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August 18, 2021

Melanie A. Bachman, Esq.
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Petition 1406A - Responses to CSC Interrogatories (Set 2)

Dear Ms. Bachman:

NuPower Bridgeport FC, LLC ("NuPower") hereby submits to the Connecticut Siting Council ("Council") its responses to the Council's July 29, 2021 interrogatories (Set 2).

Given that the Council has waived all hard copy filing requirements as part of its response to the COVID-19 pandemic, by this letter, NuPower submits to the Council an electronic copy of its responses. A hard copy of the responses will be mailed to the Council.

Should you have any questions regarding this filing, please do not hesitate to contact me.

Very truly yours,

Bruce L. McDermott

Enclosure

Interrogatory CSC-21

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-21: Can the building be designed into an L shape with 2-story and 3-story sections so that the 2-story section faces Iranistan Avenue?

A-CSC-21: The L shape approach was reviewed early in the design process. The approach was not utilized because of inefficiency of the fuel cell layout when allowing for overhaul space, storm water detention capacity for the site and maintaining safe distances from the 15 kV power line on the adjacent pole line.

Interrogatory CSC-22

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-22: During the desulfurization process, is benzene also removed? If so, would the spent solid waste need to be tested for the presence of benzene and potential characterization as D018 hazardous waste if present in an amount exceeding regulatory criteria?

A-CSC-22: Benzene is removed during the fuel cell's operation through the use of a catalyst. The Doosan Model 400 fuel cells combine the benzene and catalyst within the fuel processing system. This process converts the benzene into its basic components of carbon and hydrogen. The clean catalyst is then recovered in the fuel cell's reformer section and reused in the fuel processing system.

Interrogatory CSC-23

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-23: Do the start-up/re-start of the system require auxiliary processes to heat the fuel cells to required operating temperatures?

A-CSC-23: The fuel cells use electrical power to heat the fuel processing system for approximately 3 to 5 hours during initial startup. Once started, the fuel cell uses no external power.

Interrogatory CSC-24

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-24: Does ambient humidity negatively affect fuel cell operation? If so, how is humidity negated to mitigate any potential impacts?

A-CSC-24: The fuel cells are not affected by humidity as the interior is always operating above dew point.

Interrogatory CSC-25

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-25: Referring to Petition p. 8, provide the structure height in relation to the highway elevation.

A-CSC-25: The top of the highway concrete barrier is at an approximate elevation of 60 feet. The top of the cooling modules is at an approximate elevation of 71 feet.

Interrogatory CSC-26

NuPower Bridgeport FC, LLC

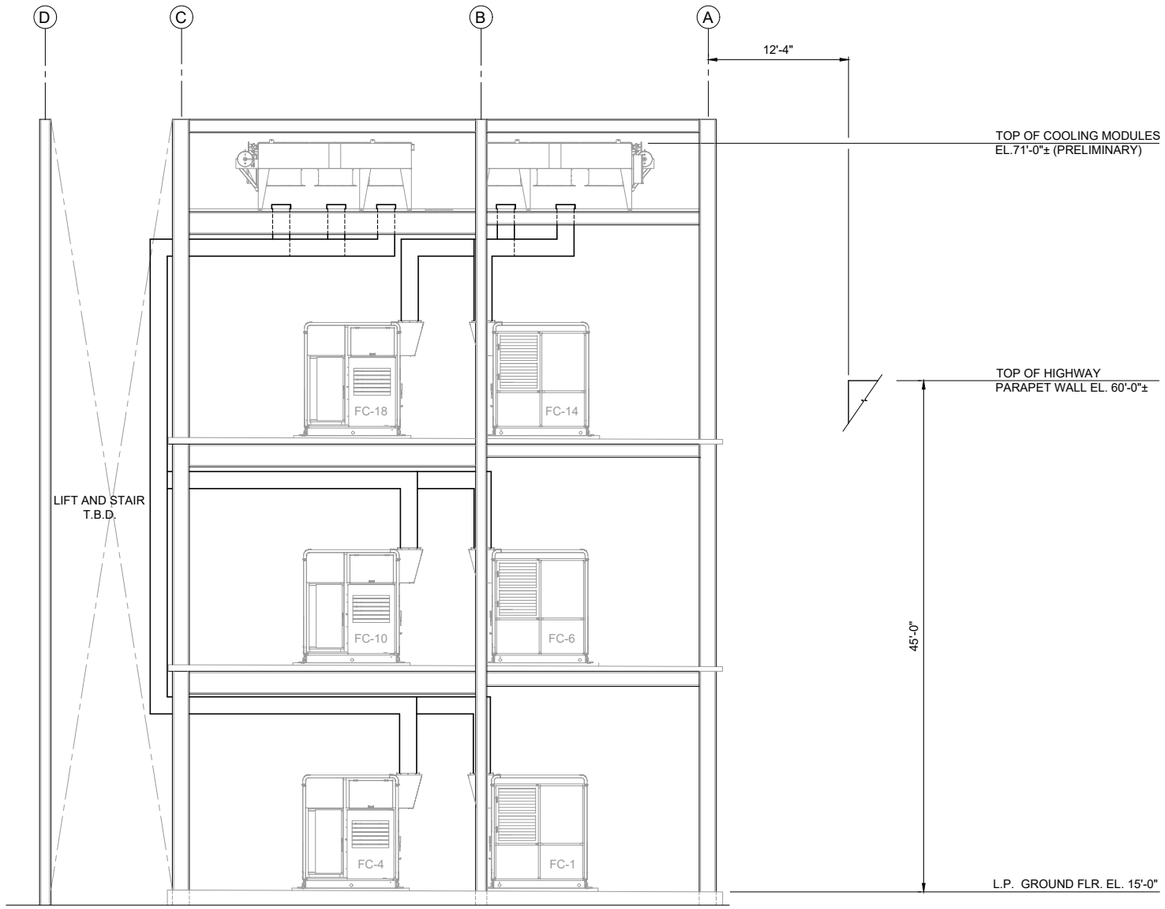
Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-26: Provide a rendering of the building in relation to the highway that includes the positioning of the exhaust vents.

