STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

PETITION OF VFS, LLC	:	PETITION NO.
FOR A DECLARATORY	:	
RULING FOR THE LOCATION AND	:	
CONSTRUCTION OF A 0.46 MEGAWATT	:	
FUEL CELL CUSTOMER-SIDE DISTRIBUTED	:	
ENERGY RESOURCE AT 83 Pink Row, Uncasville, CONNECTICUT		

PETITION OF VFS, LLC
FOR A DECLARATORY RULING

Pursuant to Conn. Gen. Stat. §§ 4-176 and 16-50k(a) and Conn. Agencies Regs. § 16-50j-38 et seq., VFS, LLC. requests that the Connecticut Siting Council ("Council") approve by declaratory ruling the location and construction of a customer-side distributed resources project comprised of one (1) new natural-gas fueled PureCell® Model 400 phosphoric acid fuel cell ("Fuel Cell") and associated equipment (the "Facility"), providing 0.46-megawatts ("MW") (net) of power to the Town of Montville, Water Pollution Control Facility located at 83 Pink Row, Uncasville, Connecticut (the "Site") (*See Attachment* 1). The Facility will be installed, owned, maintained, and operated by VFS.

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

The proposed Facility will be a customer-side distributed resource under 65 MW that complies with the air and water quality standards of the Department of Energy and Environmental Protection ("DEEP"). VFS, LLC. 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

The Facility will be a customer-side installed distributed generation resource with grid interconnection to be located at the Site. The Facility will be placed to the West of the existing standby generator directly adjacent to the operations building and within the plant area (*See Attachment* 1). The proposed installation consists of one (1) Purecell Model 400 Fuel Cell manufactured by Doosan in South Windsor, Connecticut (*See* Attachment #2 for Model 400 Data Sheets). The overall dimension of the Fuel Cell is eight feet four inches wide by twenty-seven feet four inches long by nine feet eleven inches tall. The unit is totally enclosed and factory-assembled and tested prior to shipment.

The purpose of the proposed Facility is for power and distributed generation. The Fuel Cell for Montville's WWTF will be capable of producing a total of 460 kW of continuous, reliable electric power. The Facility will be net metered and will operate in parallel with the utility grid, any electricity generated in surplus of the site's demand will be traded to the grid in accordance with Eversource's Interconnection Technical requirements. The Facility will provide 74% of the electrical requirements of the building under normal circumstances, additional base

load power will be imported from the electrical grid. The installation of the Facility will have an overall annual electrical efficiency of 41%.

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

The Fuel Cell is 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 Montville WTF 83 Pink Row Emergency Response Plan in *Attachment* #3.

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 Doosan 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 in order 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.

IV. **HAZARDOUS MATERIALS**

The Fuel Cell is capable of delivering 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 Montville WTF 83 Pink Row Emergency Response Plan (*See Attachment* #3).

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 lbs. 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 zoned GOV under the zoning regulations of the Town of Montville (the "Town"). The surrounding parcels bordering the north and west of the host property are zoned for C2 (*See Attachment* #4 and 4a). Attachment #5 shows an aerial map of the location of Facility on the Site. The nearest residential properties are West of the property and over 700 feet from the Facility. The proposed Fuel Cell facility will not be fenced as the entire plant area is secured and access to the site is restricted. No trees are required to be removed for the installation of the Facility, and no parking spaces need to be removed for the installation of the Facility. Groton/New London Airport, the nearest airport, is 8.2 miles from the proposed facility. The proposed Facility will be a maximum of 15 feet above ground level and does not fall under the FAA notification requirement of 14 CFR Part 77.9 (Attachment #6).

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 reducing the demand for grid electricity 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* #7).

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	.02

Carbon Monoxide	1	.01
Carbon Dioxide	1650	998

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	2010 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 host facility has no means to utilize the waste heat from the fuel cell.

2. Wildlife and Habitat

According to the relevant portion of the CT DEEP Montville Natural Diverse Database Areas Map (*See attachments* #8), the proposed Site is not located within the Montville Natural Diversity Data Base Areas.

