STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

PETITION OF HYAXIOM, INC. FOR A DECLARATORY RULING FOR THE LOCATION AND CONSTRUCTION OF A 4.939 MEGAWATT FUEL CELL GRID-SIDE DISTRIBUTED ENERGY RESOURCE AT 540 LONG BROOK AVE, STRATFORD, CONNECTICUT	:	PETITION NO.

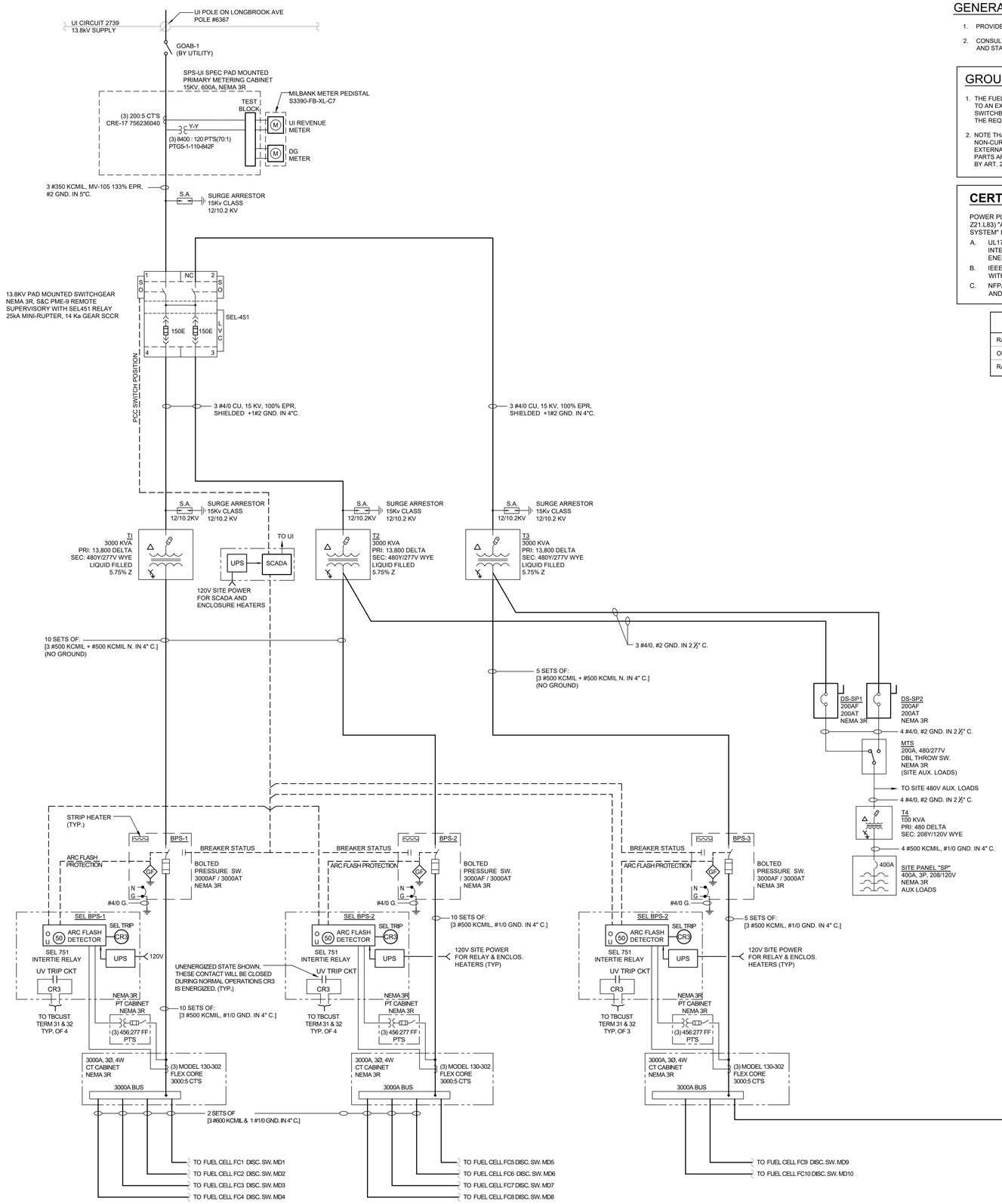
PETITION OF HYAXIOM, INC. AS AN OWNER/OPERATOR
FOR A DECLARATORY RULING

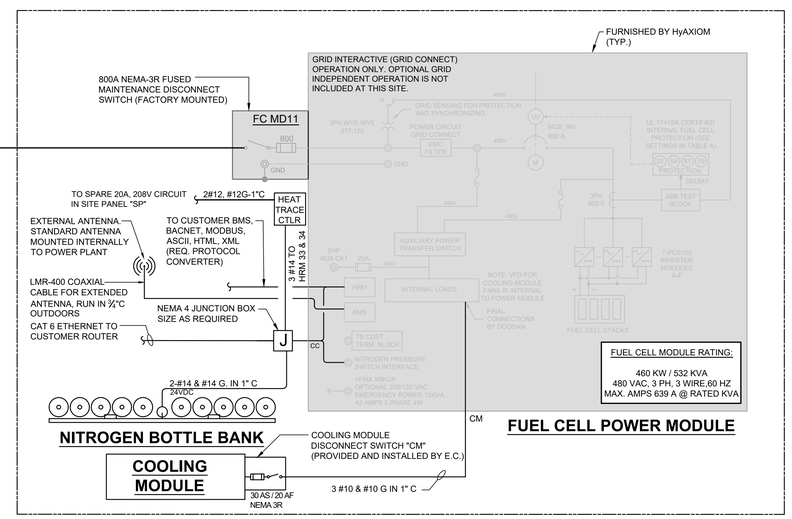
Pursuant to Conn. Gen. Stat. §§ 4-176 and 16-50k(a) and Conn. Agencies Regs. § 16-50j-38 et seq., HyAxiom, Inc. ("HyAxiom"), as an Owner/Operator, requests that the Connecticut Siting Council ("Council") approve by declaratory ruling the location and construction of a grid-side distributed resources project comprised of eleven (11) new natural-gas fueled PureCell® Model 400+ phosphoric acid fuel cell ("Fuel Cell") and associated equipment (the "Facility"), providing 4.939-megawatts ("MW") (net) of power to the Grid at 540 Long Brook Ave., Stratford, CT (*See Attachment* 1). The Facility will be installed, owned, maintained, and operated by HyAxiom.

Conn. Gen. Stat. § 16-50k(a) provides that:

> Notwithstanding the provisions of this chapter or title 16a, the council shall, in the exercise of its jurisdiction over the siting of generating facilities, approve by declaratory ruling . . . (B) the construction or location of any fuel cell, unless the council finds a substantial adverse environmental effect or of any customer-side distributed resources project or facility . . . with a capacity of not more than sixty-five megawatts, as long as such project meets air and water quality standards of the Department of Energy and Environmental Projection."

I. INTRODUCTION





TYPICAL FOR (11) MODEL 400 PureCell SYSTEM POWER PLANTS

GENERAL NOTES

1. PROVIDE SIGNAGE AS REQUIRED BY CODE AND AS INDICATED ON DWG E2.0.
2. CONSULT DOOSAN MODEL 400 INSTALLATION DESIGN GUIDE (FUEL CELL POWER PLANT) AND STANDARD INSTALLATION DRAWINGS FOR TECHNICAL REFERENCE.

GROUNDING NOTES:

1. THE FUEL CELL GROUND LUG INSIDE DISCONNECT SWITCH MD-1 SHALL BE CONNECTED TO AN EXTERNAL #1/0 COPPER EQUIPMENT GROUNDING CONDUCTOR FROM MAIN SWITCHBOARD'S GROUNDED CONDUCTOR PER NEC ART 692.44, IN ORDER TO PROVIDE THE REQUIRED SINGLE POINT GROUND PER NEC ART 250.24.A & D.
2. NOTE THAT THE FUEL CELL GROUND LUG INSIDE MD-1 IS BONDED TO ALL METALLIC NON-CURRENT CARRYING METAL PARTS BOTH INSIDE THE FUEL CELL AND ALSO AT EXTERNAL FUEL CELL ASSEMBLIES SUCH AS THE COOLING MODULE, SO ALL FUEL CELL PARTS ARE CONNECTED TO THE EQUIPMENT GROUNDING CONDUCTOR AS REQUIRED BY ART. 250.110.

CERTIFICATION:

POWER PLANT IS CERTIFIED TO: ANSI/CSA AMERICA FC 1 - 2014 (FORMALLY ANSI Z21.L83) "AMERICAN NATIONAL STANDARD FOR STATIONARY FUEL CELL POWER SYSTEM" INCLUDING,

A. UL1741SA "INVERTERS, CONVERTERS, CONTROLLERS AND INTERCONNECTION SYSTEM EQUIPMENT FOR USE WITH DISTRIBUTED ENERGY RESOURCES."
B. IEEE 1547 "STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS."
C. NFPA 70 NATIONAL ELECTRIC CODE (FOR INTERFACES TO CUSTOMER WIRING AND WIRING BETWEEN MODULES).

POWER PLANT SPECIFICATIONS

RATED POWER OUTPUT	460 kW / 532 kVA
OUTPUT TYPE	480VAC, 60 HZ, 3 PHASE, 3 WIRE
RATED OUTPUT CURRENT	639 AMPS AT RATED kVA

LEGEND

———	LIGHT INDICATES EXISTING
———	BOLD INDICATES NEW
GC	GRID CONNECT
GI	GRID INDEPENDENT

TABLE A - SEL547 RELAY
IEEE1547 / UL 1741SA GRID PROTECTION PARAMETER SETTINGS

THE REQUIRED GRID PROTECTION FUNCTIONS AND SETTINGS PER UL1741SA/IEEE1547 RESIDE IN THE INTERNAL SEL547 RELAY WITH SETTING NAMES AS SHOWN BELOW.

SETTING NAME	DESCRIPTION	GROUP 1 - "SUPPORT" 60 Hz SETTING 480Vac Tx RATIO 2.31 : 1	VOLTAGE P.U.	ANSI C37 DEVICE NUMBER
27P1P	UNDER VOLTAGE LEVEL 88%(V)	106	0.88	27
27P2P	MID UNDER VOLTAGE	106	0.88	
27P3P	UNDER VOLTAGE LEVEL 50% (V)	60	0.50	27
59P1P	OVER VOLTAGE LEVEL 110% (V)	132	1.1	59
59P2P	OVER VOLTAGE LEVEL 120% (V)	144	1.2	59
81D1P	FAST UNDER FREQUENCY LEVEL (Hz)	56.5		81U
81D2P	SLOW UNDER FREQUENCY LEVEL (Hz)	58.5		81U
81D3P	SLOW OVER FREQUENCY LEVEL (Hz)	61.2		81O
81D4P	FAST OVER FREQUENCY LEVEL (Hz)	62		81O
SV1PU	RECONNECTION TIME DELAY (CYCLES)	18,000		
SV2PU	FAST OVER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV3PU	SLOW OVER FREQUENCY CLEARING TIME (CYCLES)	18,000		
SV4PU	FAST UNDERFREQUENCY CLEARING TIME (CYCLES)	18,000		
SV5PU	FAST UNDER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV6PU	OVER VOLTAGE 120% CLEARING TIME (CYCLES)	*5		
SV7PU	OVER VOLTAGE 110% CLEARING TIME (CYCLES)	120		
SV8PU	UNDER VOLTAGE 88% CLEARING TIME (CYCLES)	120		
SV9PU	MID UNDER VOLTAGE 88% CLEARING TIME (CYCLES)	120		
SV10PU	UNDER VOLTAGE 50% CLEARING TIME (CYCLES)	66		
SV12PU	DELAY BETWEEN GRID OK STATUS AND BREAKER OPENING (CYCLES)	0		

★ NOTE 1: THE ACTUAL (TOTAL) PROTECTION CLEARING TIME EQUALS THE SUM OF THE PARAMETER CLEARING TIME SETTING IN THE TABLE PLUS 5 CYCLE BREAKER'S TRIPPING TIME. FOR EXAMPLE ACTUAL (TOTAL) FAST OVER CURRENT CLEARING TIME EQUALS PARAMETER SV6PU 5 CYCLES SETTING PLUS THE 5 CYCLE BREAKER CLEARING TIME FOR A TOTAL CLEARING TIME OF 10 CYCLES (0.16 SEC)

NOTE 2: GROUP 1 SETTINGS ARE FOR THE UL1741SA "GRID SUPPORT" AND GROUP 2 SETTINGS ARE FOR IEEE1547-2003 NON-SA SETTINGS - USE GROUP 1 FOR UL1741SA SITES.

NOTE 3: FOR DOOSAN ON-SITE PERSON - GROUP 1 OR GROUP 2 IS SET BY GROUP 9 PARAMETER "INVERTER MODE"

GROUP 1 = GRID SUPPORT (INVERTER MODE = 0 = FALSE) =UL1741SA

TABLE B - SEL451 RELAY

ANSI C37 DEVICE NUMBER	PROTECTION FUNCTION	MAGNITUDE	TIME
27	UNDER VOLTAGE	88%	2 SEC
27	FAST UNDER VOLTAGE	50%	66 CYCLES
59	OVER VOLTAGE	110%	2 SEC
59	FAST OVER VOLTAGE	120%	10 CYCLES
81	SLOW UNDER FREQUENCY	58.5 Hz	300 SECONDS
81	UNDER FREQUENCY	56.5 Hz	10 CYCLES
81	OVER FREQUENCY	62 Hz	10 CYCLES
81	SLOW OVER FREQUENCY	61.2 Hz	300 SECONDS
50P1P	INSTANTANEOUS OVERCURRENT	15 Inom (Inom = 250 A)	
50G	INSTANTANEOUS GROUND FAULT	1.0 Inom	
51S1P	TIME OVERCURRENT	1.4 x Inom (Inom = 250 A)	
51S1C	INVERSE TIME OVERCURRENT CURVE ELEMENT	18,000	U2 (INVERSE CURVE)
51S1TD	TIME OVERCURRENT DIAL ELEMENT	18,000	1

Rev.	Date	Description
A	05/29/24	ISSUED FOR CT SITING COUNCIL & UTILITY INTERCONNECTION

ICDS
Innovative Construction & Design Solutions, LLC
10 White Wood Lane
N. Branford, CT 06471
(203) 453-8596
info@icdsllc.com

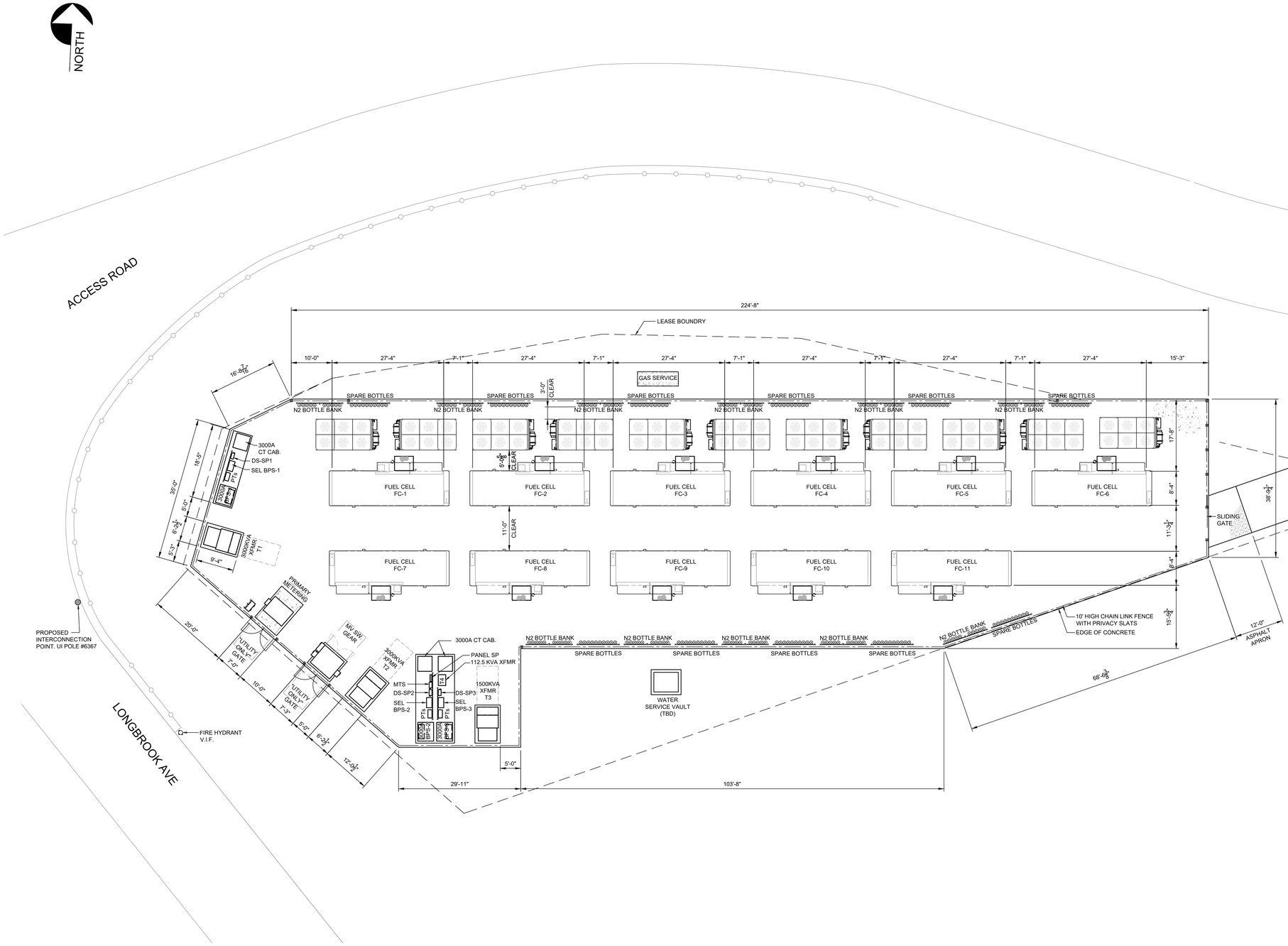
STRATFORD SCEF
540 LONGBROOK AVE, STRATFORD CT
11 FUEL CELL INSTALLATION

ELECTRICAL ONE-LINE DIAGRAM

Project No.:	Drawn By: KFH
Date: 05/29/24	Design By: DSF
Scale: AS NOTED	Check By: DSF

Drawing No.:

E1.0



1 GENERAL ARRANGEMENT
Scale: 3/32" = 1'-0"

Rev.	Date	Description
A	05/29/24	ISSUED FOR CT SITING COUNCIL & UTILITY INTERCONNECTION

ICDS
Innovative Construction & Design Solutions, LLC
10 White Wood Lane
N. Branford, CT 06471
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STRATFORD SCEF
540 LONGBROOK AVE, STRATFORD CT
11 FUEL CELL INSTALLATION

GENERAL ARRAGEMENT

Project No.:	Drawn By: KFH
Date: 05/29/24	Design By: DSF
Scale: AS NOTED	Check By: DSF

Drawing No.:

GA1.0

Attachment #3

PureCell® Model 400

PURECELL SYSTEM BENEFITS

Energy Security

Proven PAFC fuel cell technology that is setting durability records

Energy Productivity

Increased efficiency and continuous on-site generation reduces energy costs

Energy Responsibility

Ultra-low emissions equals sustainability

PURECELL SYSTEM COMPETITIVE ADVANTAGES

Long Life

Industry leading 10-year cell stack life assures high availability and low service cost

Modular & Scalable

Solutions for multi-megawatt applications to meet growing energy demand

Experience

Most knowledgeable and experienced team in the industry

High Efficiency

Up to 90% total CHP Efficiency

Grid-Independence

Proven performance delivering power when the utility grid fails

Load Following

Capable of dispatching power to match building needs

Small Footprint

Highest power density among clean generation technologies

Flexible Siting

Indoor, outdoor, rooftop, multi-unit

RATED POWER OUTPUT: 460KW, 480VAC, 60HZ

Characteristic	Units	Operating Mode	
		Power 460kW	Eco 440kW
Electric Power Output[1]	kW/kVA	460/532	440/517
Electrical Efficiency	%, LHV	43.5%	44.4%
Peak Overall Efficiency	%, LHV	90%	90%
Gas Consumption[1]	MMBtu/h, HHV (kW)	4.04 (1,185)	3.78 (1,108)
Gas Consumption[1,2]	SCFH (Nm^3/h)	3,941 (106)	3,688 (98.7)
High Grade Heat Output @ up to 250°F[1]	MMBtu/h (kW)	1.30 (382)	1.16 (341)
Low Grade Heat Output @ up to 140°F[1,6]	MMBtu/h (kW)	1.68 (492)	1.54 (452)

FUEL

Supply ..... Natural Gas
Inlet Pressure ..... 10 to 14 in. water (2.5 - 3.5 mbar)

EMISSIONS[3,4]

NOx ..... 0.02 lbs/MWh (0.009 kg/MWh)
CO ..... 0.01 lbs/MWh (0.005 kg/MWh)
VOC ..... 0.01 lbs/MWh (0.005 kg/MWh)
SO_2 ..... Negligible
Particulate Matter ..... Negligible
CO_2[1] (electric only) ..... 1,006 lbs/MWh (456 kg/MWh)
(with High-Grade heat recovery) ..... 567 lbs/MWh[5] (257 kg/MWh)
(with full heat recovery) ..... 496 lbs/MWh[5] (225 kg/MWh)

OTHER

Ambient Operating Temp ..... -20°F to 104°F (-29°C to 40°C)
Relative Humidity ..... 0 to 95% (non-condensing)
Sound Level ..... <65 dBA[6] @ 33 ft. (10m)
Water Consumption ..... None (up to 86°F (30°C) Ambient Temp.)
Water Discharge ..... None (Normal Operating Conditions)

CODES AND STANDARDS

ANSI/CSA FC1-2014: Stationary Fuel Cell Power Systems
UL1741 SA: Inverters for Use With Distributed Energy Resources

NOTES

1. Average performance during 1st year of operation.
2. Based on natural gas higher heating value of 1025 Btu/SCF (40.4 MJ/Nm3)
3. Emissions based on 440 kW operation.
4. Fuel cells are exempt from air permitting in many U.S. states.
5. Includes CO_2 emissions savings due to reduced on-site boiler gas consumption
6. With optional equipment

HyAxiom, Inc.
Corporate Headquarters
101 East River Drive
East Hartford, CT 06108
(860)727-2253
www.hyaxiom.com
email: fuelcells@doosan.com

Doosan Fuel Cell America, Inc.