A-CSC-26: See Attachment CSC-26-1.

Petition 1406A
Attachment CSC-26-1



ELEVATION ALONG COLUMN LINE "1" (LOOKING EAST)

30% DESIGN DEVELOPMENT
NOT FOR CONSTRUCTION

NOT TO SCALE

Rev.	Date	Description
A	08/18/21	SITING COUNCIL SKETCH

419A Whitfield Street
Guilford, CT 06437
Phone:(203)453-8596
Email: info@icdsllc.com
ICDS
Innovative Construction & Design Solutions, LLC

BRIDGEPORT 9.66MW FUEL CELL
600 IRANISTAN AVE. BPT., CT

PRELIMINARY ELEVATION

Project No.:	Drawn By: KFH
Date: 08/18/21	Design By: KFH
Scale: N.T.S.	Check By: DSF

Drawing No.:
SK-1

Interrogatory CSC-27

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-27: Referring to Petition p. 10, explain what is meant by “extremely small emission levels”.

A-CSC-27: In comparison to other electric generating facilities in Connecticut that operate around the clock, the air emissions resulting from the operation of the proposed fuel cells will be significantly lower. Furthermore, for some pollutants, the emissions will be so low (e.g., less than 0.01 tons per year) that they will be considered negligible. Please refer to table 1 on page 17 of the Petition for conservative estimates of the expected emissions.

Interrogatory CSC-28

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-28: Referring to Petition p. 10- Project Benefits, explain how the project will "upgrade grid infrastructure" and "contribute to grid stability".

A-CSC-28: The state's electric infrastructure is aging, and it is being pushed to do more than it was originally designed to do. For this reason, efforts have been underway to harden grid infrastructure and maintain grid stability, thereby ensuring access to reliable and resilient power. Unlike other renewable energy sources that are significantly impacted by daily changes, seasonal variations and/or weather patterns, fuel cells, such as the ones proposed, are capable of meeting user demand by consistently providing power. The always-on nature of fuel cells offers reliable power that can fill the gap of intermittent operation from other renewable technologies. As seen with the recently constructed microgrid projects, fuel cells are known to be a stable source of power during grid outages which have become more common during the past few years. Furthermore, as distributed energy sources, the proposed fuel cells will help reduce the load on transmission lines, increase energy efficiency and improve grid resiliency, among others. Thus, the proposed fuel cells will contribute to the development of a stable, balanced energy grid.

Interrogatory CSC-29

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-29: Petition p 17, Table 1 indicates project emission of CO2 at 45,465 tpy. Petition Attachment F indicates 38,026 MT. Please explain the difference.

A-CSC-29: Table 1 on page 17 of the Petition lists conservative estimates of the expected emissions. NuPower will now be installing Doosan's most recent production fuel cell system which has less CO_2 emissions than the previous model. As indicated in Attachment F, annual CO_2 emissions from the new model is 38,026 metric tons (or 41,916 US tons). Therefore, the new model emits 3,549 tons per year less CO_2 than the value presented in Table 1.

Q-CSC-30: Petition p. 12 indicates "the Project is able to operate on 100% hydrogen fuel rather than the current natural gas supply. This will permit the Project to participate in the coming hydrogen economy over its 20-year life and further reduce greenhouse gas emissions." How will the hydrogen be delivered to the project?