3. Noise Analysis

Based on the engineering study results conducted by a professional acoustic engineer of the proposed Site dated , 2020, 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 *Attachments #9*.

4. Visual Impact

The Facility will not cause any significant visual effects. The Site hosts a Municipal Water Pollution Control Plant with industrial buildings and concrete settling tanks within its proximity. The Facility would be visible only from the Site driveways while on site.

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). Doosan's copy of the notice letter, Abutters list and Abutters' Map are included in *Attachments* 10, 12 and 11. Prior to filing this Petition, Doosan sent notices to all applicable Federal, State and Municipal officials of Montville as listed in *Attachment* 14, which shows the certified mail receipts for State and Municipal officials and Abutters.

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 Doosan'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") Flood Insurance Rate Map ("FIRM") flood mapping data for Montville (*See Attachment* #15),

the proposed Facility is not situated in a 100 year flood zone. The Site is in already disturbed area with existing construction on the Site plus several industrial properties within its vicinity. The Town of Montville has no Aquifer Protection Areas 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 located 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

VFS, LLC plans to start construction work by March 1, 2020. 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. VFS, LLC and its contractors will fully cooperate with the City Inspector and will follow all Town of Montville and Connecticut State construction policies and codes.

IX. LOCAL INPUT AND STATE FUNDING

VFS, LLC. met with the local officials and presented the plans for the installation of the Facility. This project has been awarded a contract to sell Low Emission Renewable Energy Credits (LREC) to Eversource through the CT Low and Zero Emission Renewable Energy Credit Program. VFS, LLC. will complete all necessary permitting before installing the Fuel Cell.

X. CONCLUSION

As set forth above, VFS, LLC 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,

…….

Steve Pearson

Green Energy Financing Executive

VFS, LLC.