Fuel Cell Fire Prevention and Emergency Response Guide

SCEF 5 Stratford

540 Long Brook Ave.

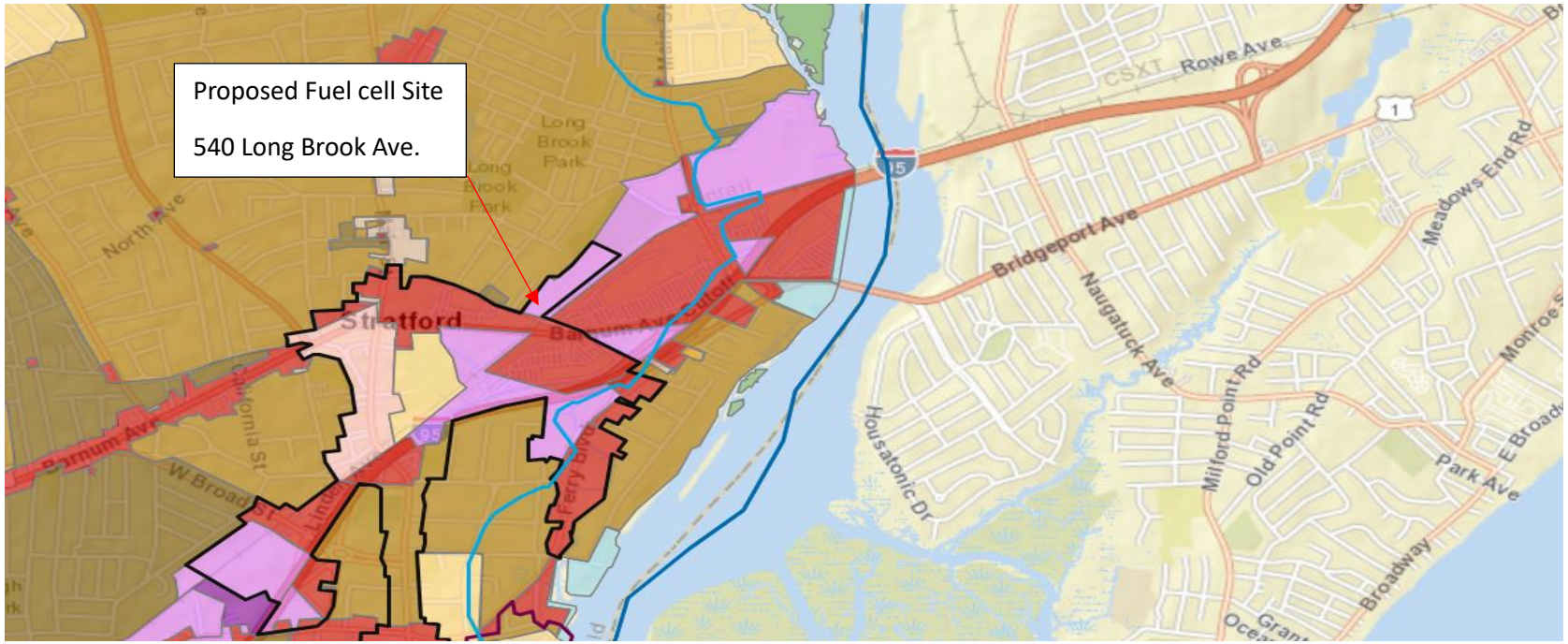
Stratford, CT 06614

Attachment #5

INDUSTRIAL DISTRICTS, MA

- LIGHT INDUSTRIAL, MA DISTRICTS
- GENERAL INDUSTRIAL, MB DISTRICTS
- COASTAL INDUSTRIAL, MC DISTRICTS
- RUNWAY ZONE
- ADD AIRPORT DEVELOPMENT ZONE

Zoning Map



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Aerial Map


540 Long Brook
Proposed Fuel Cell Site
540 Longbrook Ave
Walmart
The Home Depot
Stratford Crossing
Burlington
Kingston Kafe
Barnum Animal Hospital
McDonald's
Marshalls
Esporta Fitness
JI Global Services Ct
Barnum Avenue Cutoff
Longbrook Ave
Cottage Pl
Elliott St
Poplar St
Sidney St
Orchard St
Riverview Pl
Berry Ct
Image Landsat / Copernicus
Google Earth

Attachment #7

Title 14 —Aeronautics and Space
Chapter I —Federal Aviation Administration, Department of Transportation
Subchapter E —Airspace
Part 77 —Safe, Efficient Use, and Preservation of the Navigable Airspace
Subpart B —Notice Requirements

Authority: 49 U.S.C. 106 (g), 40103, 40113–40114, 44502, 44701, 44718, 46101–46102, 46104.
Source: Docket No. FAA–2006–25002, 75 FR 42303, July 21, 2010, unless otherwise noted.

§ 77.9 Construction or alteration requiring notice.

If requested by the FAA, or if you propose any of the following types of construction or alteration, you must file notice with the FAA of:

(a) Any construction or alteration that is more than 200 ft. AGL at its site.

(b) Any construction or alteration that exceeds an imaginary surface extending outward and upward at any of the following slopes:

(1) 100 to 1 for a horizontal distance of 20,000 ft. from the nearest point of the nearest runway of each airport described in paragraph (d) of this section with its longest runway more than 3,200 ft. in actual length, excluding heliports.

(2) 50 to 1 for a horizontal distance of 10,000 ft. from the nearest point of the nearest runway of each airport described in paragraph (d) of this section with its longest runway no more than 3,200 ft. in actual length, excluding heliports.

(3) 25 to 1 for a horizontal distance of 5,000 ft. from the nearest point of the nearest landing and takeoff area of each heliport described in paragraph (d) of this section.

(c) Any highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance, 15 feet for any other public roadway, 10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 23 feet for a railroad, and for a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of paragraph (a) or (b) of this section.

(d) Any construction or alteration on any of the following airports and heliports:

(1) A public use airport listed in the Airport/Facility Directory, Alaska Supplement, or Pacific Chart Supplement of the U.S. Government Flight Information Publications;

(2) A military airport under construction, or an airport under construction that will be available for public use;

(3) An airport operated by a Federal agency or the DOD.

(4) An airport or heliport with at least one FAA-approved instrument approach procedure.

(e) You do not need to file notice for construction or alteration of:

Attachment #8

State of California
AIR RESOURCES BOARD
Executive Order DG-047
Distributed Generation Certification of
Doosan Fuel Cell America, Inc.
460 kW PureCell Model 400

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 October 26, 2017, Doosan Fuel Cell America, Inc. applied for a DG Certification of its 460 kW PureCell Model 400 fuel cell power plant and whose application was deemed complete on February 7, 2018;

WHEREAS, Doosan Fuel Cell America, Inc. has demonstrated, according to test methods specified in title 17, California Code of Regulations (CCR), section 94207, that its natural-gas-fueled 460 kW PureCell Model 400 fuel cell power plant has complied with the following emission standards:

1. Emissions of oxides of nitrogen no greater than 0.07 pounds per megawatt-hour; and

2. Emissions of carbon monoxide no greater than 0.10 pounds per megawatt-hour; and

3. Emissions of volatile organic compounds no greater than 0.02 pounds per megawatt-hour.

WHEREAS, Doosan Fuel Cell America, Inc. has demonstrated that its 460 kW PureCell Model 400 fuel cell power plant complies with the emission durability requirements in title 17, CCR, section 94203 (d);

WHEREAS, I find that the Applicant, Doosan Fuel Cell America, Inc., has met the requirements specified in article 3, title 17, CCR, and has satisfactorily demonstrated that the 460 kW PureCell Model 400 fuel cell power plant meets the DG Certification Regulation 2007 Fossil Fuel Emission Standards;

Attachment #9

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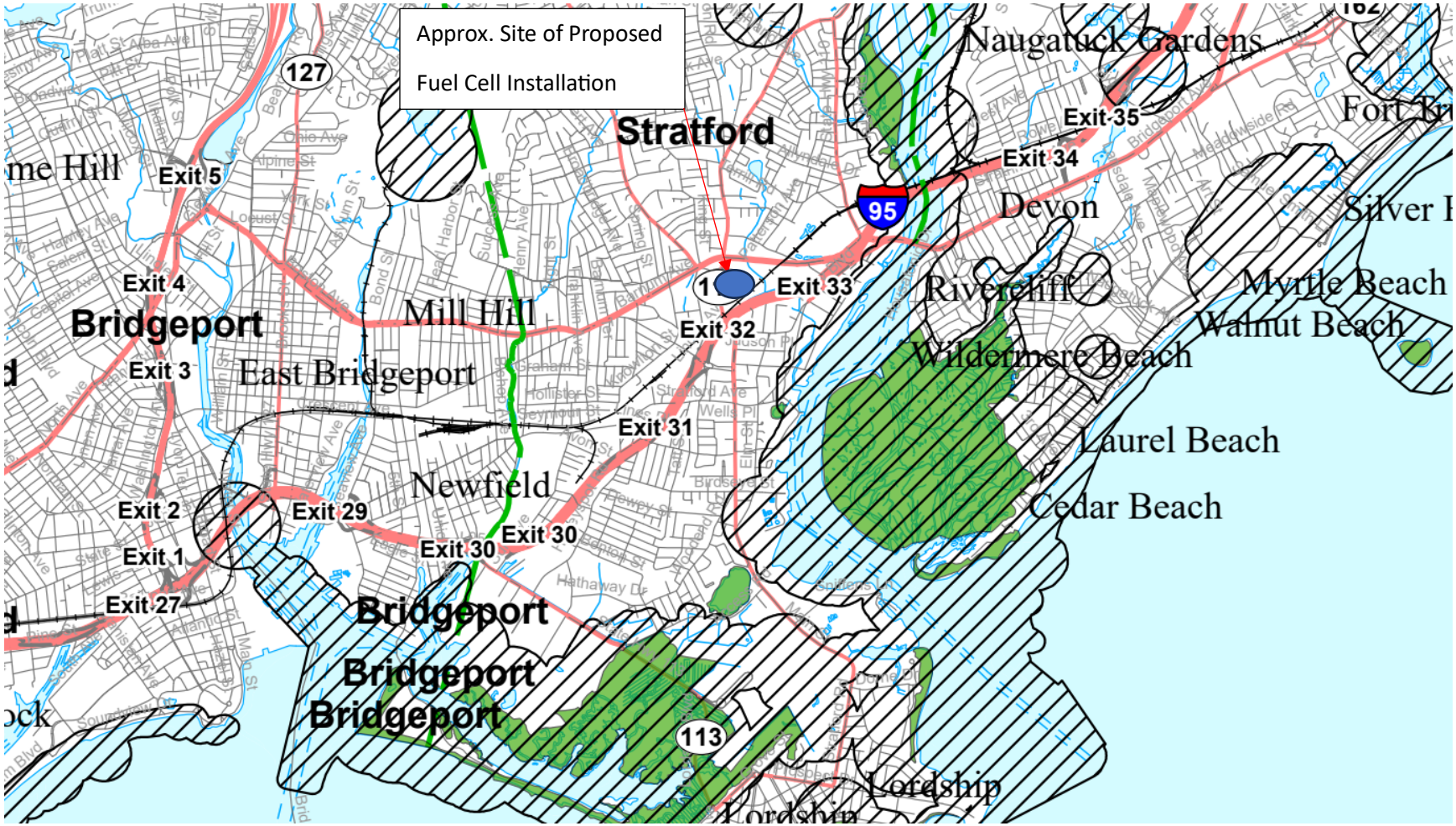
Natural Diversity Data Base Map



Prepared For: HiAxiom, Inc.

Point of Contact: Walter Bonola

Prepared by: Acoustical Technologies Inc.
50 Myrock Avenue
Waterford, CT 06385-3008

Subject: Eleven Fuel Cells
Airborne Noise Assessment
At 540 Longbrook Avenue
Stratford, CT 06614

Author: Carl Cascio

Date: June 4, 2024

Revision: 0

HyAxiom Inc,
A Doosan Company
101 East River Drive
East Hartford, CT 06108

June 3, 2024

RE: Petition for a Declaratory Ruling That No Certificate of Environmental Compatibility and Public Need is Required ("Petition") for the Installation of eleven (11) on-site, 460 kW Fuel Cells at 540 Long Brook Ave., Stratford, CT 06614.

Dear Recipient,

Pursuant to Section 16-50j-40 of the Connecticut Siting Council's (the "Council") Rules of Practice, we are notifying you that HyAxiom, Inc. intends to file a petition for declaratory ruling with the Connecticut Siting Council ("Council") on or about June 15, 2024. The petition will request the Council's approval of the installation of eleven (11) 460kW fuel cells and ancillary equipment in support of a grid-side, distributed generation project at 540 Long Brook Ave. Stratford, CT 06614. The fuel cells will be powered by natural gas and the generated electricity will be distributed directly to the Power Grid.

The proposed placement of the fuel cells will be located within Contract Plating property. The fuel cells will be arranged in a fenced area in the Southwest corner of the property.

If you have any questions regarding the proposed work, please contact any of the following:

HyAxiom, Inc.

John Prinssen
101 East River Drive
East Hartford, Ct 06108
Tel: (860) 727-2091
john.prinssen@doosan.com

Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051
Tel: 860-827-2935

Attachment #12

Abutters List

1 - WAL-MART REAL ESTATE BUSINESS TR

C/O WALMART STORES INC

2608 SE J STREET

BENTONVILLE, AR 72716-5510

2 - CHARTER STRATFORD LLC

C/O WAKEFERN FOOD CORP

REAL ESTATE DEPARTMENT

33 NORTHFIELD AVE

EDISON, NJ 08818

3 - HOME DEPOT USA INC

PROP TAX DEPT #6225

PO BOX 105842

ATLANTA, GA 30348

4 - UNITED ILLUMINATING CO

ACCOUNTS PAYALBE DEPT

P O BOX 1564

NEW HAVEN, CT 06506

5 - HASBROUCK KEITH E & ROBYN M

585 LONGBROOK AVE

STRATFORD, CT 06614-5116

6 - RIO MAR LLC

720 BARNUM AVE CUT-OFF

STRATFORD, CT 06614

7 - DRESZER OLYMPIA

615 LONGBROOK AVE

STRATFORD, CT 06614

8 - DRESZER OLYMPIA

623 LONGBROOK AVE

STRATFORD, CT 06614

9 - ETON CENTERS CO

C/O BURLINGTON COAT FACTORY ATTN LEASE A

1830 RTE 130 NORTH

BURLINGTON , NJ 08016

10 - TURNIER ERNEST

586 LONGBROOK AVE

STRATFORD, CT 06614-5115

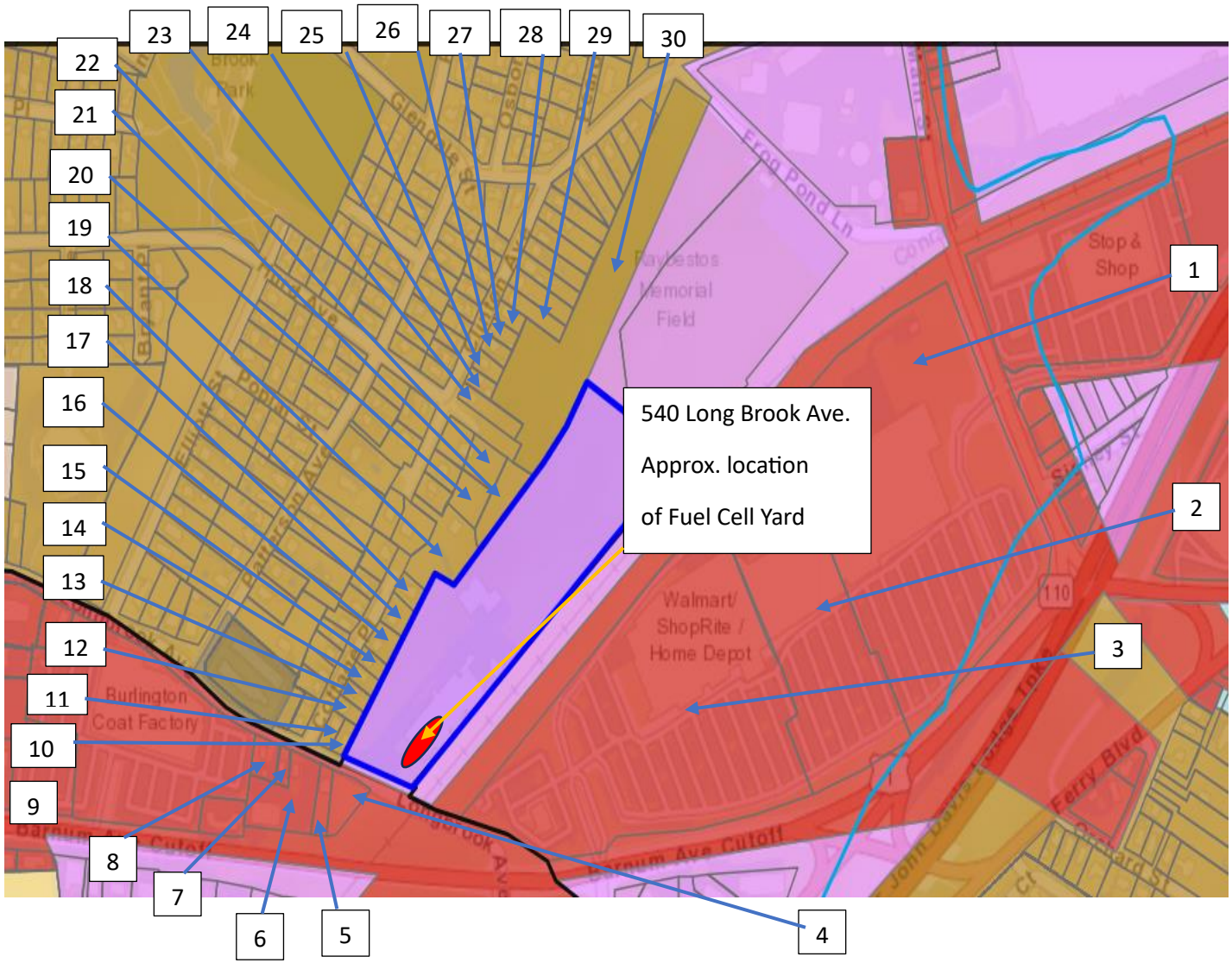
11 - DICOSTANZO PETER

594 LONGBROOK AVE

STRATFORD, CT 06614-5115

Attachment #13

Abutters Map



UNITED STATES POSTAL SERVICE®

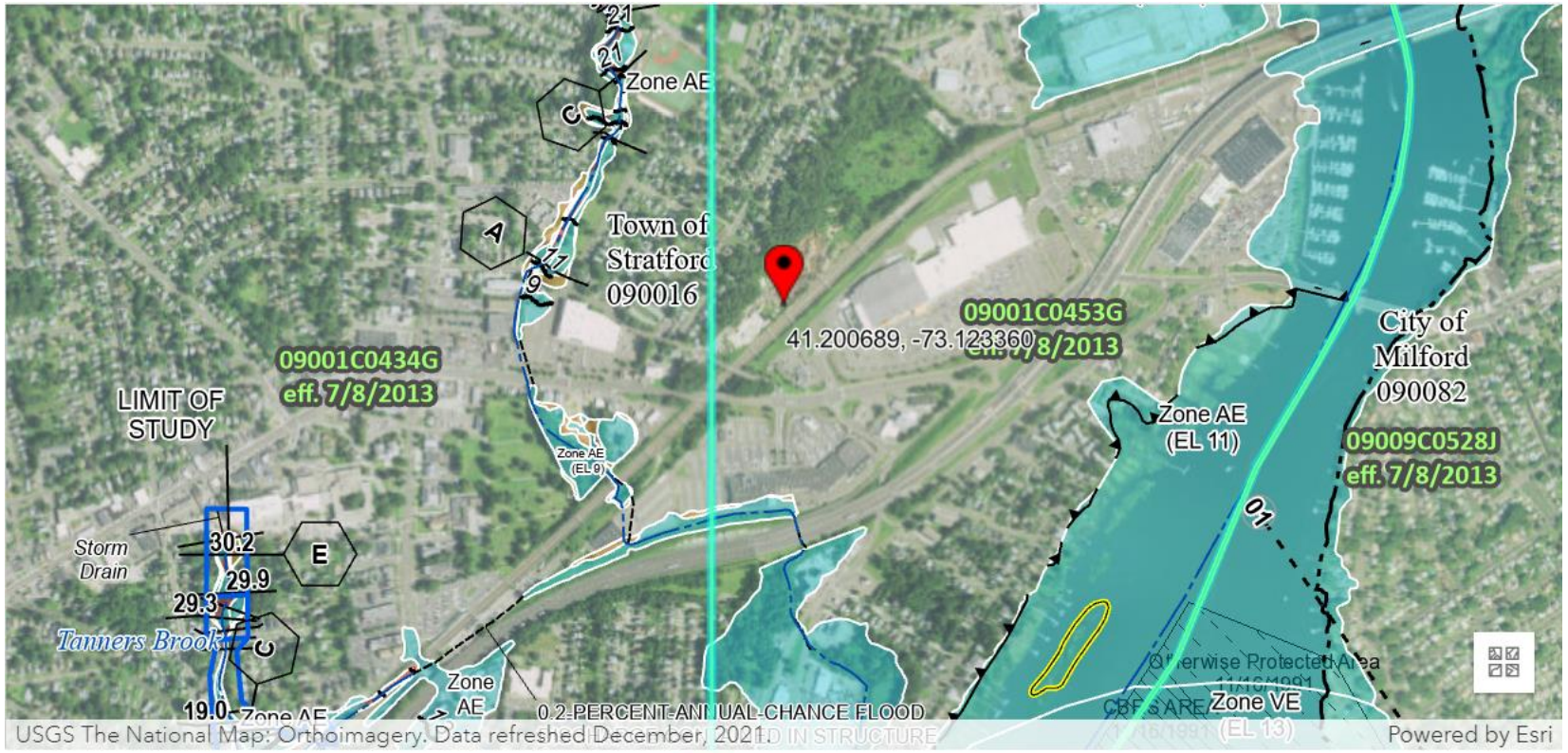
Certificate of Mailing — Firm

Name and Address of Sender	TOTAL NO. of Pieces Listed by Sender	TOTAL NO. of Pieces Received at Post Office™	Affix Stamp Here *Postmark with Date of Receipt.*
HyAxiom 101 East River Drive East Hartford, CT 06108	46	46	TORRINGTON CT 067 UNITED STATES POSTAL SERVICE® 0000 U.S. POSTAGE PAID TORRINGTON, CT 06790 JUN 04, 24 AMOUNT **$11.10** R2305K135308-70
	Postmaster, per *(name of receiving employee)*		
	JS		