A-CSC-30: There is planning and review underway for the use of existing natural gas pipelines to deliver hydrogen to a variety of end users. One of the goals of the *Infrastructure Investment and Jobs Act* ("Act"), recently approved by the Senate, is to advance the delivery of hydrogen or hydrogen-carrier fuel by means of retrofitting the existing natural gas transportation infrastructure system, among others.[1] Furthermore, according to a 2019 GE report on the use of hydrogen for power generation, natural gas turbines are capable of operating on a wide variety of fuels, including fuels with low, moderate, and high levels of hydrogen and are considered a key element of any future power to hydrogen ecosystem.[2] These turbines can be easily retrofitted to use hydrogen, thereby creating a large demand for hydrogen transportation infrastructure which will also benefit the hydrogen-based fuel cells. Given that Bridgeport has two large natural gas power plants of approximately 500 MW each, there will be an incentive to transport hydrogen to the region and/or create a hydrogen regional hub, which would allow for the use of hydrogen by many electric generating sources. Additionally, it should be noted that the delivery of blends of hydrogen and methane by pipeline can be traced back to the times when "manufactured gas" was produced from coal, a blend of fuel that remains in use in some urban areas of Honolulu, Hawaii. According to the US,

[1] One of the goals of the Infrastructure Investment and Jobs Act ("Act") is the establishment of a *Clean Hydrogen Research and Development Program* and in carrying out this program, Congress urges the Secretary of Transportation, along with the private sector, to conduct activities in advance and support of "the safe and efficient delivery of hydrogen or hydrogen-carrier fuels, including - (A) transmission by pipelines, including retrofitting the existing natural gas transportation infrastructure system to enable a transition to transport and deliver increasing levels of clean hydrogen, clean hydrogen blends, or clean hydrogen carriers." Section 40313 of the Act.

[2] See *Power to Gas: Hydrogen for Power Generation Fuel Flexible Gas Turbine as Enablers for a Low or Reduced Carbon Energy Ecosystem*, GEA 336861, February 2019, Dr. Jeffrey Goldmeer (Retrieved from https://www.ge.com/content/dam/gepower/global/en_US/documents/fuel-flexibility/GEA33861%20Power%20to%20Gas%20-%20Hydrogen%20for%20Power%20Generation.pdf)

Department of Energy, approximately 1,600 miles of hydrogen pipelines are currently operating in the United States.[3] For these reasons, in addition to the eight (8) billion dollars that the Act will allocate to the development of four regional hydrogen hubs[4], there is market interest in the production fuel cells that are capable of operating with hydrogen or hydrogen blends of fuel.

[3] *Hydrogen Pipelines - Hydrogen and Fuel Cell Technologies Offices*, U.S. Department of Energy (Retrieved from https://www.energy.gov/eere/fuelcells/hydrogen-pipelines).

[4] Additionally, the Act also seeks the establishment of a program to support the development of at least four *Regional Clean Hydrogen Hubs* that among others "demonstrate the production, processing, delivery, storage, and end-use of clean hydrogen" and "can be developed into a national clean hydrogen network to facilitate a clean hydrogen economy." Eight (8) billion dollars will be appropriated to the Secretary of Transportation to carry out this program. Section 40314 of the Act.

Interrogatory CSC-31

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola and Dave Flanaghan

Petition No. 1406A

Q-CSC-31: Referring to the response to Council interrogatory 9 - provide a table with projected sound levels at each measurement location with noise values before and after acoustic mitigation and with allowable daytime and nighttime noise limits.

A-CSC-31: See Attachment CSC-31-1.

Table 1. NuPower Expected Overall Sound Pressure Levels, in dBA ref. 20 microPascals

Location	Height in feet	Untreated	Treated	Day Limit	Night Limit	Zoning
P5 – 571 Iranistan Ave	5	69.9	67.5	70	70	Industrial
P5 – 571 Iranistan Ave	15	70.7	68.3	70	70	Industrial
P5 – 571 Iranistan Ave	25	**71.4**	69.0	70	70	Industrial
P6 – 478 Iranistan Ave	5	**65.1**	61.6	62*	62*	Residential
P3 – 756 Railroad Ave	5	**67.9**	54.2	61	61*	Residential
P3 – 756 Railroad Ave	15	**68.5**	57.3	61	61*	Residential
P3 – 756 Railroad Ave	25	**68.9**	58.7	61	61*	Residential
P9 – Garden & Railroad	5	57.6	57.6	63*	63*	Residential
P9 – Garden & Railroad	15	57.9	57.9	63*	63*	Residential
P10 - 753 South Avenue	5	57.8	54.3	61	58*	Residential
P10 - 753 South Avenue	15	**58.1**	54.7	61	58*	Residential
P11 – 270 Black Rock	5	**61.0**	50.1	61	51	Residential
P11 – 270 Black Rock	15	**61.3**	50.7	61	51	Residential
P11 – 270 Black Rock	25	**61.6**	**51.4**	61	51	Residential