5827 Terex

Clarkston, MI 48346

LIST OF ATTACHMENTS

Attachment 1: Site Plan

Attachment 2: Data Sheet

Attachment 3: Doosan PureCell® Model 400 Emergency Response Guide

Attachment 4: 83 Pink Row Zoning Map

Attachment 4a: 83 Pink Row Property Card

Attachment 5: Aerial Map

Attachment 6: 14 CFR Part 77.9

Attachment 7: CARB Certification letter

Attachment 8: NDDB Map

Attachment 9: Acoustical Site Survey and Report

Attachment 10: Abutter and Officials Notification letter

Attachment 11: Abutters Map

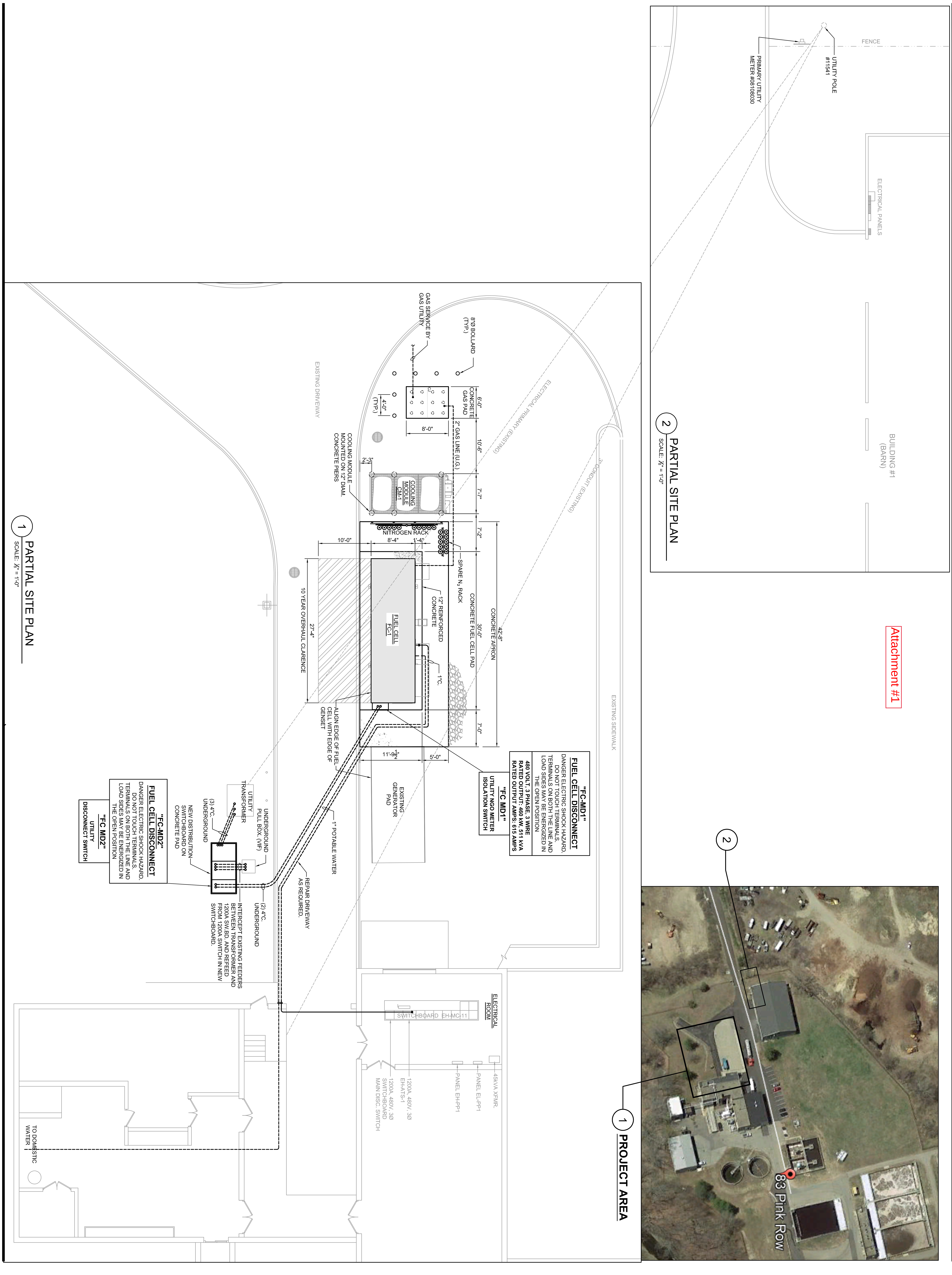
Attachment 12: Montville CT Abutters List

Attachment 13: Complete Officials List

Attachment 14: Certified Mail Receipts

Attachment 15: Firm Map

Attachment 16: Doosan Natural Gas Desulpherization Memo



CITY OF MONTVILLE
WATER POLLUTION CONTROL AUTHORITY
83 PINK ROW, UNCASVILLE, CT
FUEL CELL INSTALLATION

PARTIAL SITE PLAN

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

STATE OF CONNECTICUT — SCOTT D. FITCH — 0019780 — LICENSED PROFESSIONAL ENGINEER

Project No.:	Drawn By: KFH
Date: 11/11/19	Design By: DSF
Scale: AS NOTED	Check By: SDF
Drawing No.: SP1.0	

Rev.	Date	Description
B	01/09/20	UPDATED PER UTILITY COMMENTS
A	11/11/19	ISSUED FOR UTILITY INTERCONNECTION

Attachment #2

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, 50/60HZ

Characteristic	Units	Operating Mode	
		Power 460kW	Eco 440kW
Electric Power Output[1]	kW/kVA	460/532	440/518
Electrical Efficiency	%, LHV	43%	45%
Peak Overall Efficiency	%, LHV	90%	90%
Gas Consumption[1]	MMBtu/h, HHV (kW)	4.09 (1,200)	3.77 (1,104)
Gas Consumption[1,2]	SCFH (Nm^3/h)	3,995 (107)	3,674 (98.4)
High Grade Heat Output @ up to 250°F[1]	MMBtu/h (kW)	0.72 (212)	0.55 (162)
Low Grade Heat Output @ up to 140°F[1]	MMBtu/h (kW)	1.03 (301)	1.00 (292)

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) ..... 998 lbs/MWh (454 kg/MWh)
(with High-Grade heat recovery) ..... 815 lbs/MWh[5] (371 kg/MWh)
(with full heat recovery) ..... 485 lbs/MWh[5] (220 kg/MWh)