USPS® Tracking Number / Firm-specific Identifier	Address (Name, Street, City, State, and ZIP Code™)	Postage	Fee	Special Handling	Parcel Airlift
1.	Laura R. Hoydick MAYOR 2725 Main Street Stratford, CT 06615				
2.	THOMAS BRYAN O'CONNOR COUNCIL PERSON, FIRST DISTRICT 20 PROSPECT DR. STRATFORD. CT 06615				
3.	CHRISTOPHER GREEN COUNCIL PERSON, SECOND DISTRICT 550 HOUSATONIC AVE. STRATFORD. CT 06615				
4.	ALVIN O'NEAL COUNCIL PERSON, THIRD DISTRICT 17 MEADOWVIEW AVE. STRATFORD. CT 06615				
5.	RENE GIBSON COUNCIL PERSON, FOURTH DISTRICT 400 BURRITT AVE. STRATFORD. CT 06615				
6.	ANTHONY 0. AFRIYIE COUNCIL PERSON, FIFTH DISTRICT 181 SWANSON AVE. STRATFORD, CT 06614				

Attachment #15

NFIP (Flood map)



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

PureCell Model 400 Fuel Processing System (FPS)

The FPS converts pipeline-quality natural gas into hydrogen reformate – a hydrogen-rich gas that is delivered to the anode side of the fuel cell stacks. This module includes a condenser to recover water generated in the fuel cell reaction by condensing water vapor from the process exhaust. This eliminates the need for makeup water under most operating conditions. The recovered water is used in the steam reformation process. The main components of the FPS include the following:

Hydro-Desulfurizer

The desulfurizer system removes sulfur used as an odorant in natural gas, which is a poison to the catalysts used in the fuel cell systems. Sulfur is converted to zinc-sulfide, a non-hazardous waste, within the desulfurizer and remains there until an overhaul is required, nominally after 10 years. This system will also remove small amounts of oxygen in the gas.

Steam Reformer

Steam (H_2O) generated in the cell stack cooling loop of the TMS is combined in the reformer with methane (CH_4) in the natural gas to generate a gas composed of hydrogen (H_2), carbon monoxide (CO), and carbon dioxide (CO_2).

$2CH_4 + 3H_2O = 7H_2 + CO + CO_2$ *Equation 1*

Integrated Low-Temperature Shift Converter

The integrated low-temperature shift converter (ILS) generates additional hydrogen through a water-gas reaction in which CO and water is converted to hydrogen and CO_2. The reduced CO content minimizes its adverse effect on fuel cell stack performance.

$CO + H2O = H2 + CO2$ *Equation 2*

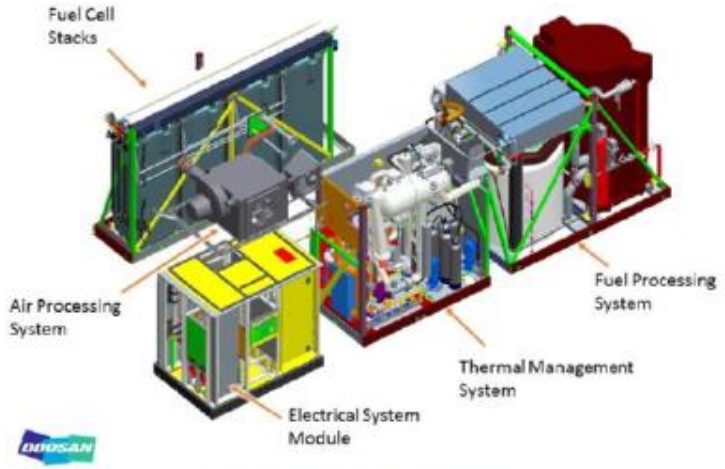


Figure 1. PureCell Model 400 Subsystems

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3.	CARL A. GLAD COUNCIL PERSON, EIGHT DISTRICT 80 CANDLEWOOD RD. STRATFORD, CT 06614				
4.	ALAN D. LLEWELYN COUNCIL PERSON, NINTH DISTRICT 949 HUNTINGTON RD. STRATFORD, CT 06614				
5.	PAUL T. AURELIA COUNCIL PERSON, TENTH DISTRICT 31 BARBARA LN. STRATFORD, CT 06614				
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3.	JF EWALD JOSEPH ZONING COMMISSION, DISTRICT II 9 ELEANOR ST. STRATFORD, CT 06615				
4.	CHRISTOPHER E. SILHAVEY ZONING BO. OF APPEALS, DISTRICT IV 111 HICKORY WOODS LN STRATFORD, CT 06614				
5.	MICHAEL P. CARROLL ZONING BO. OF APPEALS, DISTRICT V 160 DEL DR. STRATFORD, CT 06614				
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4.	Susan M. Pawluk Stratford Town Clerk 2725 Main Street Room 106 Stratford, CT 06615				
5.	Christopher Tymniak Chief Administrative Officer, Town of Stratford 2725 Main Street Stratford, CT 06615				
6.	Andrea L. Boissevain, MPH Director of Health, Town of Stratford 2725 Main Street Stratford, CT 06615				

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3.	Fire Marshal Assistant Chief, Robert Daniel 2750 Main Street Stratford, CT 06615				
4.	Donna Calicchio, Assessor 2725 Main Street Stratford, Connecticut 06615				
5.	Kelly Kerrigan Environmental Conservation Superintendent 2725 Main Street Stratford, Connecticut 06615				
6.	Lawrence Ciccarelli Emergency Management Director 2725 Main Street Stratford, Connecticut 06615				

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4.	Phillip Ryan Purchasing Agent 2725 Main Street, Room 104 Stratford, Connecticut 06615				
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4.	William Tong CT State Attorney General 165 Capitol Avenue Hartford, CT, 06106				
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3.	Rosa L. DeLauro U.S. Representative 2413 Rayburn House Office Building Washington, DC, 20515				
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4.	David Cash Federal DEP 1 Ashburton Place Boston, MA 02108				
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3.	Alexandra Daum Department of Economic and Community Development 450 Columbus Blvd Hartford, CT 06106				
4.	Pete Buttigieg Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590				
5.	Garrett T. Eucalitto Department of Transportation 2800 Berlin Turnpike Newington, CT 06111				
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4.	ETON CENTERS CO C/O BURLINGTON COAT FACTORY ATTN LEASE A 1830 RTE 130 NORTH BURLINGTON , NJ 08016				
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5.	SCHRECKENGOST LLOYD 120 CLINTON AVE STRATFORD, CT 06614-5155				
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4.					
5.					
6.					

Mayor Laura R. Hoydick

2725 Main Street

Stratford, CT 06615

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20 PROSPECT DR.

STRATFORD, CT 06615

COUNCIL PERSON, SECOND DISTRICT

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550 HOUSATONIC AVE.

STRATFORD, CT 06615

COUNCIL PERSON, THIRD DISTRICT

ALVIN O'NEAL

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STRATFORD, CT 06615

COUNCIL PERSON, FOURTH DISTRICT

RENE GIBSON

400 BURRITT AVE.

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COUNCIL PERSON, FIFTH DISTRICT

ANTHONY 0. AFRIYIE

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STRATFORD, CT 06614

COUNCIL PERSON, SIXTH DISTRICT

KERRY L. WHITHAM

2037 BROADBRIDGE AVE.

STRATFORD, CT 06614

COUNCIL PERSON, SEVENTH DISTRICT

KAITLYN SHAKE

44 CHARLTON ST.

STRATFORD, CT 06614

COUNCIL PERSON, EIGHT DISTRICT

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COUNCIL PERSON, NINTH DISTRICT

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PLANNING COMMISSION, DISTRICT II

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ZONING BO. OF APPEALS, DISTRICT V

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160 DEL DR.

STRATFORD, CT 06614

ZONING BO. OF APPEALS, DISTRICT I

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Brian Donovan, Building Official

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Andrea L. Boissevain, MPH
Director of Health
Town of Stratford
2725 Main Street
Stratford, CT 06615

Chief Joseph McNeil
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900 Longbrook Avenue
Stratford, Connecticut 06614-5099

Jermaine Atkinson, Fire Chief
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Stratford, CT 06615

Fire Marshal - Assistant Chief, Robert Daniel
2750 Main Street
Stratford, CT 06615

Donna Calicchio, Assessor
2725 Main Street
Stratford, Connecticut 06615

Kelly Kerrigan
Environmental Conservation Superintendent
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Lawrence Ciccarelli
Emergency Management Director
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Room 3400
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State Representative Laura Dancho
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William Tong
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165 Capitol Avenue
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U.S. Senator Richard Blumenthal
706 Hart Senate Office Building
Washington, DC, 20510

Rosa L. DeLauro
U.S. Representative
2413 Rayburn House Office Building
Washington, DC, 20515

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Bridgeport 06604-4902

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Hartford, CT 06106

Public Utilities Regulatory Authority

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Department of Administrative Services

Commissioner Michelle Gilman

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CT DEEP

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Department of Economic and Community Development

Alexandra Daum

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Pete Buttigieg

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Department of Transportation

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2800 Berlin Turnpike

Newington, CT 06111

Dept. of Emergency Services and Public Protection

Dante Bartolomeo, Commissioner

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Wethersfield, CT 06109

CT Airport Authority

Kevin Dillion

CAA administrative offices

Bradley International Airport

Terminal A 3rd Fl Admin Offices

Windsor Locks, CT 06096

12 - CABRERA JENNIFER E & CABRERA EDUARDO &SV

26 COTTAGE PL

STRATFORD, CT 06614

13 - GLYNN KATHERINE

36 COTTAGE PL

STRATFORD, CT 06614

14 - BELTRE IDELKYS M & JAYLEEN I (SV)

44 COTTAGE PL

STRATFORD, CT 06614

15 - PEREZ CHARLES A L/U &

MOORE LINDA E

PO BOX 1223

STRATFORD, CT 06615

16 - FORGETTE KEVIN & JOHN K

FORGETTE KEITH

66 COTTAGE PL

STRATFORD, CT 06615

17 - WOODSON RANDALL E & ANGELA M(SV)

84 COTTAGE PL

STRATFORD, CT 06615-5105

18 - KAMINSKI FRANCIS S &

KAMINSKI MARJORIE (SV)

54 COTTAGE PL

STRATFORD, CT 06615

19 - FARQUHARSON KERRY ANN

200 CLINTON AVE

STRATFORD, CT 06614

20 - HURD AVENUE DEVELOPMENT LLC

52 WESLEY DR

SHELTON, CT 06484

21 - HURD AVENUE DEVELOPMENT LLC

52 WESLEY DR

SHELTON, CT 06484

22 - HURD AVENUE DEVELOPMENT LLC

52 WESLEY DR

SHELTON, CT 06484

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MORGAN KYLE (SV)
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NEZHINSKAYA OLGA & SV
70 CLINTON AVE
STRATFORD, CT 06614

24 - SCHRECKENGOST LLOYD
120 CLINTON AVE
STRATFORD, CT 06614-5155

30 - TOWN OF STRATFORD
2725 MAIN ST
STRATFORD, CT 06615

25 - SINNOTT SCOTT A & REBECCA J (SV)
110 CLINTON AVE
STRATFORD, CT 06614-5155

26 - ALEXANDER JOSEPH C JR
100 CLINTON AVE
STRATFORD, CT 06615

27 - PREMPEH CANDACE &
ADUAMA THEOPHILUS
90 CLINTON AVE
STRATFORD, CT 06614

28 - GERWIEN EDWIN & JANE (SV)
80 CLINTON AVE
STRATFORD, CT 06614-5103

29 - ROMANIELLO MICHAEL &

Table of Contents

Summary

This document makes a positive acoustic assessment that should assist in meeting any acoustic noise concerns during the operation of eleven HiAxiom 460 KW fuel cells at the site at 540 Longbrook Avenue in Stratford, CT. An acoustic assessment plan was developed and executed to acquire airborne acoustic information useful in explaining and mitigating any potential airborne noise issues during operation of the eleven 460 KW fuel cells. It is important to show that the airborne noise generated by the fuel cells will not significantly impact the facility's neighbors.

The airborne noise levels expected to be generated by the HiAxiom fuel cells operating at the Stratford site were simulated by exciting a Soundboks speaker at two of the fuel cell Cooling Module positions. (The Cooling Module is the dominant noise source.) The Soundboks speaker produced an overall airborne noise level that was 25 dB higher than the levels measured for a single HiAxiom fuel cell installed at Montville, CT. One-third octave band analysis showed the speakers' level to be near the Montville fuel cell airborne noise levels at low frequencies where the airborne noise levels were low and to exceed the fuel cell signature by 25 dB at higher frequencies where the Montville fuel cell signature was higher in noise level.

Airborne noise levels with the speakers operating were measured at distances from 5 to 137 meters from the proposed fuel cell location on Longbrook Avenue. The speaker produced overall A-weighted sound pressure levels of approximately 98 dBA at 5 meters and roughly 91 to 92 dBA at 10 meters (reference 20 microPascals) at the proposed fuel cell locations. The airborne noise levels from the speakers as received at nearby properties on site were measured at noise levels of 50 to 76 dBA. Residential measurement locations to the west were just above background but still able to record the airborne noise with the speaker on. Analysis of the speaker data indicated propagation losses of at least 14 to 45 dB from the fuel cells' location to the nearby properties. The source level at 10 meters from the operation of a HiAxiom fuel cell at Montville, CT was then used as a basis for making the Stratford fuel cell airborne noise estimates with eleven units operating.

Operation of the eleven HiAxiom fuel cells will have no significant acoustic impact at all of the nearby properties adjacent to the HiAxiom fuel cell site on Longbrook Avenue. All the residences should be more than 8 dB below the night time noise requirement[1] while all the commercial properties should be more than 4 dB below the commercial requirement[2].

The Connecticut's Noise Code (Reference 1) also calls for review of acoustic issues associated with impulse noise, prominent discrete tones, infrasonic and ultrasonic noise. Operation of the fuel cells is expected to meet all of these requirements at all of the nearby property lines.

Introduction

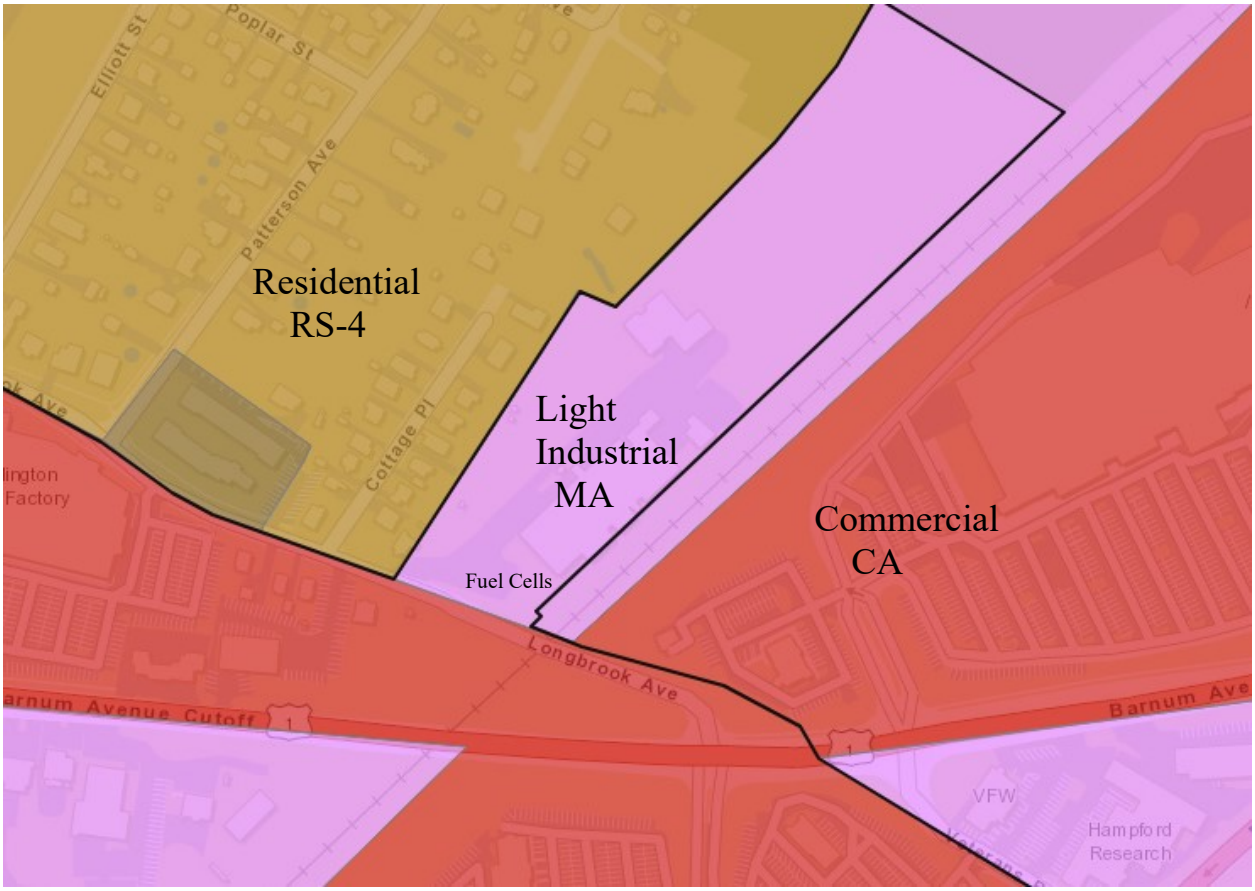
Acoustical Technologies Inc. was tasked as part of a HiAxiom site permitting process with an assessment of potential acoustic issues associated with fuel cell airborne noise reaching the properties adjacent to the proposed site at 540 Longbrook Avenue in Stratford, CT. Responding to a request from Walter Bonola, a site visit was made on May 28, 2024. During the visit, a survey of the airborne noise levels produced by a Soundboks speaker simulating the airborne noise produced by a HiAxiom Fuel Cell was made in order to identify potential airborne noise issues. Airborne noise measurements were taken to quantify the propagation of the simulated fuel cell airborne noise to the adjacent properties. Background airborne noise levels were also made with the speaker off. This document provides an acoustic assessment to assist in meeting acoustic noise concerns during the permitting process for the siting of eleven HiAxiom fuel cells at the 540 Longbrook Avenue site.