- * Noise limit set at 5 dB higher than the lowest measured street background
- **Red** indicates locations estimated to be above the noise requirement
- Assumes 4th floor treated on north and south sides as well as solid walls on the north side of floors 2 and 3

References:

Bridgeport New Power Twenty-One Fuel Cells Airborne Noise Assessment At 600 Iranistan Avenue, Carl Cascio, April 28, 2020

Bridgeport New Power Twenty-One Fuel Cells Airborne Noise Recommendations At 600 Iranistan Avenue, Carl Cascio, April 30, 2020

Interrogatory CSC-32

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola, Dave Flanaghan, and Trinity Consultants

Petition No. 1406A

Q-CSC-32: Petition p. 22 states dry heated air provided by the dry air-coolers will serve to mix with the exhaust gas to evaporate fog-like water vapor plumes. Provide additional information as to how this process occurs.

A-CSC-32: The exhaust will be directly ducted to the intake side of the cooling modules where it will be diluted by up to 67,283,128 CFM of warm dry air and dispersed over a wide area reducing or eliminating the likelihood of a vapor plume. The CALPUFF FOG model, which was used by Trinity to analyze the potential of fogging and summarized in Trinity's March 24, 2021 report did not reflect mixing the exhaust with high velocity, hot air from the cooling modules. However, subsequent to the Trinity report being issued, it has been determined that it is possible to duct the exhaust to the cooling module intakes. Trinity has concluded that mixing the original exhaust with dry air of the cooling modules will result in exhausts with significantly lower water vapor concentration and increased exit velocity. These changes are expected to reduce the overall plume-induced fog and icing events as originally modeled by lowering the water vapor concentration in the exhaust as it enters the atmosphere. The March 24th report results, which forecast slight annual increases in fog, would be further reduced or eliminated.

Interrogatory CSC-33

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola, Dave Flanaghan, and Trinity Consultants

Petition No. 1406A

Q-CSC-33: Petition p. 22 states that during 2016-2020, the modeled plume-induced conditions produced only one hour of icing conditions and three total hours of fog over the five-year period. Is there methodology to forecast when a plume or icing condition will occur in real time? If so, could the unit be shut down to avoid such a situation?

A-CSC-33: The model uses five years of observed hourly meteorological data to statistically predict the probability of occurrence of natural and plume-induced fogging and icing. While hourly forecasts of meteorological parameters that could be useful in predicting plume-induced fogging or icing are possible, such precise forecasts of short-term changes in meteorological conditions remain challenging, and publicly available forecasts may not provide the necessary precision to make predictions for a particular event consistently reliable. Observations of past actual weather are used in the model rather than forecasts for the reason that observations of weather are more reliable than forecasts. Additionally, operational challenges are present with rapid shut down and re-start of operations based on short term weather forecasts.

Interrogatory CSC-34

NuPower Bridgeport FC, LLC

Witnesses: Walter Bonola, Dave Flanaghan, and Trinity Consultants

Petition No. 1406A

Q-CSC-34: Referring to Petition Attachment B- Trinity Consultants Fogging/Icing Analysis;

a. P. 22, was the plume-induced fog concurrent with the background fog or was it an independent event?

b. Table 3, why are the number of events for 2016 and 2017 low when compared to 2018, 2019, and 2020?

c. Has there been any exhaust plume modeling to determine the direction of the plume and the areas affected by the plume?

A-CSC-34: a. Natural fog occurs when the atmospheric temperature approaches the dewpoint (i.e., 100% relative humidity) and winds are light. Plume induced fog occurs when the temperature is close to the dewpoint, but water in the plume increases the dewpoint such that 100% relative humidity is achieved. The model results show natural and plume-induced fog as independent events. However, based on the atmospheric conditions that lead to ground-level fog (i.e., temperatures at or very near the dewpoint) for both natural and plume-induced events, a plume-induced fog event is more likely under similar meteorological conditions when natural fog would be expected to form.

b. The number of events differ year over year depending on the specific combination of variables in the meteorological data. Actual hourly meteorological data from a representative observation station are used for the modeled years. Every meteorological year has a unique set of wind directions, temperatures, humidity, etc., therefore, a different number of events are modeled for each year.

c. The data points for the plume modeling only cover the area of I-95 near the facility as this area was expected to be of concern if a large number of events were modeled. Modeling five years of meteorological data is intended to account for the expected distribution of meteorological conditions, including wind direction, that could be conducive to plume induced ice or fog formation on the roadway.