OTHER

Ambient Operating Temp ..... -20°F to 104°F (-29°C to 40°C)
Relative Humidity ..... 0 to 100%
Sound Level ..... <65 dBA @ 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

Doosan Fuel Cell America, Inc.
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195 Governor's Highway
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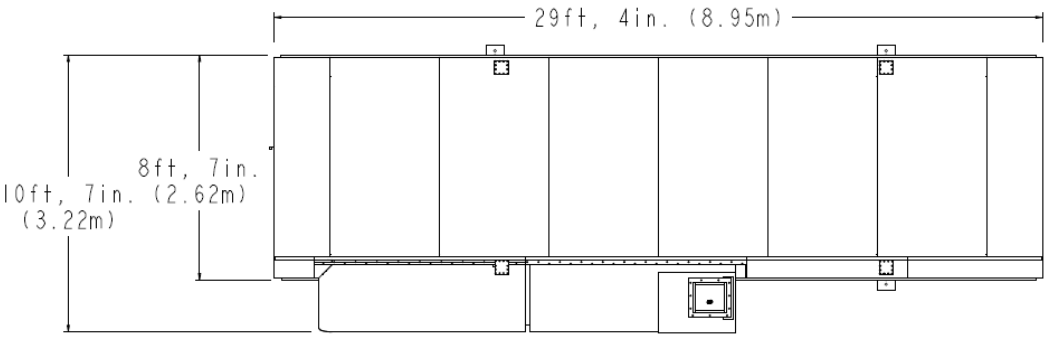
email: fuelcells@doosan.com

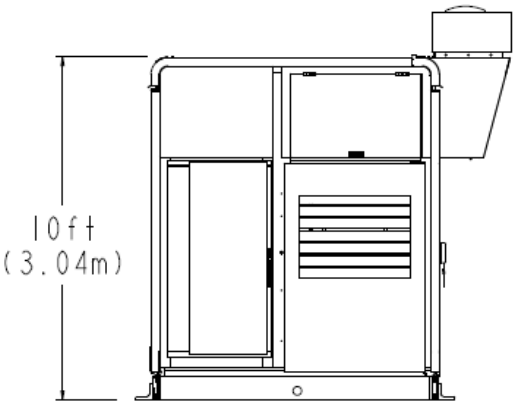
PureCell® Model 400

SYSTEM DIMENSIONS

Power Module

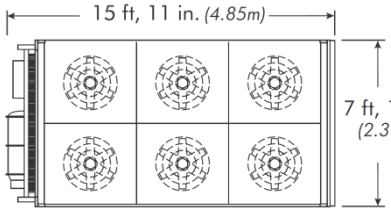


Top View

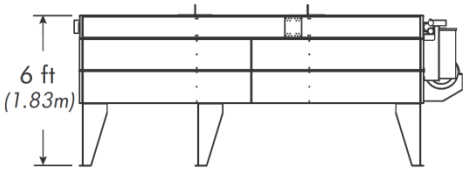


Side View

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

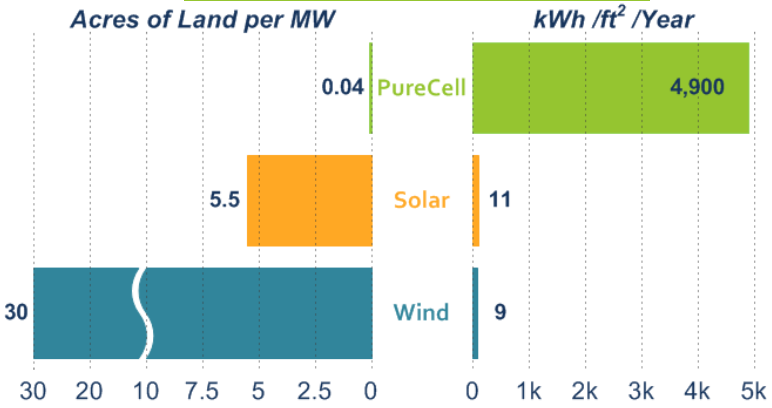
OFFSET 3x MORE CO_2

PureCell® System vs. Solar vs. Wind

CAPACITY FACTOR

CO_2 OFFSET

USE LESS LAND



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860.727.2253
www.doosanfuelcellamerica.com
email: fuelcells@doosan.com

Attachment #3

Doosan Fuel Cell America, Inc.