Development of the Acoustic Assessment Plan

The purpose of this effort is to acquire acoustic information useful in explaining the potential airborne noise issues associated with the operation of eleven HiAxiom 460 KW fuel cells at the site on Longbrook Avenue. The proposed site at 540 Longbrook Avenue is located in a Light Industrial (MA) Zone. This Industrial Zone is surrounded by a Residential RS-4 zone to the west and Commercial (CA) Zones to the north, east and south. Figure 1 shows a section of the Stratford zoning map where the site is located. It is important to determine whether the airborne noise generated by the eleven HiAxiom fuel cells will impact these neighbors.

The acoustic impact is assessed in the following way. The fuel cells are yet to be installed so there is no way to measure fuel cell operating airborne noise levels at the new site. The fuel cell airborne noise has been measured at other sites and both overall and one-third octave band airborne noise data of a typical HiAxiom 460 KW fuel cell are available (Reference 3). Using this data, a Soundboks speaker has been programmed through a set of filters to generate a noise spectrum similar to that of the 460 KW fuel cell. (It is assumed that the Cooling and Power Module noise in the existing measured 460 KW fuel cell are similar to the new units.) This spectrum will then be played through an audio amplifier to create the electrical voltage necessary to drive the Soundboks speaker. In order to overcome the potentially high background noise at the Stratford site the speaker output will be increased to a level more than 25 dB higher than the overall dBA noise level measured on a 460 KW fuel cell at a distance of 10 meters. With the speaker on, this approach then follows the traditional “What is the airborne noise level at the neighbor’s property line?”. The speaker will be run and airborne measurements made near the proposed fuel cell locations and at several of the nearest neighbor’s properties. This measured site data can also be used to estimate noise levels at other neighbor’s property lines. The State of Connecticut’s Noise Ordinance[1] and the Town of Stratford Noise Ordinance[2] will then be consulted to assess the impact of the measured and estimated acoustic levels. Because of the closeness of the proposed fuel cell site to the nearest properties noise mitigation may be recommended if the airborne noise estimated for eleven fuel cells comes near or exceeds the noise requirements at the neighbors’ property lines.

Figure 1. Part of the Stratford Zoning Map Showing the Area near the Eleven Fuel Cells



Acoustic Measurement Program

The acoustic data necessary to assess the impact of eleven 460 KW HiAxiom Fuel Cells are described below: Airborne sound pressure measurements were conducted at the 540 Longbrook Avenue site on May 28, 2024 during the midday hours. This testing established both background airborne noise levels and simulated airborne noise levels with the speaker operating. The overall A-weighted airborne noise measurements were made with an ExTech model 407780A Digital Sound Level Meter (s/n 140401544) that had been calibrated prior to and just after the test with a Quest model QC-10 Calibrator (s/n Q19080194). Measurements were taken with A-weighting (frequency filtering that corresponds to human hearing) and with the sound level meter in a Slow response mode. For reference, a noise level increase of 1 dB is equal to an airborne sound pressure increase of 12.2 per cent. All measurements were made with the microphone at a height above ground between five and six feet. The sound pressure data reported herein are all given in dB reference 20 microPascals.

In Stratford “speaker on” and background airborne noise measurements were taken at 5 and 10 meters from the proposed 460 KW fuel cell site and at the following nine nearby properties.

Location	Business	Distance	Zone	Type
1 – Fuel Cell West Side	HiAxiom	5 meters	MA	Light Industrial
2 – Fuel Cell West Side	HiAxiom	10 meters	MA	Light Industrial
3 – Fuel Cell East Side	HiAxiom	5 meters	MA	Light Industrial
4 – Fuel Cell East Side	HiAxiom	10 meters	MA	Light Industrial
P1 – 586 Longbrook Avenue	Home	78 meters	RS-4	Residential
P2– 26 Cottage Place	Home	89 meters	RS-4	Residential
P3 – 36 Cottage Place	Home	83 meters	RS-4	Residential
P4 – 44 Cottage Place	Home	81 meters	RS-4	Residential
P5 – 66 Cottage Place	Home	81 meters	RS-4	Residential
P6 – 585 Longbrook Avenue	Home	94 meters	CA	Commercial
P7 – A Longbrook Avenue	Empty Lot	70 meters	CA	Commercial
P8 – 450 Barnum Avenue	Webster Bank	63 meters	CA	Commercial
P9 – 350 Barnum Avenue	Home Depot	137 meters	CA	Commercial

See the Google satellite map in Figure 2 for the approximate measurement locations. Measurements were made near the proposed west and east Cooling Module units. Sound pressure data were taken with the ExTech sound level meter. Figures 3 and 4 provide photographs of the speaker locations for the West and East positions, respectively. At these locations, a one-minute record of the acoustic noise was analyzed for the speakers in the "on" condition. One minute of background noise data was also analyzed at 5 and 10 meters with the same speaker positions and at the nine nearby property lines.

Airborne noise measurements taken outside are corrupted by rain and wind so a day was selected when the winds were expected to be 10 miles per hour or less. Table 1 provides the weather data in Stratford for the measurements on May 28, 2024. Data was taken from 10:00 am until 1:00 pm. Table 1 shows the temperature and wind speeds in hourly intervals. Wind conditions were very good until noon when the wind speed picked up. The data was not affected because the received levels were high because of the closeness to the speakers to the remaining locations. Also, there was no rain during the testing. Vehicle traffic along Longbrook and Barnum Avenues was heavy and the measurements had to be delayed until all visible traffic was absent.

Because of the distant traffic noise, background noise levels at all of the property line measurement positions were high with levels from 47 to 58 dBA. At all of the measurement locations it was possible to audibly hear the airborne noise from the speaker over the background noise. Airborne noise loss versus range was determined at all nine of these locations.
The highest airborne noise levels were obtained across the railroad tracks at Webster Bank from the East speaker location. These east and west transfer functions were then applied to the 460 KW data from Montville[3] in order to estimate the received levels for the new 460 KW fuel cells in Stratford. Eleven fuel cells could make as much as 10.4 dB more noise than one fuel cell if they were all in one place. Since they are spread out the highest level across the tracks would be across from the middle of the eleven units. Reasonable estimates for this and the other locations were calculated by looking at the relative distances to the property line for each of the eleven fuel cells. At 80 to 90 meters away the correction is 9.4 dB for eleven modules. At 63 meters the correction is 9.2 dB for eleven modules. At 70 meters the correction is 9.3 dB for eleven modules. At 137 meters the correction is 9.7 dB for eleven modules.

Figure 2. Google Map Showing Measurement Positions P1 through P9

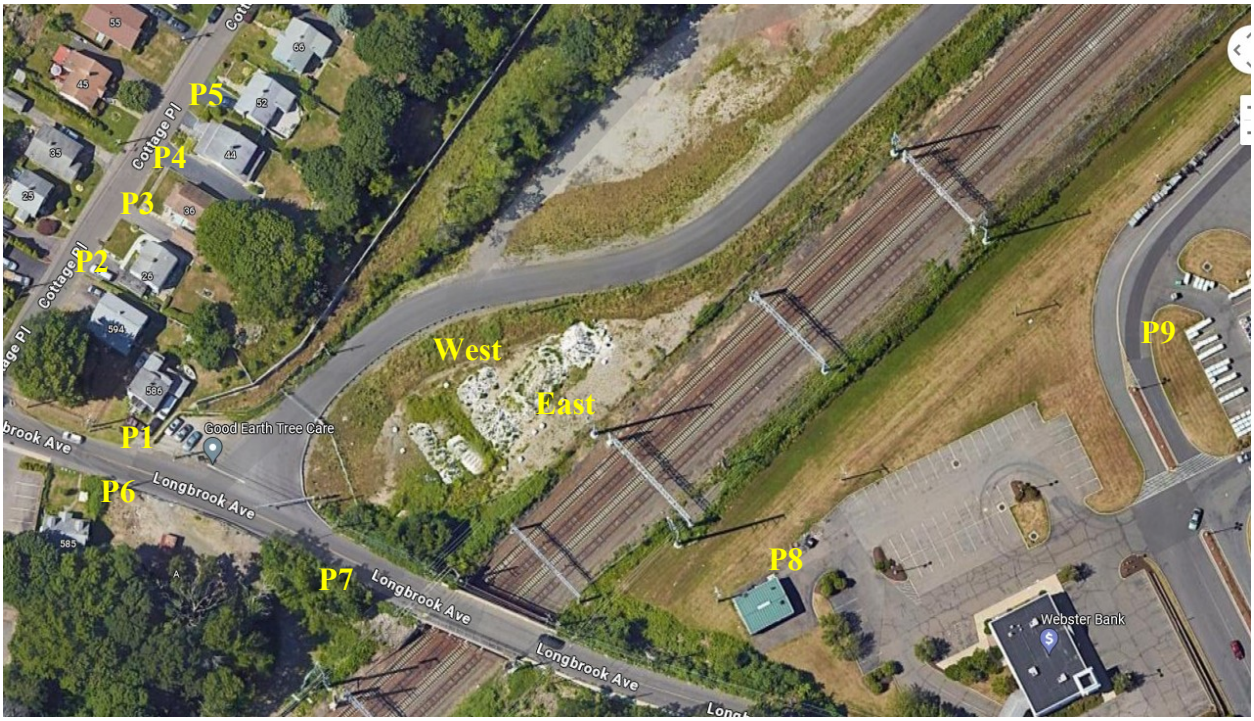


Figure 3. HiAxiom West Cooling Module Location Looking Southeast at Longbrook Avenue

For properties to the west the eleven cooling modules are side by side so the distance to the property is slightly different for each fuel cell. Each cooling module will be modeled at a 10-meter source level of 65 dBA while each power module will be modeled at a 10-meter source level of 61 dBA.[3] The fuel cell module layout is shown in Figure 5 below. The adjustments mean the eleven module source levels increase to about 74.5 dB for the cooling modules and about 70.5 dB for the power modules at a distance of 10 meters. The modules combine for an overall source level of 76 dBA at 10 m.

The west direction requires a combination of cooling module and power module noise. This direction will produce the highest **residential** property line noise levels since the property lines are closest (about 80 meters). The commercial east and south property lines are closer (63 - 137 meters away) and should have slightly higher noise levels. The airborne noise at the property lines is calculated by combining eleven power modules and eleven cooling modules. The Stratford cooling module and power module noise is approximated by adding 9.5 dB to the single fuel cell data from Montville. Calculations are made for all nine locations.

Figure 4. HiAxiom East Location Looking Southeast at Longbrook Avenue

Figure 5. Proposed Fuel Cell Layout

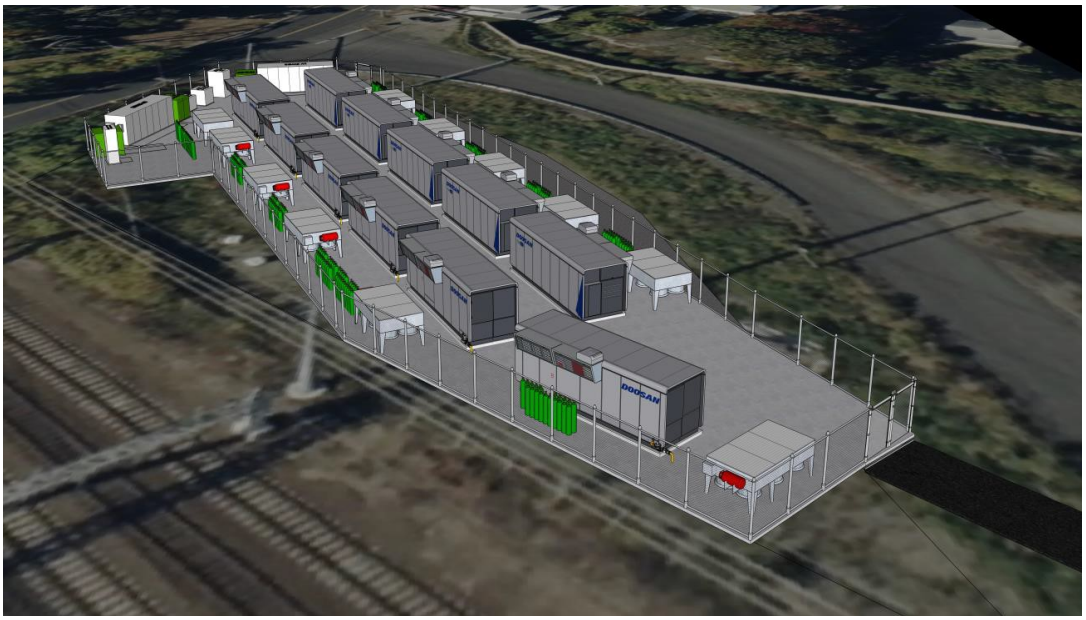


Table 1. Weather Data near Stratford on May 28, 2024
https://www.wunderground.com/history/daily/us/ct/stratford/KBDR/date/2024-5-28

Time	Temp	Dew Point	Humidity	Wind	Wind Speed	Pressure	Condit
8:16 AM	67 °F	66 °F	97 %	SW	9 mph	29.71 in	Mist
8:52 AM	67 °F	66 °F	97 %	SW	12 mph	29.70 in	Mist
9:16 AM	69 °F	65 °F	87 %	SW	9 mph	29.69 in	Mist
9:52 AM	72 °F	65 °F	78 %	SW	10 mph	29.69 in	Haze
10:09 AM	75 °F	63 °F	66 %	W	8 mph	29.68 in	Partly Cloudy
10:52 AM	75 °F	60 °F	60 %	WNW	10 mph	29.69 in	Mostly Cloudy
11:52 AM	75 °F	63 °F	66 %	SSW	17 mph	29.71 in	Mostly Cloudy
12:52 PM	76 °F	60 °F	58 %	SW	16 mph	29.70 in	Fair
1:52 PM	75 °F	59 °F	57 %	SW	14 mph	29.71 in	Fair

Data Analysis

This section analyzes the airborne noise levels measured at the Stratford site and then estimates the received level and transmission loss to nearby properties expected during actual fuel cell operation. These estimated levels will be compared to the noise limits in the Connecticut and Stratford noise ordinances. Speaker operating noise levels at the Stratford site are reported in Table 2 for the west speaker location and Table 3 for the east speaker location. Background noise levels at the Stratford site are reported in Table 4. The background data are used to correct the received speaker levels providing estimates in Table 5 of only the speaker noise contribution at each location. Table 5 also reports the transfer functions and the operating noise levels estimated for the proposed eleven new 460 KW fuel cells at 540 Longbrook Avenue.

Table 2. Overall Sound Pressure Levels in dBA ref. 20 microPascals with West Speaker On

Location	Range in Meters	Location	Leq	Max	Min	L90
Speaker On	5	West	98.4	99.1	96.1	**98.3**
Speaker On	10	West	92.4	93.3	92.1	**92.3**
West Speaker						
586 Longbrook	78	Southwest	59.9	71.6	59.2	**59.4**
26 Cottage PL	89	West	57	66.7	51.2	**51.7**
36 Cottage PL	83	West	52.1	56	49.7	**50**
44 Cottage PL	81	West	56.2	68.6	50.9	**51.2**
66 Cottage PL	81	West	52.7	66.6	51.4	**52**
585 Longbrook	94	Southwest	61.8	80.1	51.1	**61.3**
A Longbrook	70	South	69.9	74.6	65.5	**67.1**

Leq: Equivalent continuous sound level over the measurement period. – **this is normally the level to be identified as the value to be compared with the steady state overall noise requirement. Because of the heavy traffic noise, the L90 value is used instead.**

SPL MAX: Maximum one-second sound level observed during the measurement period.
SPL MIN: Minimum one-second sound level observed during the measurement period.
L90: - 90% percentile sound level –L90 is the level that is exceeded 90% of the time.
The CT State Noise Ordinance[1] identifies the L90 acoustic calculation as useful in determining background airborne noise. **This value will also be used as the background noise level.**

Table 3. Overall Sound Pressure Levels in dBA ref. 20 microPascals with East Speaker On

Location	Range in Meters	Location	Leq	Max	Min	L90
Speaker On	5	East	98.1	98.9	95.6	**98**
Speaker On	10	East	92.5	93.5	91	**90.7**
East Speaker						
450 Barnum	63	Southeast	78	80.4	75.8	**76.4**
350 Barnum	137	East	67.7	72	63.2	**64.5**

The overall airborne noise levels are about 25 dB higher for the speakers as compared to what was measured from the HiAxiom 460 KW cooling module at Montville, CT. These 25 dB differences in level were subtracted from the Stratford measured levels to estimate the expected fuel cell acoustic signature for one fuel cell. Column 4 of Table 5 provides the background corrected data for the property line measurements. The transfer function to each property line is shown in column 5 and the estimated level for eleven fuel cells in shown in column 6. The 10-meter Montville airborne noise levels were used with the Stratford transmission loss data to estimate the expected eleven fuel cell airborne noise at the nine nearby neighbors. Only the location closest to the fuel cells at 450 Barnum Street is near the 66 dBA noise limit. All the locations measured meet both the residential day time and night time noise requirements as well as the commercial noise limit.

Note: The Cottage Place measurements were made in the front yard at the driveway so the houses were not blocking the sound from the speakers. The lots on Cottage Place appear to be about 100 feet deep so measurements in the back yard could be as much as 33 meters closer than the front yard. Typical spreading loss calculations indicate this would result in as much as 4 dB higher levels in the backyard. The 4 dB increase would mean the Cottage Place residences would still be at least 12 dB below the night time noise limit.

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Table 4. Overall Sound Pressure Levels in dBA ref. 20 microPascals with **Speakers Off**

Location	Range in Meters	Direction	Leq	Max	Min	L90
586 Longbrook	78	Southwest	52.5	54.7	51.3	51.5
26 Cottage PL	89	West	52.8	57	50.3	51.3
36 Cottage PL	83	West	51.3	53.8	49.4	50.1
44 Cottage PL	81	West	49.3	54.1	46.6	47.6
66 Cottage PL	81	West	54.0	68.7	46.7	47.2
585 Longbrook	94	Southwest	54.2	79.4	53.2	53.4
A Longbrook	70	South	57.0	62.3	548	55.0
450 Barnum	63	Southeast	56.4	59.4	54.4	55.0
350 Barnum	137	East	58.4	60.5	56.5	57.5

Table 5. Background Corrected L90 Sound Pressure Levels in dBA ref. 20 microPascals

Location	Range in Meters	Direction	L90 Estimate	Transfer Function	Property Line	Night Spec	Over Spec
West Speaker			In dBA	In dB	dBA	dBA	dBA
586 Longbrook	78	Southwest	58.7	-33.6	42.4	51	-8.6
26 Cottage PL	89	West	48.9	-43.4	32.6*	51	-18.4
36 Cottage PL	83	West	47	-45.3	30.7*	51	-20.3
44 Cottage PL	81	West	49.6	-42.7	33.3*	51	-17.7
66 Cottage PL	81	West	50.8	-41.5	34.5*	51	-16.5
585 Longbrook	94	Southwest	60.6	-31.7	44.3	66	-21.7
A Longbrook	70	South	66.8	-25.5	50.5	66	-15.5
East Speaker							
450 Barnum	63	Southeast	76.4	-14.3	61.7	66	-4.3
350 Barnum	137	East	63.7	-27	49	66	-17

Note: * Backyard noise levels could be as much as 4 dB higher than front yard levels

Allowable Noise Levels

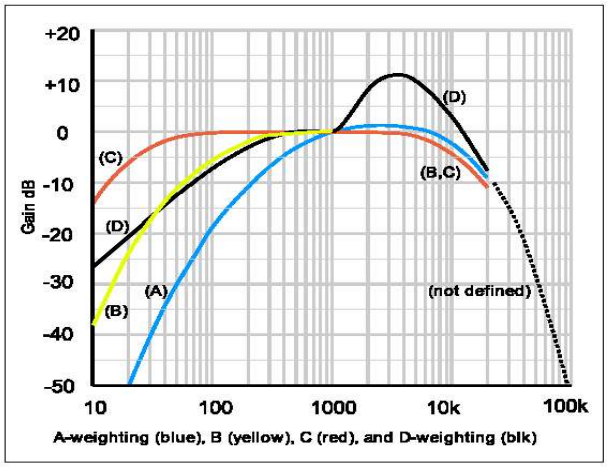
Connecticut's regulation for the control of noise provides in *CT section 22a-69*-3[1] the requirements for noise emission in Connecticut. *Section 22a-69*-3.1 states that no person shall cause or allow the emission of excessive noise beyond the boundaries of his/her Noise Zone so as to violate any provisions of these Regulations. The CT ordinance will be used to evaluate the noise generated by the HiAxiom 460 KW Fuel Cells. (The Stratford noise ordinance has the same noise limits.) Following sections discuss each type of noise using the results obtained from the May 28, 2024 speaker measurements in Stratford and the HiAxiom 460 KW fuel cell test in Montville, CT reported on July 13, 2020.

The Stratford site is located in an Industrial Zone on Longbrook Avenue and is surrounded by Residential and Commercial Zones. The closest residential zone on Cottage Place is about 40 meters away. Based on the analysis resulting in Table 5 the airborne noise from the eleven new fuel cells should be well below the 51 dBA noise limit at distances greater than 40 meters. All residential properties at greater distances are expected to be well below the day time and night time Residential Zone noise limits for an emitter in an Industrial zone. The closest commercial zone on Barnum Road is about 45 meters away. Based on the analysis resulting in Table 5, the airborne noise from the eleven new fuel cells should be well below the 66 dBA noise limit at distances greater than 45 meters. All other commercial properties at greater distances are expected to be well below the Commercial Zone noise limits for an emitter in an Industrial zone.

