin. Code** 1102, and, when applicable 7 **DE Admin. Code** 1125, and receiving approval of such application from the Department; except as exempted in 7 **DE Admin. Code** 1102 Section 2.2.

2. Emission Limitations

- 2.1 Air contaminant emission levels shall not exceed those specified in 7 **DE Admin. Code** 1100 and the following:
 - 2.1.1 Nitrogen Oxide (NOx) Emissions
NOx emissions shall not exceed 0.042 pounds per hour and 0.19 tons per twelve (12) month rolling period;
 - 2.1.2 Carbon Monoxide (CO) Emissions
CO emissions shall not exceed 0.85 pounds per hour and 3.71 tons per twelve (12) month rolling period;

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- 2.1.3 Volatile Organic Compounds (VOC) Emissions
VOC emissions shall not exceed 0.40 pounds per hour and 1.73 tons per twelve (12) month rolling period;
- 2.1.4 Sulfur Dioxide (SO₂) Emissions
SO₂ emissions shall not exceed 0.0025 pounds per hour and 0.011 tons per twelve (12) month rolling period;
- 2.1.5 Carbon Dioxide (CO₂) Emissions
CO₂ emissions shall not exceed 17,430 pounds per hour and 76,343 tons per twelve (12) month rolling period;
- 2.2 No person shall cause or allow the emission of visible air contaminants and/or smoke from a stationary or mobile source, the shade or appearance of which is greater than twenty (20%) percent opacity for an aggregate of more than three (3) minutes in any one (1) hour or more than fifteen (15) minutes in any twenty-four (24) hour period.
- 2.3 Odors from this source shall not be detectable beyond the plant property line in sufficient quantities such as to cause a condition of air pollution.

3. Operational Limitations

- 3.1 The owner or operator shall comply with the following operational limits:
 - 3.1.1 No more than 52 Bloom Energy ES5-BABAAA 200 kW fuel cells and 58 ES5-AACAAA 250 kW fuel cells shall be constructed at this location.
 - 3.1.2 Only natural gas shall be used as input fuel to the cells.
 - 3.1.3 Total hourly natural gas fuel consumption shall not exceed 0.1498 MMft³ per hour, determined on a monthly average.
 - 3.1.4 Total rolling twelve month natural gas fuel consumption shall not exceed 1,312 MMft³.
 - 3.1.5 The sulfur content of the natural gas shall not exceed 0.1 ppm after the fuel cells desulfurization beds.
 - 3.1.6 Each fuel cell shall only be rated at either 200 kW or 250 kW.
 - 3.1.7 The desulfurization beds (filters) shall be operated and maintained according to manufacturer's recommendations and good engineering practices to ensure that the rate of removal of sulfur from the fuel cells does not result in emissions in excess of the rate contained in Condition 2.1.4 of this permit.
 - 3.1.8 At no time during the deployment of the upgrade will the natural gas consumption nor the emission limitations in **Permit: APC-2012/0013 – OPERATION (Amendment 6)** dated July 14, 2014 be exceeded.

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3.1.9 At no time during the deployment of the upgrade will the nameplate capacity in **Permit: APC-2012/0013 – OPERATION (Amendment 6)** dated July 14, 2014 be exceeded.

3.2 At all times, including periods of startup, shutdown, and malfunction, the owner or operator shall, to the extent practicable, maintain and operate the facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating procedures are being used will be based on information available to the Department which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

3.3 All structural and mechanical components of the equipment or process covered by this Permit shall be maintained in proper operating condition.

4. Testing and Monitoring Requirements

4.1 The Department reserves the right to require that the owner or operator perform emission tests using methods approved in advance by the Department.

5. Record Keeping Requirements

5.1 The owner or operator shall maintain all records necessary for determining compliance with this permit in a readily accessible location for five (5) years and shall make these records available to the Department upon written or verbal request.

5.2 The following information shall be recorded, initialed and maintained by the owner or operator:

5.2.1 records of daily, monthly, and annual natural gas fuel consumption by the fuel cells;

5.2.2 records of the sulfur content of the natural gas utilized to operate the fuel cells;

5.2.3 documentation that the desulfurization beds (filters) are operated and maintained according to manufacturer's recommendations and good engineering practices;

5.2.4 as-built drawings of the Red Lion Project showing, at a minimum, the fuel cells, fuel lines, grid connection locations and any controls and monitoring equipment;

5.2.5 documentation that the equipment is utilized and maintained according to manufacturer's recommendations;

5.2.6 records of all routine and non-routine maintenance to the facility; and

5.2.7 records of monthly emissions.

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- 5.3 The rolling twelve (12) month total emissions shall be calculated and recorded each month in a log for each of the following pollutants.
- 5.3.1 Nitrogen Oxide (NO_x) Emissions;
 - 5.3.2 Carbon Monoxide (CO) Emissions;
 - 5.3.3 Volatile Organic Compounds (VOC) Emissions;
 - 5.3.4 Sulfur Dioxide (SO₂) Emissions; and
 - 5.3.5 Carbon Dioxide (CO₂) Emissions.

6. Reporting Requirements

- 6.1 Emissions in excess of any permit condition or emissions which create a condition of air pollution shall be reported to the Department immediately upon discovery by calling the Environmental Emergency Notification and Complaint number, (800) 662-8802.
- 6.2 In addition to complying with Condition 6.1 of this permit, any reporting required by 7 **DE Admin. Code 1203 "Reporting of a Discharge of a Pollutant or an Air Contaminant"**, and any other reporting requirements mandated by the State of Delaware, the owner or operator shall, for each occurrence of excess emissions, within thirty (30) calendar days of becoming aware of such occurrence, supply the Department in writing with the following information:
- 6.2.1 The name and location of the facility;
 - 6.2.2 The subject source(s) that caused the excess emissions;
 - 6.2.3 The time and date of the first observation of the excess emissions;
 - 6.2.4 The cause and expected duration of the excess emissions;
 - 6.2.5 For sources subject to numerical emission limitations, the estimated rate of emissions (expressed in the units of the applicable emission limitation) and the operating data and calculations used in determining the magnitude of the excess emissions; and
 - 6.2.6 The proposed corrective actions and schedule to correct the conditions causing the excess emissions.
- 6.3 One original and one copy of all required reports shall be sent to the address below:

Division of Air Quality
State Street Commons
100 W. Water Street, Suite 6A
Dover, DE 19904

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- 6.4 A monthly permit compliance report showing average daily, monthly, and rolling twelve (12) month gas consumption and electricity output, rolling twelve (12) month emissions data, and maintenance performed shall be submitted by the end of the following month.
- 6.5 The owner or operator shall notify the Department a minimum of 15-days disclosure prior to the implementation of any de-coking/Process Improvement Procedures (PIP's).

7. Administrative Conditions

- 7.1 This permit shall be made available on the premises.
- 7.2 Failure to comply with the provisions of this permit may be grounds for suspension or revocation.

Sincerely,

Angela D. Marconi, P.E.
Program Manager
Engineering & Compliance Branch

ADM:KAM
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pc: Dover File
Karen Mattio