Fuel Cell Emergency Response Guide

Town of Montville Water Pollution Control

83 Pink Rd

Montville, CT 06382

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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, operating materials, and those listed in this guide. All information in this document is as of February 10, 2020.

Policy

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.

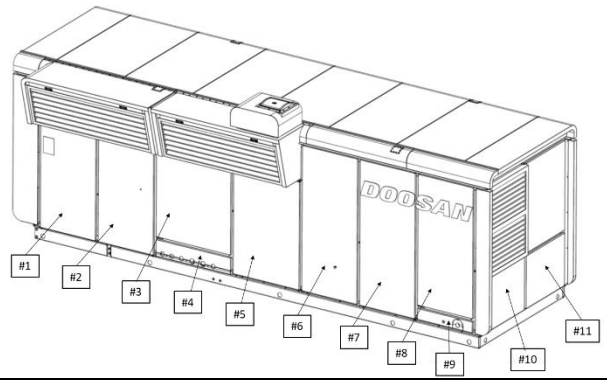
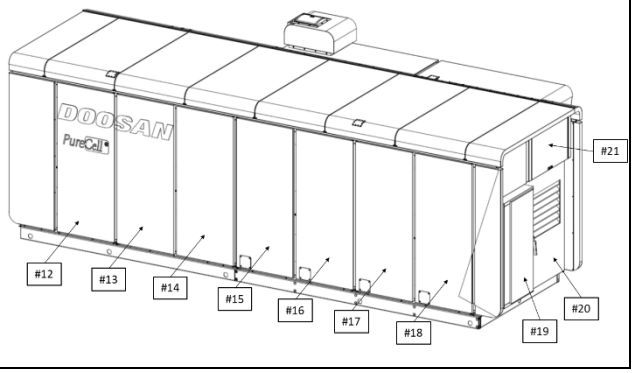
Scope

This Emergency Response Guide shall be integrated into the site Emergency Response Plan. Information contained in this document is customized to meet local requirements and shall be shared with local responders as necessary. This guide 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**
Fire Department – Non-emergency number	Town of Montville Fire Department (860) 848-8070
Hospital – Non-emergency number	Backus Hospital 326 Washington St. Norwich, CT 06360 (860) 889-8331
Electric Utility Name: Eversource Energy	**888-783-6617**
Gas Utility Name: Eversource Energy	**888-688-7267** ***Gas Leaks Only: 877-944-5323**
Local Oil & Chemical Spill Response Division	**800-645-8265**
Connecticut Oil & Chemical Spill Response Division	**860-424-3338**
EPA - Environmental Protection Agency Region 1	**(800) 424-8802** Environmental Emergency
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
 480 V Grid Disconnect	 Emergency Stop Button

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
2 (Swing Door)	Electrical = 480 VAC	**13 (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	**14 (Reformer)**	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
4 (Mechanical Entry)	Chemical = Propylene Glycol Thermal = 350°F Steam Pressure = 150 psi Steam	**15 (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	**16 (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	**17 (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	**18 (DC Cell Stack)**	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
8 (Fuel Processing Area)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**19 (Grid Connect Disconnect)**	Electrical = 480 VAC
9 (Gas/Nitrogen Inlet)	Chemical = combustibles	**20 (ESM)**	Electrical = 1400 VDC / 480 VAC
10 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	**21 (Blower 110)**	Electrical = 300 VDC Mechanical = Blower
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. Follow local spill response protocol or contact Clean Harbors Emergency Cleanup Response **(800) 645-8265** 2. 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. Follow local spill response protocol or contact Clean Harbors Emergency Cleanup Response **(800) 645-8265** 2. Contact Doosan Fuel Cell America Control Center **(860) 727-2847**
Disconnects/Other Equipment No leaks or smoke	Smoke or fire coming from equipment	1. Dial 911 or Local Emergency Response Number 2. Establish safe perimeter 3. 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. **If Indoors – Evacuate Immediately!** Dial 911 or Local Emergency Response Number 2. Establish safe perimeter 3. 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	Monthly
Waste and Chemical Storage*	N/A	Weekly
Internal Combustible Gas Monitor	AT-160 Calibration Kit	Annual
Fire Prevention	N/A	Monthly