Impulse Noise

The Connecticut noise code states in *CT section 22a-69*-3.2 (part a) *Impulse Noise* that no person shall cause or allow the emission of impulse noise in excess of 80 dB peak sound pressure level during the night time to any class A Noise Zone. Night time is defined as 10 pm to 7 am. *CT section 22a-69-3.2 (part b) Impulse Noise* states that no person shall cause or allow the emission of impulse noise in excess of 100 dB peak sound pressure level at any time to any Noise Zone. The Stratford noise ordinance sets the same limits for Impulse Noise.

Figure 6. Acoustic Airborne Noise Weighting Curves



Impulse noise in excess of 80 dBA was not observed during any of the ten property line measurements of the Doosan 460 KW fuel cell made at the Montville site on 7 July, 2020[3]. The maximum level measured was 79.7 dBA at location P2 using the ExTech sound level meter. This and the other levels above 70 dBA were caused by vehicle traffic and not by the fuel cell. Unweighted impulse noise levels were determined using a Hewlett Packard HP3561A spectrum analyzer. (The maximum level ten meters from the fuel cell was 77 dBA.) The closest Stratford property showed 14 dB of transmission loss so the highest expected level would be below 64 dB. Given the steady state nature of the fuel cell's noise signature there should be no acoustic issues with the State of Connecticut's or the Town of Stratford's impulse noise requirements.

A few words are in order to discuss the difference between A-weighted and un-weighted impulse noise. A-weighting emphasizes the middle and higher frequencies while reducing the influence of the low frequencies. Figure 6 above plots the A-weighting curve versus frequency in blue. Below a frequency of 1 kiloHertz the acoustic level is attenuated by increasing amounts. The reduction is about 10 dB at 200 Hertz, 20 dB at 90 Hertz and 30 dB at 50 Hertz. It also reduces the level at very high frequency being down in level by 10 dB at 20 kiloHertz. The fuel cell measurements show the unweighted overall levels to be about 9 dB higher than the A-weighted noise levels. Adding 9 dB to the Montville measured levels brings the peak impulse up to about 73 dB reference 20 microPascals. The impulse noise levels on Barnum Road should be no higher than 73 dB reference 20 microPascals, well below both the 80- and 100-dB limits.

Prominent Discrete Tones

The Connecticut regulation for the control of noise states in *CT section 22a-69-3.3 Prominent discrete tones:* Continuous noise measured beyond the boundary of the Noise Zone of the noise emitter in any other Noise Zone which possesses one or more audible discrete tones shall be considered excessive noise when a level of 5 dBA below the levels specified in section 3 of these Regulations is exceeded. The CT Regulations establish different noise limits for different land use zones. Residential (homes and condominiums) and hotel uses are in Class A. Schools, business, parks, recreational activities and government services are in Class B. Forestry and related services are in Class C. By my reading of the regulations the Stratford fuel cells are a Class C emitter in an Industrial Zone. The noise zone standards in *CT section 22a-69-3.5* state that a Class C emitter cannot exceed the following overall sound pressure levels:

To Class C 70 dBA To Class B 66 dBA To Class A 61 dBA (day) 51 dBA (night)

The discrete tones limits are 5 dBA lower so that no tone may be higher than the following:

To Class C 65 dBA To Class B 61 dBA To Class A 56 dBA (day) 46 dBA (night)

The Stratford noise ordinance does not discuss discrete tones so the CT Noise Ordinance will be used. To address the discrete tone issue, we use measured spectral data from the Reference 3 Montville testing. The data is the maximum level received in 1/30 octave bands for frequencies from 0.32 to 100,000 Hz. Figure 7 plots the airborne noise measured 10 meters from the Cooling and Power Modules in 1-30th octave bands. This figure shows some discrete tones in the middle

frequencies produced by the HiAxiom Fuel Cell Cooling and Power Modules. The eight largest tones are given in Table 6. The highest is 55.1 dB reference 20 microPascals at 302 Hz. The second highest tone is at 213.8 Hz at a level of 54.3 dB reference 20 microPascals. All the remaining tones are below 53 dBA. The A-weighted discrete tone corrections are given in the 4th row of Table 6. Incorporating the transmission loss to the properties gives the A-weighted levels in the last five rows of Table 6 after the 9.5 dB correction for eleven units is added. All the frequencies at the nearest residences on Cottage Place have levels that are at least 15 dB below the 46 dBA requirement in a Residential Zone. All the nearby residential properties should meet all the discrete tone requirements. The closest commercial property is given in the last row of Table 6. The expected level is at least 10 dB below the limit of 61 dBA. There should be no acoustic issue with the CT discrete tone noise requirements at any of the nearby properties.

Figure 7. Montville Tones 460 KW Fuel Cell Cooling & Power Modules in 1-30th octave bands

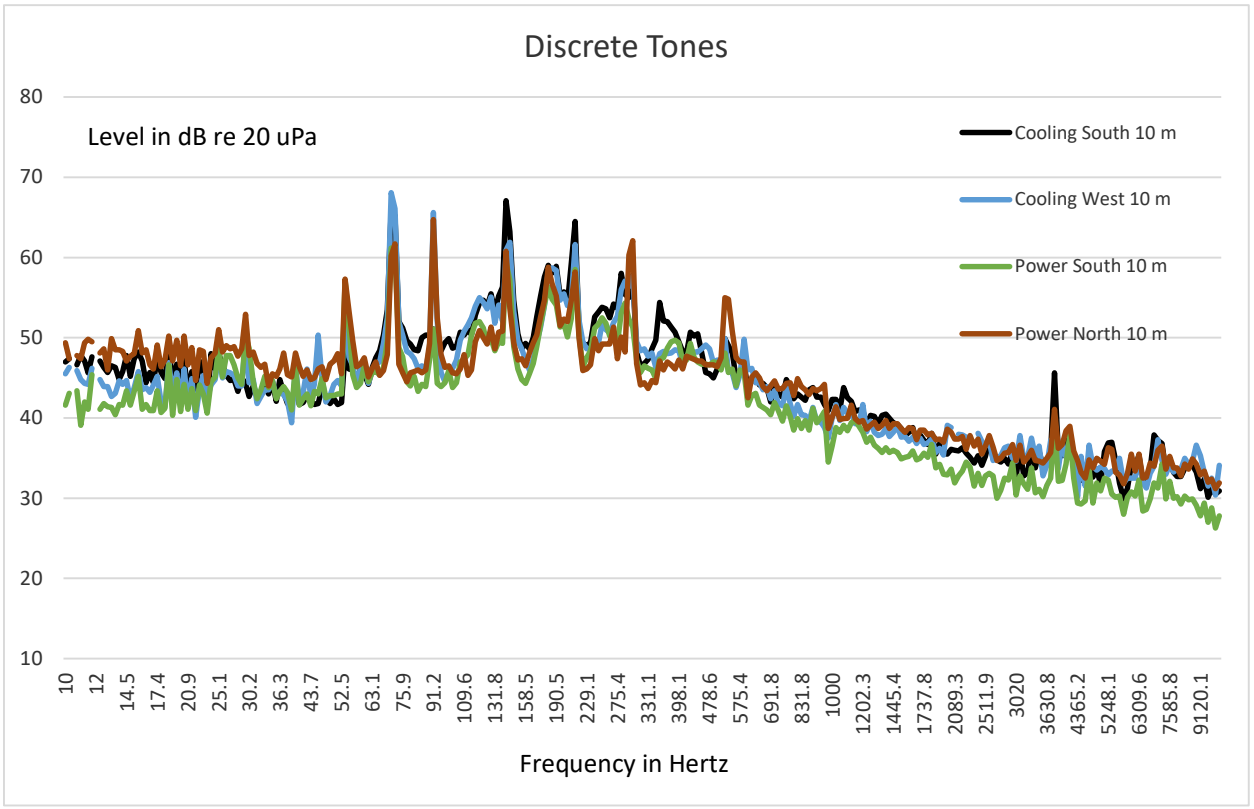


Table 6. Peak Discrete Sound Pressure Level Estimates in dB ref. 20 microPascals

Location	Range Meters	53.7 Hz	70.8 Hz	91.2 Hz	141.3 Hz	213.8 Hz	302 Hz	3801 Hz	4169 Hz
Allowed Level		**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
Montville	10	57.3	68.1	65.6	67.1	64.5	62.1	45.6	39
A Weighting		-29.0	-24.3	-20.5	-14.7	-10.2	-7.0	1.0	0.9
Stratford 1 unit	10	28.3	43.8	45.1	52.4	54.3	55.1	46.6	39.9
11 Fuel Cells	10	37.8	53.3	54.6	61.9	63.8	64.6	56.1	49.4
586 Longbrook	78	4.2	19.7	21	28.3	30.2	31	22.5	15.8
26 Cottage PL	89	-5.6	9.9	11.2	18.5	20.4	21.2	12.7	6
36 Cottage PL	83	-7.5	8	9.3	16.6	18.5	19.3	10.8	4.1
44 Cottage PL	81	-3.7	11.8	13.1	20.4	22.3	23.1	14.6	7.9
450 Barnum	63	23.5	39	40.3	47.6	49.5	50.3	41.8	35.1

Infrasonic and Ultrasonic Noise

The Connecticut regulation for the control of noise states in *CT section 22a-69-3.4 Infrasonic and Ultrasonic* that no person shall emit beyond his/her property infrasonic or ultrasonic sound in excess of 100 dB at any time. 100 dB with respect to the reference of 20 microPascals is a sound pressure of 2 Pascals or 0.00029 psi. Infrasonic sounds are sound pressure fluctuations below a frequency of 20 Hertz. Ultrasonic sounds are sound pressure fluctuations at frequencies above 20,000 Hertz. There is no mention in the Stratford Noise Ordinance that limits infrasonic or ultrasonic noise so the State of CT Noise Ordinance will be used.

Narrow bandwidth sound pressure spectrums in dB reference 20 microPascals made at the Montville western 10-meter Cooling Module location can be used to compare with the infrasonic and ultrasonic noise requirements. The Montville airborne noise data were processed in the 0 to 200 Hertz and 0 to 100,000 Hertz frequency ranges. The bandwidth of each data point is 0.75 Hertz for the 200 Hertz range and 375 Hertz for the 100,000 Hertz frequency range. The infrasonic noise for frequencies up to 20 Hertz is shown in Figure 8 for the 460 KW unit at Montville[3]. The maximum level at 10 meters is 48 dB reference 20 microPascals. The entire 20 Hertz band can be power summed and never exceeds 70 dB reference 20 microPascals at 10 meters in Montville. After subtracting 14.3 dB for the maximum transfer function correction at Point P8, the closest site, and adding the gain of 9.5 dB for eleven units, the 65.2 dB level is well below the Infrasonic requirement of 100 dB for the Stratford site. The noise levels at all the other nearby residential and commercial neighbors will be lower. There should be no issue with the infrasonic noise requirement at any of the neighboring residential properties.

The ultrasonic noise for frequencies up to 100 KiloHertz is given in Figure 9. The Montville data uses a microphone with flat high frequency performance and provides a good estimate for

the 460 KW fuel cell. The entire 80 KiloHertz band from 20 to 100 kiloHertz has been power summed and never exceeds a noise level of 62 dB reference 20 microPascals 10 meters from the fuel cell at Montville. After subtracting 14.3 dB for the maximum transfer function correction at Point P8, the closest site, and adding the gain of 9.5 dB for eleven units, the ultrasonic level of about 57.2 dB is well below the requirement of 100 dB for the Stratford site. The noise levels at all the other nearby residential and commercial neighbors will be lower and there should be no issue with ultrasonic noise at any of the neighboring properties.

Figure 8. Infrasonic Noise from Montville Fuel Cell Cooling Modules in 1-30th octave bands

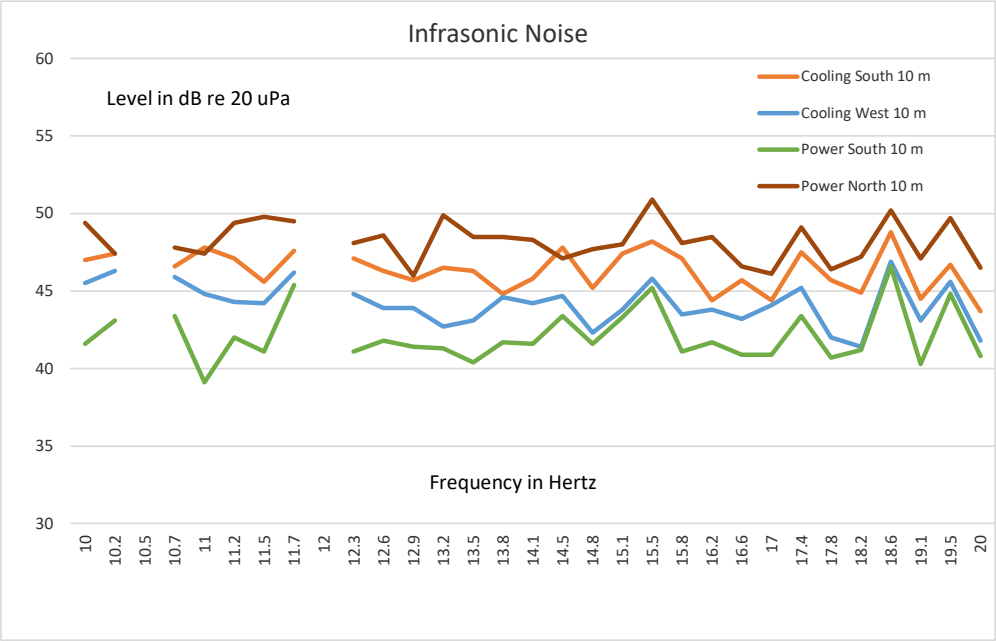
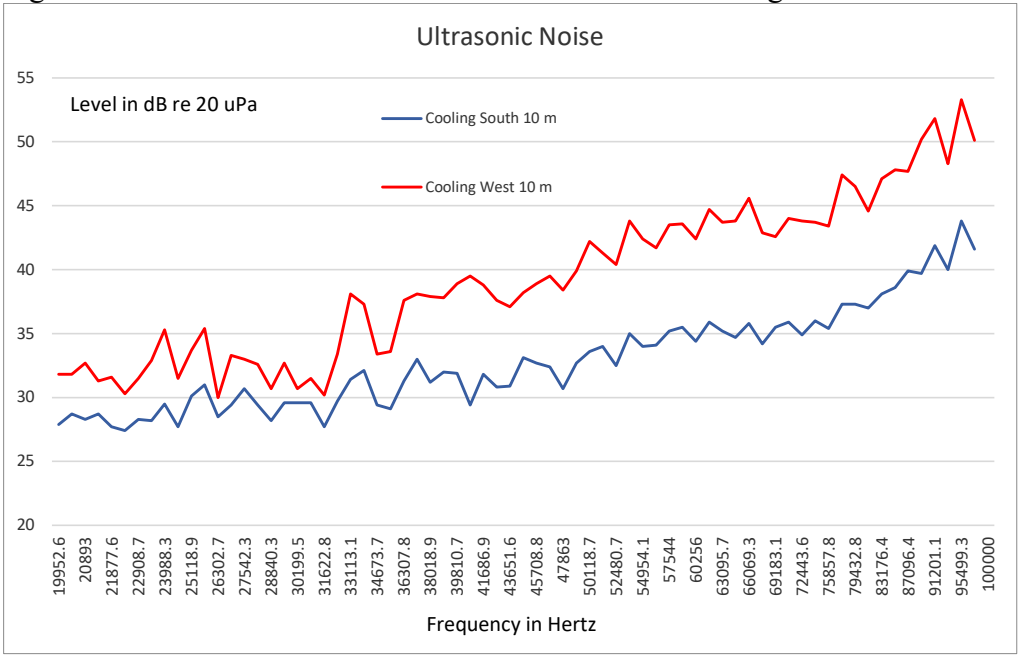


Figure 9. Ultrasonic Noise from Montville Fuel Cell Cooling Modules in 1-30th octave bands



Overall Sound Pressure Levels

The Connecticut regulations for the control of noise state that
(a) No person in a Class C Noise Zone shall emit noise exceeding the levels below:

To Class C 70 dBA To Class B 66 dBA To Class A 61 dBA (day) 51 dBA (night)

The Stratford site is in an Industrial Zone that has surrounding Residential and Commercial Zones. The nearby neighbors in RS-4 residential zones have airborne noise limits of 61 dBA during the day and 51 dBA at night. The Commercial Zone limit is 66dBA.

The estimated overall A-weighted sound pressure levels for eleven fuel cells in dBA reference 20 microPascals are given in column 6 of Table 5 above using the background corrected measurements made on May 28, 2024. The second column gives the approximate distance from the fuel cells to the measurement location, with locations identified by a P number in Figure 2. Column 3 gives the direction from the fuel cell to the property. The airborne noise values given in columns 4 are the estimated received level for one speaker. Transfer functions in column 5 provide the loss in sound level from the fuel cells to the property lines. The values in column 6 provide the estimated airborne noise levels at the property lines with eleven fuel cells operating. The values are all below both the residential and commercial noise limits. Operation of the eleven HiAxiom fuel cells will have no significant acoustic impact on the nearby properties adjacent to the HiAxiom fuel cell site on Longbrook Avenue.

All of the nearby residential and industrial properties should not be affected by the operation of the eleven fuel cells.

Conclusions

The purpose of this effort is to evaluate the acoustical environment at the Stratford site during operation of the eleven HiAxiom 460 KW fuel cells. This effort has been accomplished and the results show that the operation of the eleven HiAxiom 460 KW fuel cells will meet all of the State of Connecticut and Town of Stratford airborne noise requirements at all the nearby properties. All the residences should be more than 8 dB below the night time noise requirement while all commercial properties should be more than 4 dB below the commercial requirement.

References

1) CT DE&EP *Noise Control Regulation RCSA Section 22a-69*-1 to 22a-69-7.4
http://www.ct.gov/dep/lib/dep/regulations/22a/22a-69-1through7.pdf

2) Stratford Noise Ordinance, stratfordnoiseordinancepdf.pdf

3) Town of Montville Water Pollution Control Authority Airborne Noise Test
At 83 Pink Row, Acoustical Technologies Inc., July 13, 2020

NOW THEREFORE, IT IS HEREBY ORDERED, that a DG Certification, Executive Order DG-047 is granted.

This DG Certification:

1) is subject to all conditions and requirements of the ARB's DG Certification Program, article 3, title 17, CCR, including the provisions relating to inspection, denial, suspension, and revocation; and

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; and

3) shall expire on the 5th day of April, 2023.

Executed at Sacramento, California, this 6th day of April 2018.

/S/

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

(1) Any object that will be shielded by existing structures of a permanent and substantial nature or by natural terrain or topographic features of equal or greater height, and will be located in the congested area of a city, town, or settlement where the shielded structure will not adversely affect safety in air navigation;

(2) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device meeting FAA-approved siting criteria or an appropriate military service siting criteria on military airports, the location and height of which are fixed by its functional purpose;

(3) Any construction or alteration for which notice is required by any other FAA regulation.

(4) Any antenna structure of 20 feet or less in height, except one that would increase the height of another antenna structure.

DISCLAIMER

Doosan Fuel Cell America reserves the right to change or modify, without notice, the design or equipment specifications of the PureCell® system Model 400 without obligation with respect to equipment either previously sold or to be sold. This guide is provided by Doosan Fuel Cell America, and no liability will accrue to Doosan Fuel Cell America based on the information or specifications included herein. No warranties or representations are made by this guide and no warranties or representations shall apply to the equipment except as stated in Doosan Fuel Cell America's standard terms and conditions of sale applicable at the time of purchase, a copy of which will be provided upon request. The Model 400 is designed to provide safe and reliable service when operated within design specifications, according to all applicable instructions, and with the appropriate operating materials. When operating this equipment, use good judgment and follow safety precautions to avoid damage to equipment and property or injury to personnel. Be sure to understand and follow the procedures and safety precautions contained in all applicable instructions, Owner's Manual, operating materials, and those listed in this guide. All information in this document is as of ~~August 21, 2018~~February 28, 2019.

Policy

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The following plan has been developed to minimize the severity of damage to human health, the environment, and property in the event of an unexpected failure.

Scope

This Emergency Response Guide shall be integrated into the site Fire Prevention and Emergency Response Plan. Information contained in this document shall be customized to meet local requirements and shall be shared with local responders as necessary. This guide is only a template and in no way assumes or transfers liability or ownership. Doosan Fuel Cell America should be contacted if clarification is needed.

Emergency Contacts and Numbers

Local Emergency Number	**911**
Doosan Fuel Cell America Control Center	**(860) 727-2847**
Clean Harbors Emergency Cleanup Response	(800) 645-8265
Fire Department – Non-emergency number	Stratford Fire Department (203) 385-4070 ~~[Phone n~~
Hospital – Non-emergency number	Bridgeport Hospital Milford Campus 300 Seaside Avenue Milford, CT 06460 203-876-4000~~Hartford Healthcare Medical Group~~ ~~1 Buckland Road, Suite 7 South Windsor CT~~ ~~860-698-4301~~
Electric Utility Name: United Illuminating Company~~Eversource Energy~~	**203-929-1730** **~~888-783-6617~~**
Gas Utility Name: Connecticut Natural Gas/Southern Connecticut Gas~~Eversource~~	**~~888-688-7267~~** **~~*Gas Leaks Only: 877-944-5323~~** 203-499-3417 *Gas Leaks Only: 800-513-8898
Local Oil & Chemical Spill Response Division	**800-645-8265**~~**800-645-8265**~~
~~Connecticut Oil & Chemical Spill Response Division~~	~~**860-424-3338**~~
EPA - Environmental Protection Agency ~~[LOCAL REGION]~~	**(800) 424-8802** Environmental Emergency

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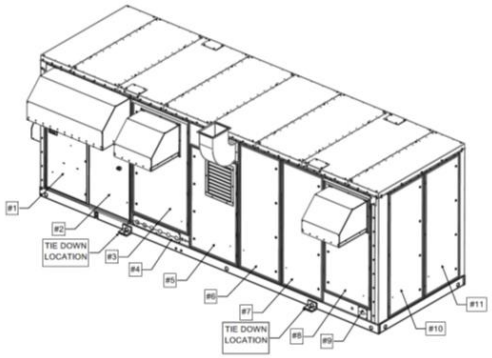
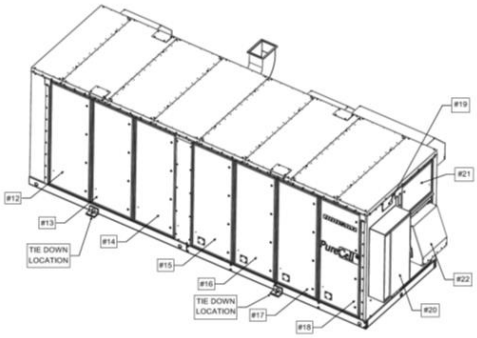
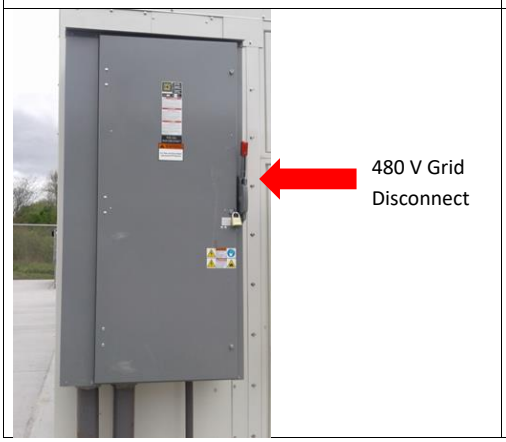
OSHA - Occupational Safety and Health Admin. Emergency Number	**(800) 321-6742** National Emergency Number
Poison Control Center	**(800) 222-1222** National Emergency Number

Fuel Cell Hazard Overview

Front	Back
	

Rear View	Front View
	

Rear View Panel	Primary Hazard	Front View Panel	Primary Hazard
1 (Computer Terminal)	Electrical = 120 VAC	**12 (Reformer)**	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
		13 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
2 (Swing Door)	Electrical = 480 VAC	**14 (Reformer)**	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
3 (Mechanical Entry)	Electrical = 480 VAC Chemical = Propylene Glycol Thermal = 350°F Steam Pressure = 150 psi Steam	**15 (DC Cell Stack)**	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
4 (Mechanical Entry)	Chemical = Propylene Glycol Thermal = 350°F Steam Pressure = 150 psi Steam	**16 (DC Cell Stack)**	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
5 (TMS)	Electrical = 480 VAC Chemical = Propylene Glycol / Deionized Water / Resin Thermal = 350oF Steam Pressure = 150 psi Steam	**17 (DC Cell Stack)**	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
6 (ILS)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**18 (DC Cell Stack)**	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
7 (Fuel Processing Area)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**19**	Not accessible
8 (Fuel Processing Area)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**20 (Grid Connect Disconnect)**	Electrical = 480 VAC
9 (Gas/Nitrogen Inlet)	Chemical = combustibles	**21 (Blower 110)**	Electrical = 300 VDC Mechanical = Blower
10 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**22**	Electrical = 1400 VDC / 480 VAC
11 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**ALL Roof Panels**	Multiple Hazards DO NOT WALK ON ROOF!

Conditional Assessment

Normal Condition	Potential Abnormal Condition	Response
Fuel Cell White steam exiting power plant at exhaust chimney, above panel #6 (It can be a large amount of white steam depending on ambient conditions)	Dark colored smoke exiting chimney or any other part of enclosure	1. Establish safe perimeter 2. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
	Observable fire or heavy smoke at any point on fuel cell	1. Press Fuel Cell 'Stop Button' – Only if safely accessible! 2. Dial 911 or Local Emergency Response Number 3. Establish safe perimeter 4. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Fuel Cell Moderate humming, clicking and fan sounds	Grinding or loud intermittent noises	1. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
	Observable fire or heavy smoke at any point on fuel cell	1. Press Fuel Cell 'Stop Button' – Only if safely accessible! 2. Dial 911 or Local Emergency Response Number 3. Establish safe perimeter 4. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Cooling Module Fan humming	Smoke or fire coming from module	1. Press Fuel Cell 'Stop Button' – Only if safely accessible! 2. Dial 911 or Local Emergency Response Number 3. Establish safe perimeter 4. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**

	Grinding or loud noise coming from fans	1.	Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Cooling Module No leaking from cooling loop piping or coils	Small leak dripping from joint, valve or connection	1.	Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
	Medium to large leak	1. 2.	Follow local spill response protocol or contact Clean Harbors Emergency Cleanup Response **(800) 645-8265** Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Mechanical Hi/Lo Grade Piping Small amounts of condensate dripping from piping	Small leak dripping from joint, valve or connection	1.	Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
	Medium to large leak	1. 2.	Follow local spill response protocol ~~or contact Clean Harbors Emergency Cleanup Response (800) 645-8265~~ Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Disconnects/Other Equipment No leaks or smoke	Smoke or fire coming from equipment	1. 2. 3.	Dial 911 or Local Emergency Response Number Establish safe perimeter Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Compressed Gas Manifold (N2/H2) No leaks, May hear intermittent gas flow during purges	Leaks – may be able to hear hissing sound.	1. 2. 3.	**If Indoors – Evacuate Immediately!** Dial 911 or Local Emergency Response Number Establish safe perimeter Contact Doosan Fuel Cell America Control Center **(860) 727-2847**

Fuel Cell Related Safety Data Sheets (SDS)

1	Propylene Glycol – DowFrost®
2	Phosphoric Acid – Solid
3	Reformer/ILS Catalysts
4	Anion/Cation Resin
5	Nitrogen / Hydrogen Compressed Gas Mixture (non-flammable)

Inspections

Inspection Type	Equipment Requirements	Frequency Required
General Maintenance	Laptop, Service Vehicle	Monthly
General Housekeeping	N/A	Daily
Waste and Chemical Storage*	N/A	Weekly
Internal Combustible Gas Monitor	AT-160 Calibration Kit	Annual
Fire Prevention	N/A	Monthly

*When applicable

General Houskeeping: Combustible materials should not be stored near power plant. Keep combustible materials at least five feet away from power plant.

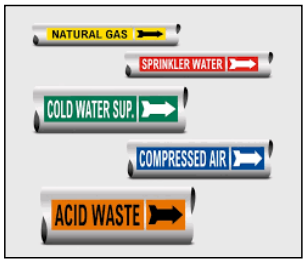
Fuel Cell operation is monitored and controlled remotely 24 hours a day 7 days a week by the Doosan Fuel Cell America Control Center. Upset or abnormal occurrences outside of normal operating parameters are immediately identified and service technicians are dispatched within 24 hours to respond when required.

Emergency Procedures

Alarms	There are no audible or visual alarms on Fuel Cell. Alarm conditions are relayed immediately to the Doosan Fuel Cell America Control Center. The Doosan Fuel Cell America Control Center will then contact the appropriate site personnel on the site's emergency contact list.
Emergency Shut Down Onsite	Actuate Fuel Cell Stop Button
Emergency Area Egress - Gas Odor	Evacuate 330 Feet in all directions
Emergency Area Egress - Fire	Evacuate employees and visitors no directly involved in fire-fighting activities 330 Feet in all directions – ~~CV000 automatic natural gas supply shut off~~ Notify fire response personnel. Coordinate with security forces or other designated personnel to admit pulic fire department and control traffic and personnel. There are no restrictions for type of fire suppression

	equipment. CV000 automatic natural gas supply shut off will engage through tripping of power plant thermal fuses or by depressing the Fast Stop button. No further power plant interaction is required. If necessary, a Fire Report should be filed, investigation conducted and corrective actions identified.
Emergency Egress - General	Fuel cell is unmanned remotely monitored and controlled. No Doosan Fuel Cell America employees attending unit unless service or maintenance is required.

Signage and labeling



General:

Safety Hazard Analysis

The PureCell® Model 400 fuel cell system has been designed to meet strict ANSI/CSA safety standards to protect against risks from electrical, mechanical, chemical, and combustion safety hazards. The following items are a few of the safety measures incorporated into the design.

Fire Detection and Protection:

The power plant design incorporates a combustible gas sensor as well as thermal fuses located throughout the power module cabinet to detect fire. The detection of a potential flammable gas mixture, a fire, or the failure of this detection circuit will result in a power plant shutdown and a subsequent inert gas (nitrogen) purge of the fuel cell stack and fuel processing system. This event will also result in an alarm callout notification to Doosan Fuel Cell America service personnel. The power plant is designed with an integral emergency-stop button on the outside of the enclosure to enable immediate shutdown in the event of an emergency. There is also a gas shut-off valve and electrical disconnect switch easily accessible to emergency personnel. There are no restrictions for type of fire suppression equipment.

Gas Leak:

Augmenting the internal combustible gas sensor, the power plant also monitors the flow rate of natural gas. If the gas flow rate exceeds the equivalent power production of the power plant then a shutdown will result. The largest possible accumulation from a leak prior to shutdown is below combustible limits. Fuel valves inside the power plant are “fail safe” and will return to their normally closed position upon loss of power. The power plant is designed to have a physical barrier that separates the equipment handling combustible gases (fuel compartment) from electrical or potential spark-creating equipment (motor compartment). The fuel compartment is kept at a negative pressure to contain and remove any potential gas leaks, whereas the motor compartment is pressurized by a fan source to prevent combustible gases from entering.

Hydrogen:

Hydrogen is lighter than air and thus does not pool like other fuels and will readily dissipate with proper ventilation making it less likely to ignite. Although hydrogen has low self-ignition characteristics, the fuel in the power plant is not pure hydrogen. Also, the power plant is not producing or storing hydrogen, it consumes hydrogen-rich gas equal to what it requires to produce power. The fuel cell stack is wrapped in a fire retardant blanket. There are no materials inside the unit that would sustain a flame. There is no large volume of gas or any ignition that occurs within the cell stack.

Phosphoric Acid:

Phosphoric acid is integral part of the fuel cell system, acting as the electrolyte within the fuel cell stack. Phosphoric acid is a surprisingly common substance that is contained in common cola drinks. A leak of phosphoric acid is not possible because phosphoric acid is not in liquid form once applied in the equipment. There is no reservoir of liquid. Phosphoric acid is contained in the porous structure of the fuel cell stack material by capillary action, similar to how ink is absorbed into a blotter.

Fluid Leaks:

All pressurized water vessels are designed to ASME boiler codes and inspected annually. All piping, welds, etc. meet pressurized piping standards. There are three fluid sources inside the fuel cell power module:

1) Water produced through the electrochemical process is “pure” water and is reclaimed and reused by the process.
2) Fluid used in the external cooling module, which is water mixed with a polypropylene glycol and a rust inhibitor to prevent rust and freezing in colder climates.
3) Fluid used in the heat recovery loops, this is the same glycol solution used in the external cooling module.

If a leak is observed around the fuel cell power module or absorption use a gray or blue absorbent mat, pad, or boom to contain the leak and prevent it from entering any drains. Contact Doosan Fuel Cell America, Inc Control Center for further assistance in identifying the leak source.

Transformers:
NEMA 3R, OIL FILLED, LESS FLAMMABLE OIL, 13.8 KV DELTA PRIMARY, 480-277V GROUNDED WYE SECONDARY, UL LISTED total oil capacity 950 gallons.

Methods and material for containment and clean up.

1. Large spills: Dike area to contain spill. Knock down and dilute vapors with water fog or spray. Collect with vacuum equipment or inert materials. Approach release upwind.
2. Small spills: Absorb with non-combustible liquid-binding material (sand, diatomaceous earth (clay), acid binders, universal binders). Remove with shovel. Collect in suitable and properly labeled containers. Wash surfaces with aqueous cleaner and hot water. Used rags or other cleaning materials should be soaked with water and placed in a sealed container to prevent spontaneous combustion. Dispose of contents/container in accordance with local regulations.

Hazardous Waste:

The fuel cell does not produce any hazardous waste. Standard Material Safety Data Sheets (MSDS) are available upon request.

APPENDIX A — FUEL CELL AND ANCILLARY EQUIPMENT DAILY CHECKLIST

⚠ CAUTION

This checklist has been developed as a guide. It is not intended to provide a comprehensive list of all possible hazards or risks. At no time are you authorized to open or manipulate any equipment, including but not limited to the fuel cell, cooling module, or liquid chiller.

If you observe an EMERGENCY, use your local emergency notification protocol and then notify Doosan Control Center at (860) 727-2847.

Month: _____	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*
General Housekeeping																															
1.Safe access is provided to/from fuel cell location (snow and ice removed - 48" parameter around fuel cell and 48" wide cleared access, lighted access, etc.)																															
2. No construction or other hazards/risks exist																															
3. Access gate is locked/secured (site specific)																															
4. No combustible material within 60” of PPLT																															
Fuel Cell																															
1. Doors are closed and appear secured																															
2. Fuel cell appears to be operating as normal																															
a. No leaks																															
b. No smoke or burning smell (if the fuel cell is running, steam will come out of chimney - this is normal)																															
4. No strong natural gas (mercaptan) smell is observed																															
5. No leaks or discharges are coming from mechanical piping to/from fuel cell																															

APPENDIX 1 – SAFETY DATA SHEETS

SAFETY DATA SHEET

1. Identification

Product identifier: PHOSPHORIC ACID

Other means of identification

Synonyms: Ortho-Phosphoric Acid, White Phosphoric Acid

Product No.: 0240, 6908, 2798, 2797, 5854, 2796, 5804, 2788, 0259, 5372, 0274, 0269, 0268, 0265, 0264, 0262, 0260, 0255, 0251

Recommended use and restriction on use

Recommended use: Not available.

Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:

24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Corrosive to metals	Category 1

Health hazards

Acute toxicity (Oral)	Category 4
Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1
Specific target organ toxicity - single exposure	Category 3

Unknown toxicity

Acute toxicity, oral	0 %
Acute toxicity, dermal	0 %
Acute toxicity, inhalation, vapor	100 %
Acute toxicity, inhalation, dust or mist	100 %

Unknown toxicity

Acute hazards to the aquatic environment	84 %
Chronic hazards to the aquatic environment	84 %

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement:
May be corrosive to metals.
Harmful if swallowed.
Causes severe skin burns and eye damage.
May cause respiratory irritation.

Precautionary statement

Prevention: Keep only in original container. Do not breathe dust/fume/mist/vapors. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling.

Response: Absorb spillage to prevent material damage. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.

Storage: Store locked up. Store in a well-ventilated place. Keep container tightly closed. Store in corrosive resistant container with a resistant inner liner.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
PHOSPHORIC ACID		7664-38-2	80 - 90%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion:	Do NOT induce vomiting. Call a physician or poison control center immediately. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Inhalation:	Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.
Skin contact:	Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.
Eye contact:	Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms:	Causes severe skin and eye burns. Causes digestive tract burns.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards:	No data available.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	The product is non-combustible. Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media:	None known.
Specific hazards arising from the chemical:	Not combustible, but if involved in a fire decomposes to produce toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Product is highly acidic. Wear protective gear if spilled during fire fighting.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	See Section 8 of the MSDS for Personal Protective Equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Keep unauthorized personnel away. Keep upwind. Ventilate closed spaces before entering them.

Methods and material for containment and cleaning up:	Neutralize with lime or soda ash. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. Handling and storage

Precautions for safe handling:	Do not get in eyes, on skin, on clothing. Do not taste or swallow. Wash thoroughly after handling. Do not eat, drink or smoke when using the product. Use caution when adding this material to water. Add material slowly when mixing with water. Do not add water to the material; instead, add the material to the water.
Conditions for safe storage, including any incompatibilities:	Do not store in metal containers. Keep container tightly closed. Store in a well-ventilated place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
PHOSPHORIC ACID	TWA	1 mg/m3	US. ACGIH Threshold Limit Values (2011)
	STEL	3 mg/m3	US. ACGIH Threshold Limit Values (2011)
	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	STEL	3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	1 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	3 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	1 mg/m3	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
	STEL	3 mg/m3	US. Tennessee. OELs. Occupational Exposure Limits, Table Z1A (06 2008)
	ST ESL	10 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (12 2010)
	AN ESL	1 µg/m3	US. Texas. Effects Screening Levels (Texas Commission on Environmental Quality) (12 2010)
	TWA PEL	1 mg/m3	US. California Code of Regulations. Title 8, Section 5155. Airborne Contaminants (08 2010)
	STEL	3 mg/m3	US. California Code of Regulations. Title 8, Section 5155. Airborne Contaminants (08 2010)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.
Eye/face protection:	Wear safety glasses with side shields (or goggles) and a face shield.
Skin protection	
Hand protection:	Chemical resistant gloves
Other:	Wear suitable protective clothing and gloves.
Respiratory protection:	In case of inadequate ventilation use suitable respirator. Respirator type: Chemical respirator with acid gas cartridge.
Hygiene measures:	Provide eyewash station and safety shower. Observe good industrial hygiene practices. Wash hands before breaks and immediately after handling the product. Wash contaminated clothing before reuse. Avoid contact with eyes. Avoid contact with skin.

9. Physical and chemical properties

Appearance	
Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	1.5 0.1 N Aqueous solution
Melting point/freezing point:	21.1 °C
Initial boiling point and boiling range:	158 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	0.3 kPa
Vapor density:	No data available.
Relative density:	1.69 (20 °C)
Solubility(ies)	
Solubility in water:	Miscible with water.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity: No dangerous reaction known under conditions of normal use.

Chemical stability: Material is stable under normal conditions.

Possibility of hazardous reactions: Hazardous polymerization does not occur.

Conditions to avoid: Avoid contact with oxidizing agents. Avoid contact with strong reducing agents. Contact with alkalis.

Incompatible materials: Strong reducing agents. Alkalies. Strong oxidizing agents. Metals.

Hazardous decomposition products: oxides of phosphorus

11. Toxicological information

Information on likely routes of exposure

Ingestion: Harmful if swallowed.

Inhalation: Severely irritating to respiratory system.

Skin contact: Causes severe skin burns.

Eye contact: Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: ATEmix (Rat): 1,700 mg/kg

Dermal
Product: ATEmix (): 3,044.44 mg/kg

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: Causes severe skin burns.

Serious eye damage/eye irritation
Product: Causes serious eye damage.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: None known.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: Not classified

Other effects: Not known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Chronic hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Toxicity to Aquatic Plants
Product: No data available.

Persistence and degradability

Biodegradation
Product: Expected to be readily biodegradable.

BOD/COD ratio
Product: No data available.

Bioaccumulative potential
Bioconcentration factor (BCF)
Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)
Product: No data available.

Mobility in soil: The product is water soluble and may spread in water systems.

Other adverse effects: The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1805
UN proper shipping name:	Phosphoric acid solution
Transport hazard class(es)	
Class(es):	8
Label(s):	8
Packing group:	III
Marine Pollutant:	No

IMDG

UN number:	UN 1805
UN proper shipping name:	PHOSPHORIC ACID SOLUTION
Transport hazard class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing group:	III
Marine Pollutant:	No

IATA

UN number:	UN 1805
Proper Shipping Name:	Phosphoric acid, solution
Transport hazard class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing group:	III

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):
PHOSPHORIC ACID Reportable quantity: 5000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [X] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance
None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
PHOSPHORIC ACID	5000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
PHOSPHORIC ACID	500 lbs

SARA 313 (TRI reporting)
None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
PHOSPHORIC ACID Reportable quantity: 5000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
None present or none present in regulated quantities.

US state regulations

US. California Proposition 65
No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act
PHOSPHORIC ACID Listed

US. Massachusetts RTK - Substance List
PHOSPHORIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances
PHOSPHORIC ACID Listed

US. Rhode Island RTK
PHOSPHORIC ACID Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date:	04-07-2014
Revision date:	No data available.
Version #:	1.0
Further information:	No data available.
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NN53

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Doosan Fuel Cell America, Inc.
195 Governors Hwy.
South Windsor, CT 06074
USA

TELEPHONE: 24 HOUR EMERGENCY: 1-800-424-9300 (CHEMTREC)
PRODUCT INFORMATION: 860-727-2300

MSDS NO: NN53 INITIAL RELEASE DATE: 4/23/2009 REVISION DATE:

GENERIC DESCRIPTION: Reduced catalyst
PHYSICAL FORM: Cylindrical tablets
COLOR: Dark brown
ODOR: None
NFPA 704 CODES: HEALTH: 1 FLAMMABILITY: 4 REACTIVITY: 2

NOTE: NFPA = NATIONAL FIRE PROTECTION ASSOCIATION

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

CAS NUMBER	%WT/VOL.	COMPONENTS	EXPOSURE LIMITS OSHA	EXPOSURE LIMITS ACGIH
The following is the composition of the packed tablets:				
1344-28-1	9-12	Aluminum oxide	15 mg/m3 5 mg/m3 (respirable)	1 mg/m^3 (respirable)
7440-50-8	55-62	Copper	1 mg/m3	1 mg/m^3 (dust)
1314-13-2	28-33	Zinc oxide	15 mg/m3 5 mg/m3 (respirable)	2 mg/m^3 (respirable)

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 3. EFFECTS OF OVEREXPOSURE

ACUTE EFFECTS:

EYE:	May cause irritation
SKIN:	Frequent or prolonged contact may irritate the skin and cause a skin rash (dermatitis).
INHALATION:	Prolonged or repeated inhalation may cause lung damage. Prolonged or excessive inhalation may cause respiratory tract irritation.
ORAL:	Moderately toxic and may be harmful if swallowed; may damage the liver, pancreas, kidney or nervous systems.

REPEATED EXPOSURE EFFECTS:

EYE:	Signs and symptoms of overexposure may include scratch or abrasion, damage to cornea (necrosis).
SKIN:	Overexposure may cause skin rash, dermatitis and or itching.
INHALATION:	Overexposure may cause coughing, wheezing, shortness of breath, difficult breathing, chest pain.
ORAL:	Ingestion may cause upset stomach and intestinal distress.

SECTION 3. EFFECTS OF OVEREXPOSURE

NOTE TO PHYSICIANS: N/D

THIS MATERIAL CONTAINS THE FOLLOWING COMPONENTS WITH THE SPECIAL HAZARDS LISTED BELOW.

CARCINOGENS	N/A
TERATOGENS	N/A
MUTAGENS	N/A
REPRODUCTIVE TOXINS	N/A
SENSITIZERS	N/A
COMMENTS:	None
NTP CLASSIFICATION:	N/A
IARC CLASSIFICATION:	N/A
OSHA CLASSIFICATION:	N/A

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 4. FIRST AID MEASURES

EYE:	**Immediately flush eyes with plenty of water for at least 30 minutes. Get immediate medical attention.**
SKIN:	**Wash with plenty of soap and water. Get medical attention if irritation develops or persists.**
INHALATION:	**Remove to fresh air. If breathing is difficult seek immediate medical attention.**
ORAL:	**If swallowed, do NOT induce vomiting. Give victim large quantities of water. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.**
COMMENTS:	**Exposure to fumes of the metal oxides may cause metal fume fever including irritation of eyes and respiratory tract and flu-like symptoms.**

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT (METHOD):	N/A
AUTOIGNITION TEMPERATURE:	N/A
FLAMMABILITY LIMITS IN AIR:	N/A
EXTINGUISHING MEDIA:	Protect exposures; cool with water fog. For small fires use Class D extinguishing media.
UNSUITABLE EXTINGUISHING MEDIA:	N/D
FIRE FIGHTING PROCEDURES:	Wear full protective clothing and SCBA's.
UNUSUAL FIRE HAZARDS:	Packed material will spontaneously oxidize in air, producing significant heat. Keep away from combustible materials.
HAZARDOUS DECOMPOSITION PRODUCTS:	Toxic metal fumes may be emitted if thermally decomposed.

SECTION 6. ACCIDENTAL RELEASE MEASURES

CONTAINMENT / CLEAN UP:

Small spill	With shovel or scoop, place material onto clean, dry non-flammable surface to allow catalyst to oxidize. Place oxidized catalyst into container and cover loosely. Remove containers from spill area. Protect against inhalation of dusts or fumes, Wear eye protection.
Large spill	Wet methods of cleanup are preferred. Keep airborne particulates to a minimum. Protect against inhalation of dusts or fumes, Wear eye protection. Place in appropriate containers for disposal.

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 7. HANDLING AND STORAGE

HANDLING: No special precautions for intact containers.

STORAGE: Store in dry area. Prevent exposure to air by maintaining under an inert gas atmosphere such as nitrogen. Use additional precautions to prevent asphyxiant hazards due to inert gas usage.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS

LOCAL EXHAUST: If user operations generate dust or fume, use ventilation to keep exposure to airborne contaminates below the exposure limits.

GENERAL VENTILATION: N/A

PERSONAL PROTECTIVE EQUIPMENT FOR ROUTINE HANDLING

EYES: Wear safety glasses with side shields or goggles.

SKIN: Wear protective clothing, including long sleeves and gloves to prevent skin contact.

SUITABLE GLOVES: Impermeable, such as latex, Nitrile, etc.

INHALATION: Wear NIOSH approved respirator with particulate filter.

PERSONAL PROTECTIVE EQUIPMENT FOR SPILLS

EYES: Chemical goggles

SKIN: Chemical resistant gloves

INHALATION / SUITABLE RESPIRATOR: (Min) Use NIOSH-approved respirator with particulate filter

PRECAUTIONARY MEASURES: N/D

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

TYPICAL PHYSICAL PROPERTIES ARE GIVEN BELOW.

APPEARANCE: Cylindrical tablets	POUR POINT C (F): N/A
COLOR: Dark brown	FREEZING POINT C (F): N/A
ODOR: None	VOLATILE ORGANIC COMPOUND:
ODOR THRESHOLD: N/A	SPECIFIC GRAVITY: (H_2O = 1) >8
pH: N/A	VAPOR PRESSURE - mmHg: N/A
BOILING POINT C (F): N/A	VAPOR DENSITY @ TEMP:____: N/A
MELTING POINT C (F): N/A	EVAPORATION RATE RELATIVE TO____: N/A
SOLUBILITY IN WATER: Insoluble	EXPLOSIVE PROPERTIES: Will not explode
VISCOSITY AT____: N/A	OXIDIZING PROPERTIES: Not an oxidizer
VISCOSITY AT____:	
RELATIVE DENSITY TO: 65-85 lb./CF (bulk)	

SECTION 10. STABILITY AND REACTIVITY

STABILITY (THERMAL, LIGHT, ETC.): Generally considered stable when contained under an inert atmosphere.

CONDITIONS TO AVOID: Exposure to air.

INCOMPATIBILITY (MATERIALS TO AVOID): Combustible materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce metal oxide fumes.

HAZARDOUS POLYMERIZATION: Not expected to occur.

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 11. TOXICOLOGICAL DATA

Exposure to metal oxide fume may produce "metal fume fever" which is characterized by flu-like symptoms including fever, chills and general aches.

SECTION 12. ECOLOGICAL INFORMATION

No data available.

SECTION 13. DISPOSAL CONSIDERATIONS

Local regulations may vary; all waste must be disposed/recycled/reclaimed in accordance with federal, state and local environmental control regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME: Self-heating solid, inorganic, N.O.S.

HAZARD TECHNICAL NAME: Reduced copper catalysts.

HAZARD CLASS: 4.2

UN NUMBER: 3190

PACKING GROUP: II

SECTION 15. REGULATORY INFORMATION

TSCA STATUS: Component materials are in the TSCA inventory.

EPA SARA TITLE III CHEMICAL LISTINGS:

SECTION 302 HAZARDOUS SUBSTANCES: No

SECTION 355 EXTREMELY HAZARDOUS SUBSTANCES: No

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Shift Max 230, Reduced Heterogeneous Catalyst, FC72372

SECTION 15. REGULATORY INFORMATION, CONTINUED

SECTION 312 HAZARD CLASS:

ACUTE:	Yes
CHRONIC:	Yes
FIRE:	Yes
PRESSURE:	No
REACTIVE:	No

SECTION 372 TOXIC CHEMICALS: Copper.

SECTION 16. OTHER INFORMATION

COMMENTS: N/D = Not Determined
N/A = Not Applicable

As a unit, the materials do not pose a hazard. However, should the container be compromised and the packed catalyst become available, measures must be taken to prevent exposure to air.

PREPARED BY: D. Black, J. Preston DATE: 4/23/2009
Revision By:

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Safety Data Sheet

According to OSHA Hazard Communication Standard, 29 CFR 1910.1200

Initial preparation date: 12.14.2017

Revision date: 05.21.2018

ENVIROTEMP™ FR3™ FLUID

SECTION 1: Identification

Product identifier

Product name: ENVIROTEMP™ FR3™ FLUID

Product code: 100088941; 100089128; 100089127; 100089129; 110013820; 110016511

Recommended use of the product and restriction on use

Relevant identified uses: Dielectric fluid

Uses advised against: Not determined or not applicable.

Reasons why uses advised against: Not determined or not applicable.

Manufacturer or supplier details

Manufacturer:

United States

Cargill, Incorporated
Cargill Industrial Specialties
13400 15th Avenue North
Plymouth, MN 55441
1-800-842-3631, 1-952-984-9122
CIS_CustomerService@Cargill.com

Emergency telephone number:

United States

ChemTel Inc

North America: 1-800-255-3924
International: 01-813-248-0585

SECTION 2: Hazard(s) identification

GHS classification: Not a hazardous substance or mixture

Label elements

Hazard pictograms: None

Signal word: None

Hazard statements: None

Precautionary statements: None

Hazards not otherwise classified: None

SECTION 3: Composition/information on ingredients

Identification	Name	Weight %
CAS number: 8001-22-7	Soybean Oil	>99

Additional information:

*This material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

SECTION 4: First aid measures

Description of first aid measures

General notes:
No special measures required

After inhalation:
If inhaled, remove to fresh air
Get medical advice if you feel unwell

After skin contact:
Wash with plenty of water / soap and rinse thoroughly
Get medical advice if skin irritation occurs or you feel unwell

After eye contact:
Rinse cautiously with water for several minutes
Remove contact lenses, if present and easy to do. Continue rinsing
If symptoms persist, consult a doctor

After swallowing:
Rinse mouth and do not induce vomiting
Get medical advice if you feel unwell or concerned

Most important symptoms and effects, both acute and delayed

Acute symptoms and effects:
Any additional important symptoms and effects are described in Section 11: Toxicological Information

Delayed symptoms and effects:
Not determined or not applicable.

Immediate medical attention and special treatment

Specific treatment:
Not determined or not applicable.

Notes for the doctor:
Not determined or not applicable.

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media:
Use Water (fog only), dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam

Unsuitable extinguishing media:
Do not use water as an extinguisher

Specific hazards during fire-fighting:
Thermal decomposition can lead to release of irritating gases and vapors

Special protective equipment for firefighters:
Use typical firefighting equipment, self-contained breathing apparatus, special tightly sealed suit

Special precautions:
Rags, steel wool, or waste contaminated with this product may spontaneously catch fire if improperly discarded

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Spilled material may cause a slipping hazard. Use appropriate safety equipment

Environmental precautions:
Should not be released into the environment
Prevent from reaching drains, sewers, or waterways

Methods and material for containment and cleaning up:
Large spills: Dike area to contain spill. Knock down and dilute vapors with water fog or spray. Collect with vacuum equipment or inert materials. Approach release upwind
Small spills: Absorb with non-combustible liquid-binding material (sand, diatomaceous earth (clay), acid binders, universal binders). Remove with shovel. Collect in suitable and properly labeled containers
Wash surfaces with aqueous cleaner and hot water. Used rags or other cleaning materials should be soaked with water and placed in a sealed container to prevent spontaneous combustion
Dispose of contents / container in accordance with local regulations

Reference to other sections:
Not determined or not applicable.

SECTION 7: Handling and storage

Precautions for safe handling:
Use appropriate personal protective equipment (see Section 8).
Avoid breathing mist or vapor. Use with adequate ventilation. Avoid repeated and prolonged skin contact.
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse.
Surfaces of porous or fibrous materials saturated with this material can self-heat and auto ignite when exposed to air. Thin films of material on non-porous surfaces in contact with air will polymerize over time making it increasingly more difficult to clean.
Immediately after use, place rags, steel wool, or waste in a sealed water-filled metal container.

Conditions for safe storage, including any incompatibilities:
Protect material from extreme temperatures, humidity, and water prior to use. Store in labeled, tightly closed containers at 10-40° C (50-104° F) in dry, isolated and well-ventilated areas, away from sources of ignition and heat.

SECTION 8: Exposure controls/personal protection

Only those substances with limit values have been included below.

Occupational Exposure limit values:

Country (Legal Basis)	Substance	Identifier	Permissible concentration
United States (OSHA)	Vegetable oil mist	NA	OSHA PEL 15 mg/m3 (Total); 5 mg/m3 (Respirable fraction)
	Vegetable oil mists (except castor, cashew nut or similar irritant oils)	NA	California (OSHA) PEL 10 mg/m3 (Total); 5 mg/m3 (Respirable fraction)
NIOSH	Vegetable oil mist	NA	NIOSH REL 10-hr TWA 10 mg/m3 (Total); 5 mg/m3 (Respirable fraction)
ACGIH	Vegetable oil mists (except castor, cashew nut or similar irritant oils)	NA	ACGIH TLV TWA: 5 mg/m³ (respirable fraction), 10 mg/m³ (As 'Oil mist, mineral')

Biological limit values:
No biological exposure limits noted for the ingredient(s).

Information on monitoring procedures:

Monitoring procedures should be chosen according to the indications set by national authorities or recognized standards.

Appropriate engineering controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Personal protection equipment

Eye and face protection:
Safety glasses, goggles, or face shield recommended to protect eyes from mists or splashing.

Skin and body protection:
Wear protective clothing as necessary to minimize prolonged skin contact. Selection of specific items will depend on task

Respiratory protection:
Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. In misty atmospheres, use an approved particulate respirator.

General hygienic measures:
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Wash hands before breaks and at the end of work. Wash contaminated clothing before reusing.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Light green liquid
Odor	Slight
Odor threshold	Not determined or not available.
pH	Not determined or not available.
Melting point/freezing point	Not determined or not available.
Initial boiling point/range	>360°C (>680°F)
Flash point (closed cup)	>265°C (Closed Cup)
Evaporation rate	Not determined or not available.
Flammability (solid, gas)	Not determined or not available.
Upper flammability/explosive limit	Not determined or not available.
Lower flammability/explosive limit	Not determined or not available.
Vapor pressure	< 1.3 Pa (<0.01 mmHg)
Vapor density	Not determined or not available.
Density	0.92 g/cm³ (7.677 lbs./gal)
Relative density	Not determined or not available.
Solubilities	Insoluble.
Partition coefficient (n-octanol/water)	Not determined or not available.
Auto/Self-ignition temperature	401-404°C (ASTM E659)
Decomposition temperature	Not determined or not available.
Dynamic viscosity	Not determined or not available.

Kinematic viscosity	33-35 mm²/s @ 40°C
Explosive properties	Not determined or not available.
Oxidizing properties	Not determined or not available.

Other information

SECTION 10: Stability and reactivity

Reactivity:
Does not react under normal conditions of use and storage.
Chemical stability:
Stable under normal conditions.
Possibility of hazardous reactions:
None under normal conditions of use and storage.
Conditions to avoid:
To avoid thermal decomposition, avoid temperatures > 250C
Incompatible materials:
Strong oxidizing agents.
Strong alkali.
Hazardous decomposition products:
Carbon monoxide, carbon dioxide.

SECTION 11: Toxicological information

Acute toxicity
Assessment: Based on available data, the classification criteria are not met.
Product data:

Route	Result
Oral	LD50 > 5000 mg/kg bw (calculated)
Dermal	LD50 > 2000 mg/kg bw (calculated)
Inhalation	Acute inhalation toxicity data not available. At room temperature, exposure to vapor is minimal due to low volatility; single exposure is not likely to be hazardous

Substance data: No data available.
Skin corrosion/irritation
Assessment: Based on available data, the classification criteria are not met.
Product data:
Not expected to cause irritation base on component or similar materials.
Substance data: No data available.
Serious eye damage/irritation
Assessment: Based on available data, the classification criteria are not met.
Product data:
Minimal irritation or no effect expected base on component or similar materials.
Substance data: No data available.
Respiratory or skin sensitization
Assessment: Based on available data, the classification criteria are not met.
Product data:
Not expected to be a skin sensitizer based on animal data for similar substances.

Substance data: No data available.

Carcinogenicity

Assessment: Based on available data, the classification criteria are not met.

Product data: No data available.

Substance data: No data available.

International Agency for Research on Cancer (IARC): None of the ingredients are listed.

National Toxicology Program (NTP): None of the ingredients are listed.

Germ cell mutagenicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

Not expected to be a germ cell mutagen. In vitro and in vivo tests did not show mutagenic effects using similar materials.

Substance data: No data available.

Reproductive toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

Not expected to be toxic to reproductive or developmental based on testing in rats for similar materials.

Substance data: No data available.

Specific target organ toxicity (single exposure)

Assessment: Based on available data, the classification criteria are not met.

Product data:

Not expected to cause organ damage from a single exposure.

Substance data: No data available.

Specific target organ toxicity (repeated exposure)

Assessment: Based on available data, the classification criteria are not met.

Product data:

Not expected to cause organ damage from prolonged or repeated exposure based on animal studies for similar materials.

Substance data: No data available.

Aspiration toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

No data available.

Substance data: No data available.

Information on likely routes of exposure:

No data available.

Symptoms related to the physical, chemical and toxicological characteristics:

No data available.

Other information:

No data available.

SECTION 12: Ecological information

Acute (short-term) toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

Fish	This product is not expected to be harmful to aquatic organisms.

Substance data: No data available.

Chronic (long-term) toxicity
Product data: No data available.
Substance data: No data available.
Persistence and degradability
Product data:
Readily biodegradable
Substance data: No data available.
Bioaccumulative potential
Product data:
Not expected to bioaccumulate based on testing of similar subtance in fish.
Substance data: No data available.
Mobility in soil
Product data:
Product has low mobility in soil.
Substance data: No data available.
Other adverse effects: No data available.

SECTION 13: Disposal considerations

Disposal methods:
It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory agencies Product and packaging must be disposed of in accordance with relevant national and local regulations. May be incinerated. Unopened product may be returned for reclamation

SECTION 14: Transport information

United States Transportation of dangerous goods (49 CFR DOT)

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Maritime Dangerous Goods (IMDG)

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Air Transport Association Dangerous Goods Regulations (IATA-DGR)

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None

Packing group	None
Environmental hazards	None
Special precautions for user	None

SECTION 15: Regulatory information

United States regulations

Inventory listing (TSCA): All ingredients are listed.
Significant New Use Rule (TSCA Section 5): Not applicable.
Export notification under TSCA Section 12(b): Not applicable.
SARA Section 302 extremely hazardous substances: Not listed.
SARA Section 313 toxic chemicals: Not listed.
CERCLA: Not listed.
RCRA: See Section 13.
Section 112(r) of the Clean Air Act (CAA): Not listed.
Massachusetts Right to Know: Not listed.
New Jersey Right to Know: Not listed.
New York Right to Know:

NA	Vegetable oil >5%	Listed

Pennsylvania Right to Know:

8001-22-7	Soybean Oil	Listed

California Proposition 65: Not listed.

SECTION 16: Other information

Abbreviations and Acronyms: None
Disclaimer:
This document is provided for your information and convenience only. All information, statements, recommendations and suggestions are believed to be true and accurate but are made without guarantee, express or implied. WE DISCLAIM, TO THE FULLEST EXTENT PERMITTED BY LAW, ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE and FREEDOM FROM INFRINGEMENT and disclaim all liability in connection with the storage, handling or use of our products or information, statements, recommendations and suggestions made by Cargill. All such risks are assumed by you/user. The labeling, substantiation and decision making relating to the regulatory approval status of, the labeling on and claims for your products is your responsibility. We recommend you consult regulatory and legal advisors familiar with applicable laws, rules and regulations prior to making regulatory, labeling or claims decisions for your products. The information, statements, recommendations and suggestions contained herein are subject to change without notice.

NFPA: 0-1-0
HMIS: 0-1-0
Initial preparation date: 12.14.2017
Revision date: 05.21.2018

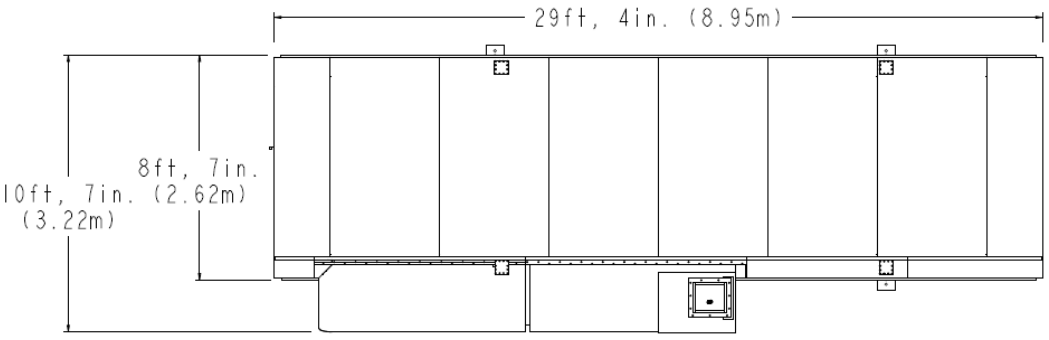
End of Safety Data Sheet

HyAxiom
A Doosan Company

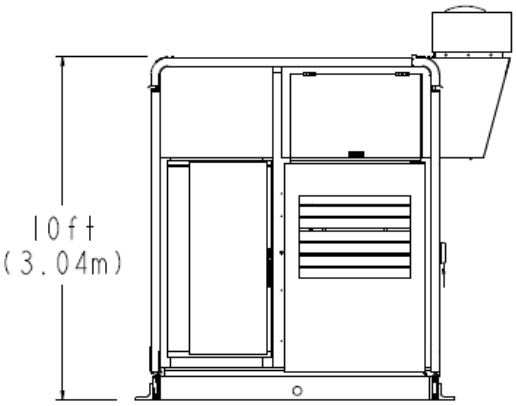
PureCell® Model 400

SYSTEM DIMENSIONS

Power Module

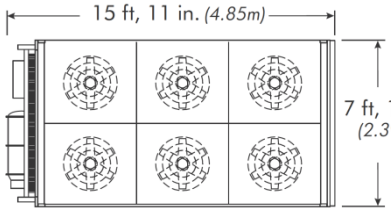


Top View

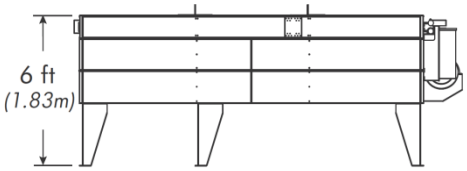


Side View

Cooling Module



Top View



Side View

PHYSICAL SPECIFICATIONS

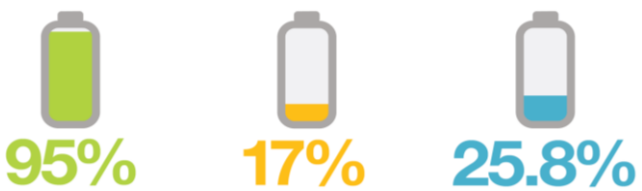
	Power Module	Cooling Module
Length	29′ 4″ (8.95m)	15′ 11″ (4.85m)
Width	8′ 7″ (2.62m)	7′ 10″ (2.39m)
Height	10′ (3.02m)	6′ 0″ (1.83m)
Weight	57,000 lb (27,216 kg)	3,190lb (1,447 kg)

PURECELL ADVANTAGE

OFFSET 3x MORE CO_2

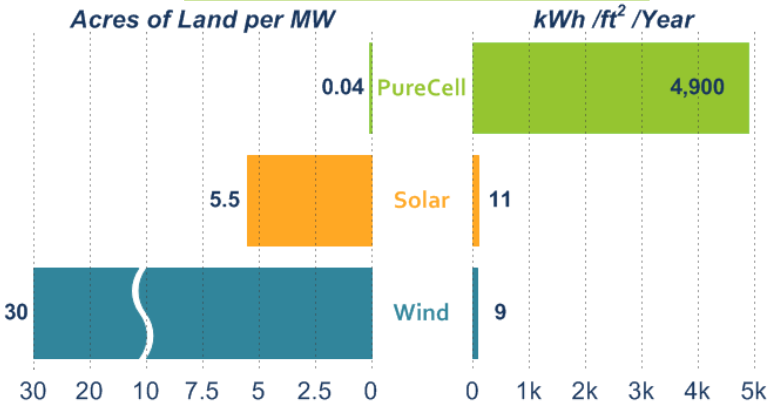
PureCell® System vs. Solar vs. Wind

CAPACITY FACTOR



CO_2 OFFSET

USE LESS LAND



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Corporate Headquarters
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The proposed Facility will be a grid-side distributed resource under 65 MW that complies with the air and water quality standards of the Department of Energy and Environmental Protection ("DEEP"). HyAxiom submits that no Certificate of Environmental Compatibility and Public Need is required because the proposed installation will not have a substantial adverse environmental effect.

II. DESCRIPTION AND PURPOSE OF THE PROJECT

HyAxiom Inc. was awarded this project by United Illuminating under the Shared Clean Energy Facilities program with final approval granted by PURA. The completed facility will utilize a State designated Brown Field located at 540 Long Brook Ave., Stratford the former site of Contract Plating and will be operated as a grid-side installed distributed generation resource with grid interconnection to be located at the Site. The proposed Facility will be located on the West end of the site adjacent to Long Brook Ave. partially within the footprint of the previously demolished building which housed Contract Plating, Inc.. (*See Attachments* 1 and 2). The proposed installation consists of eleven (11) Fuel Cells manufactured by HyAxiom in South Windsor, Connecticut (*See* Attachment #3 for Model 400+ Data Sheets). The overall dimension of each Fuel Cell is eight feet four inches wide by twenty-seven feet four inches long by nine feet eleven inches tall. The Fuel Cells are totally enclosed and factory-assembled and tested prior to shipment. The total installation will encompass an area 249' x 85'

The purpose of the proposed Facility is to provide distributed generation directly to the grid. The Fuel Cell's will be capable of producing a total of 4.939 MW of continuous, reliable electric power. The Facility will be net metered and will operate in parallel with the utility grid,

any electricity generated will be traded to the grid in accordance with United Illuminating's Interconnection Technical requirements. The installation of the Facility will have an overall annual electrical efficiency of Approx. 41%. The facility will have the capability to provide 13.2 million BTU's of hot water per hour to future tenants for space heat or cooling significantly improving overall efficiency.

When a utility grid outage occurs, all of the Fuel Cells will automatically disconnect from the utility electrical system using an internal breaker while continuing to operate providing all the internal loads needed to operate the Fuel Cells. Upon return of the utility supply, the fuel cells will monitor the grid for stability for five minutes and then will automatically reconnect and ramp up output.

The Fuel Cells are designed to have a minimum 20-year product life. This requires overhaul or replacement of major components after 10 years of operation. Components requiring overhaul include the cell stack assemblies and components in the fuel processing system.

III. **SAFETY**

The Fuel Cell is certified by CSA international to meet strict ANSI/CSA FC-1 2014 safety standards to protect against risks from electrical, mechanical, chemical, and combustion safety hazards. The Fuel Cell will be installed in accordance with NFPA 853. In accordance with Public Act 11-101, the fuel line pipe cleaning procedure uses inert nitrogen gas or atmospheric air. The following items are a few of the safety measures incorporated into the design. Please also refer to the Sample Emergency Response Plan. (*Attachment* #4).

A. Fire Protection

The Fuel Cell design incorporates a combustible gas sensor and thermal fuses located throughout the Fuel Cell cabinet. The detection of a potential combustible gas mixture, a fire, or the failure of this detection circuit will result in a Fuel Cell shutdown, closing of the natural gas supply valves, and a subsequent inert gas (nitrogen) purge of the Fuel Cell stack and fuel processing system. This event will also result in an alarm callout notification to HyAxiom service personnel. The Fuel Cell is designed with an integral stop button on the outside of the enclosure to enable immediate shutdown in the event of an emergency. There is also a site-installed manual gas shut-off valve and electrical disconnect switch easily accessible to emergency personnel.

B. Gas Leak

The Fuel Cell is designed with a physical barrier that separates the equipment handling combustible gases (fuel compartment) from electrical or potential spark-creating equipment (motor compartment). The fuel compartment is maintained at a negative pressure relative to both ambient and the motor compartment to ensure that any gas leaks do not reach the electrical equipment in the motor compartment. The cabinet ventilation system ("CVS") is designed to dilute a potential gas leak in the fuel compartment to non-combustible levels.

C. Cell Stacks and Hydrogen

The Fuel Cell operates by converting hydrogen to DC electricity. Hydrogen is lighter than air and thus does not pool like other fuels and will readily dissipate with proper ventilation, making it less likely to ignite. Also, the Fuel Cell does not store hydrogen; instead, it produces hydrogen-

rich gas at a rate equal to what it requires to produce power. The Fuel Cell stack is wrapped in a fire-retardant blanket. There are no materials inside the unit that would sustain a flame. There is no large volume of gas or any ignition that occurs within the cell stack.

D. Phosphoric Acid

Phosphoric acid is an integral part of the fuel cell system, acting as the electrolyte within the fuel cell stack. Phosphoric acid is a surprisingly common substance that is contained in common cola drinks. A leak of phosphoric acid is not possible because there is no reservoir of liquid: phosphoric acid is constrained within the porous structure of the fuel cell stack material by capillary action.

E. Fluid Leak

The only fluid source is water. All piping systems and pressurized water vessels are designed and fabricated to the appropriate ASME codes. Water produced through the electrochemical process is "pure" water and is reclaimed and reused by the process. Water mixed with propylene glycol and a rust inhibitor (to prevent rust and freezing in colder climates) is also used in the external cooling module. The onsite power transformers will be equipped with oil level sensors which will connect to the fuel cell telemetry. If a leak is detected a service call out will be received in HyAxiom's Control Room and a Technician will immediately be dispatched to the site.

IV. **HAZARDOUS MATERIALS**

Each Fuel Cell can deliver 460 kW of electric power. As with other fuel cell technologies, hydrogen and oxygen combine in the presence of a catalyst, which causes an electrochemical

reaction to produce an electric current. A phosphoric acid fuel cell uses an inorganic, concentrated phosphoric acid as the electrolyte, allowing the electrochemical reaction to take place. The Fuel Cell also employs on-board natural gas reforming as part of the balance of plant to provide hydrogen to the fuel cell. Within this Fuel Cell, there are only two components that contain hazardous material: the Cell Stack Assembly ("CSA") and the Integrated Low-Temperature Shift Converter ("ILS") . Neither of these components present risk when servicing the Fuel Cell. The material in both the CSA and the ILS is classified as hazardous material for the purposes of shipping. The CSA is classified as a "bulk bin," made from the repeating elements of the Fuel Cell stack. Some of these repeating elements are porous carbon graphite plates. The phosphoric acid used as the electrolyte is contained by capillary action within the pores of these plates. The ILS is a tank containing a self-heating solid catalyst composed of copper, zinc oxide, and alumina. Safety Data Sheets ("SDS") are available in the Ansonia SCEF Emergency Response Plan (*Attachment* #4).

A. Shipping of Hazardous Material

The Fuel Cell is classified as "hazardous in transportation" under the U.S. Department of Transportation ("DOT") 49CFR regulations, and likewise as dangerous goods under the International Maritime Dangerous Goods ("IMDG") regulations. The description of hazardous materials contained within each Fuel Cell are listed in subsections B and C below.

B. Integrated Low Shift Converter

The tank, a non-DOT specification container as described below, is a SELF HEATING SOLID INORGANIC N.O.S. (contains metallic copper on zinc oxide and alumina), CLASS 4.2, UN3190, PGII, 900 lb. net wt. of hazardous material.

C. Cell Stack Assembly

The bulk bin, a non-DOT specification container as described below, is a SOLIDS CONTAINING CORROSIVE LIQUID N.O.S. (contains phosphoric acid), Class 8, UN3244, PGII, 1200 lb. net of hazardous material. The amount of phosphoric acid in the Fuel Cell complies with all applicable state and federal regulations. The exact amount of phosphoric acid is proprietary technical information and is less than the 5,000 lb. reportable quantity under 40 CFR 117.3.

D. Integration into Fuel Cell Power Plant

The above items are individual components assembled side by side, with other non-hazardous components, to form one complete Fuel Cell. The containers holding the hazardous material are non-DOT specification containers. DOT regulations allow for the transportation of the hazardous material noted above in non-DOT specification portable tanks and closed bulk bins, as used for the shipment of the Fuel Cell. IMDG regulations require United Nations ("UN") specified containers or an exemption for international ocean transport.

E. Servicing of Product with Hazardous Material Present

The hazardous material contained within the CSA and the ILS presents no danger to installation and service personnel because direct exposure to the material is not possible. Under normal operating conditions, each container, as defined above, will contain its hazardous material for the

life of the component. When end of life requires replacement of either component, no special precautions need to be employed with respect to handling because hazardous material will not come in contact with service personnel.

F. Hazardous Waste

The Fuel Cell does not produce any hazardous waste.

V. **THE SITE**

The Facility is proposed to be located entirely on the Site. The proposed location is former Contract Plating Company site presently zoned Light Industrial MA under the zoning regulations of the Town of Stratford (the "Town") with the surrounding parcels to the North behind a 16' permanent barrier wall are zoned RS-4 residential. And to the South the Amtrack railroad and further South CA retail condo. (*See Attachment* #5). Attachment #6 shows an aerial map of the location of Facility on the Site. The nearest residential properties are to the North some 200'. The proposed Fuel Cell facility will be fenced for security. No trees are required to be removed for the installation of the Facility. Sikorsky Memorial Airport, is the nearest airport, Approx. 2 miles from the proposed facility. The proposed Facility will be a maximum of 25 feet above ground level and does not fall under the FAA notification requirement of 14 CFR Part 77.9 (Attachment #7).

VI. **PROJECT BENEFITS**

Fuel cell technology represents an important step in advancing Connecticut's goal of diversifying its energy supply through the use of renewable energy, as expressed in Connecticut General Statutes Section 16-244 et seq. The Facility will serve as a cost-effective clean energy source while also bolstering the grid from this location. Further, this Fuel Cell installation will support the efforts of the State of Connecticut to be a leader in the utilization of fuel cell technology.

Because a fuel cell does not burn fuel, the system will significantly reduce air emissions associated with acid rain and smog. Emissions standards of Connecticut will further be discussed in the next section. The Facility is designed to operate in total water balance – no make-up water is normally required after start-up and no water discharges to the environment will occur under normal operating circumstances.

VII. ENVIRONMENTAL EFFECTS

1. Water, Heat and Air Emissions

The proposed installation will have no substantial adverse environmental effect. The installation and operation of the Fuel Cell will meet all air and water quality standards of DEEP.

Section 22a-174-42 of the Regulations of Connecticut State Agencies ("RCSA") governing air emissions from new distributed generators exempts fuel cells from air permitting requirements. Notwithstanding this exemption, the Fuel Cell meets the Connecticut emissions standards for a new distributed generator as shown in Table 1 below, and no permits, registrations or applications are required under rules based on the actual emissions of the Fuel

Cell. Furthermore, the Fuel Cell is certified by the California Air Resources Board to meet the Distributed Generation Certification Regulation 2007 Fossil Fuel Emissions Standards (*See Attachment* #8).

Table 1: CT Emissions Standards for a New Distributed Generator

Air Pollutant	CT Emissions Standard (lbs./MWh)	PureCell Model 400 Fuel Cell System at Rated Power (lbs./MWh)
Oxides of Nitrogen	0.15	.01
Carbon Monoxide	1	.02
Carbon Dioxide	1650	1,049

With respect to water discharges, the Fuel Cell is designed to operate without water discharge under normal operating conditions. To the extent that minimal water overflow may occasionally occur, such discharges will consist of de-ionized water and will be directed to a site dry well. This discharge will be incorporated into the overall site design and will be covered by the Site's water discharge permit, if necessary. The Fuel Cell operates in water balance below 86°F. The initial fill requires 350 gallons of water. The amount of make-up water above 86°F increases linearly from 0gpm to 1gpm at 110°F.

The Facility will also meet state criteria thresholds and projected emissions for all greenhouse gases defined in as Section 22a-174-1(49) as shown in Table 2. Section 22a-174-1(49) states the following: "Greenhouse gases" or "GHGs" means the aggregate of the following six components gases: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexa fluoride (SF6), any hydrofluorocarbon (HFC) or any perfluorocarbon (PFC)." There is no defined criteria threshold for these compounds, however Section 22a-174-1(21) provides a method for computing carbon dioxide equivalent emissions "CO2e." The proposed Facility will

have no emissions of SF6, HFC, and PFC. Emissions of CH4 and N2O will be very low and will not contribute significantly to the GWP of the proposed facility.

Table 2: PureCell® Model Emissions Data

Emission Type	Projected Emissions	GWP in 40 CFR 98, Table A-1	Projected CO2e
CO2	2025 ton/yr.	1	2025 ton/yr.
CH4	<0.02 ton/yr.	25	<0.5 ton/yr.
N2O	<0.01 ton/yr.	298	<3 ton/yr.
SF6	N/A	22,800	N/A
HFC	N/A	12 to 14,900*	N/A
PFC	N/A	7,390 to 17,340	N/A

Current control technologies are not commercially available to reduce the greenhouse gas emissions from the Facility. The utilization of the waste heat from the Facility by the host facilities processes once utilized will significantly raise the overall efficiency of the installation.

2. Wildlife and Habitat

According to the relevant portion of the CT DEEP Stratford Natural Diverse Database Areas Map (*See attachments* #9), the proposed Site is not located within the Stratford Natural Diversity Data Base Areas.

3. Noise Analysis

Based on the engineering study results conducted by a professional acoustic engineer on the proposed Site dated May 27, 2024, the noise level of the Facility will not exceed local and state noise level ordinance levels. Please review the attached Acoustic Survey Report and Recommendations in (*Attachment #10).*

4. Visual Impact

The Facility will not cause any significant visual effects. The Site hosts a State designated Brown Field. The Fuel Cell Facility will be located some 12' below street level within existing Light Industrial area and will have limited visible impact from the street.

5. Public Notice

Notice was provided via certified mail to all property owners, abutters and state and local officials pursuant to Conn. Agencies Regs. §16-50j-40(a). HyAxiom's copy of the notice letter, Abutters list and Abutters' Map are included in *Attachments* 11, 12 and 13. Prior to filing this Petition, HyAxiom, Inc. sent notices to all applicable Federal, State and Municipal officials of Stratford as listed in (*Attachment* #14) which shows the Proof of mailing for all notice recipients.

Project Decommissioning Plan

Following the 20-year operational life of the Facility, the decommissioning plan is as follows:

A) Isolate, lock out and disconnect all piping for cooling module at the power module. Remove gas piping to the unit. Disconnect nitrogen purge system at power module.

B) Disconnect all electrical conductors and conduit at the Fuel Cell to include electrical power, cooling module power, and nitrogen pressure switch. Shore power to be maintained to the unit to maintain temperature as needed.

C) Contractor will work in concert with HyAxiom's Service Department personnel during decommissioning and shutdown.

D) Return Site to original condition with the exception of the concrete pads.

E) The decommissioned Fuel Cell will be stripped, the parts are separated and either recycled, reclaimed, or transported to landfill.

7. Aquifer Protection Area, Coastal Boundaries, and Flood Zones

Based on an analysis of the Federal Emergency Management Agency's ("FEMA") National Flood Insurance Program ("NFIP") flood mapping data for Stratford (*See Attachment* #15), the proposed Facility is not situated in a 100- or 500-year flood zone. The Site is in already disturbed condition with existing structures on the Site having been demolished and several industrial properties within its vicinity. The Site is not located near Aquifer Protection areas in the Town and there is no wetland close to the proposed installation site with the nearest watercourse over 250' feet away from the proposed Site. No negative impact to the watercourses and wetlands is anticipated throughout the construction or operation of the Fuel Cell.

8. Cultural Resources.

The proposed Facility will be in an already developed vicinity, consequently construction and operation of the Fuel Cell will have no unpleasant effect on any cultural (historical and archaeological) resources in the area.

9. Natural Gas Desulfurization Process

Sulfur is present in pipeline natural gas. It is primarily used as an odorant so leaks can be easily detected. Unfortunately, sulfur is also a poison to fuel cell systems and must be removed by the Fuel Cell. For further details of desulfurization please refer to the attached Desulfurization Memo (*See Attachment* #16).

VIII. CONSTRUCTION AND MAINTENANCE

HyAxiom plans to start construction work by August 2024. Construction will take approximately fifteen weeks, followed by approximately four weeks of testing and startup. Regular working hours for the proposed project are Monday through Friday from 8:00 am to 5:00 pm. HyAxiom and its contractors will fully cooperate with the Town Inspector and will follow all Town of Stratford and Connecticut State construction codes and policies.

IX. LOCAL INPUT AND STATE FUNDING

HyAxiom met extensively with the Town officials and presented the plans for the installation of the Facility. HyAxiom will complete all necessary permitting before installing the Fuel Cell.

X. CONCLUSION

XI. As set forth above, HyAxiom requests that the Council issue a determination, in the form of a declaratory ruling, that the proposed installation above is not one that would have a substantial adverse effect, and, therefore, that a Certificate is not needed.

Respectfully submitted,

……

John Prinssen

Installation Project Manager

HyAxiom, Inc.

John.prinssen@doosan.com

LIST OF ATTACHMENTS

Attachment 1: One Line Electrical drawing

Attachment 2: General Arrangement Drawing

Attachment 3: Doosan PureCell® Model 400 Datasheet

Attachment 4: Sample Emergency Response Plan

Attachment 5: City Zoning Map

Attachment 6: Aerial Map

Attachment 7: 14CFR Part 77.9

Attachment 8: California Air Resources Board Emission Certification

Attachment 9: National Diverse Database Areas Map

Attachment 10: Acoustic Site Survey Report

Attachment 11: Notification Letter

Attachment 12: Abutters and Officials List

Attachment 13: Abutters Map

Attachment 14: Proof of Mailing

Attachment 15: Flood Map

Attachment 16: Desulfurization Memo