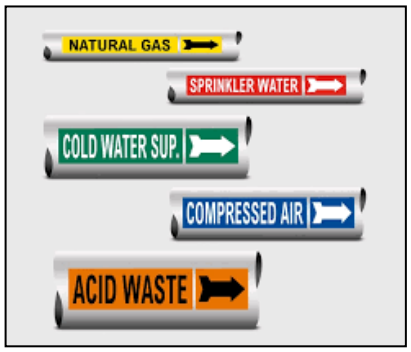
*When applicable

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 330 Feet in all directions – CV000 automatic natural gas supply shut off
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



Perimeter fencing will have signage clearly identifying that “No smoking, no ignition sources” on every side of the fence. Signage will be similar to the sign below:

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 Leak:

The only fluid source is water. All pressurized water vessels are designed to ASME boiler codes and inspected annually. All piping, welds, etc. meet pressurized piping standards. Water produced through the electrochemical process is “pure” water and is reclaimed and reused by the process. The other source of water is water used in the external cooling module, which is mixed with a polypropylene glycol and a rust inhibitor to prevent rust and freezing in colder climates.

Hazardous Waste:

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

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

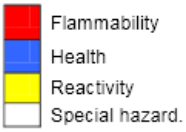
US. Rhode Island RTK
PHOSPHORIC ACID Listed

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.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED "AS IS," AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION, WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

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: NN58 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/m³ (respirable)
7440-50-8	55-62	Copper	1 mg/m3	1 mg/m³ (dust)
1314-13-2	28-33	Zinc oxide	15 mg/m3 5 mg/m3 (respirable)	2 mg/m³ (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
COLOR: Dark brown
ODOR: None
ODOR THRESHOLD: N/A
pH: N/A
BOILING POINT C (F): N/A
MELTING POINT C (F): N/A
SOLUBILITY IN WATER: Insoluble
VISCOSITY AT_____: N/A
VISCOSITY AT_____:
RELATIVE DENSITY TO: 65-85 lb./CF (bulk)

POUR POINT C (F): N/A
FREEZING POINT C (F): N/A
VOLATILE ORGANIC COMPOUND:
SPECIFIC GRAVITY: (H_2O = 1) >8
VAPOR PRESSURE - mmHg: N/A
VAPOR DENSITY @ TEMP:_____: N/A
EVAPORATION RATE RELATIVE TO_____: N/A
EXPLOSIVE PROPERTIES: Will not explode
OXIDIZING PROPERTIES: Not an oxidizer

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
Revision By:

DATE: 4/23/2009

INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

Attachment #4

Attachment #4a

The Assessor's office is responsible for the maintenance of records on the ownership of properties. Assessments are computed at 70% of the estimated market value of real property at the time of the last revaluation which was 2016.

Information on the Property Records for the Municipality of Montville was last updated on 9/3/2019.

Parcel Information

Location:	83 PINK ROW	Property Use:	Special Purpose	Primary Use:	Water Treatment Plant
Unique ID:	M0367100	Map Block Lot:	074/040/00A	Acres:	16.58
490 Acres:	0.00	Zone:	GOV	Volume / Page:	0139/0183
Developers Map / Lot:		Census:	695100		

Value Information

	Appraised Value	Assessed Value
Land	1,242,429	869,700
Buildings	1,877,384	1,314,170
Detached Outbuildings	213,960	149,770
Total	3,333,773	2,333,640

Owner's Information

Owner's Data
MONTVILLE TOWN OF WPCA WASTE WATER TREATMENT PLANT 310 NORWICH NL TPKE UNCASVILLE CT 06382

Attachment #5

Attachment #6

14 CFR § 77.9 - Construction or alteration requiring notice.

- CFR
-
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§ 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:

(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.

Attachment #7

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;

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

Attachment #8

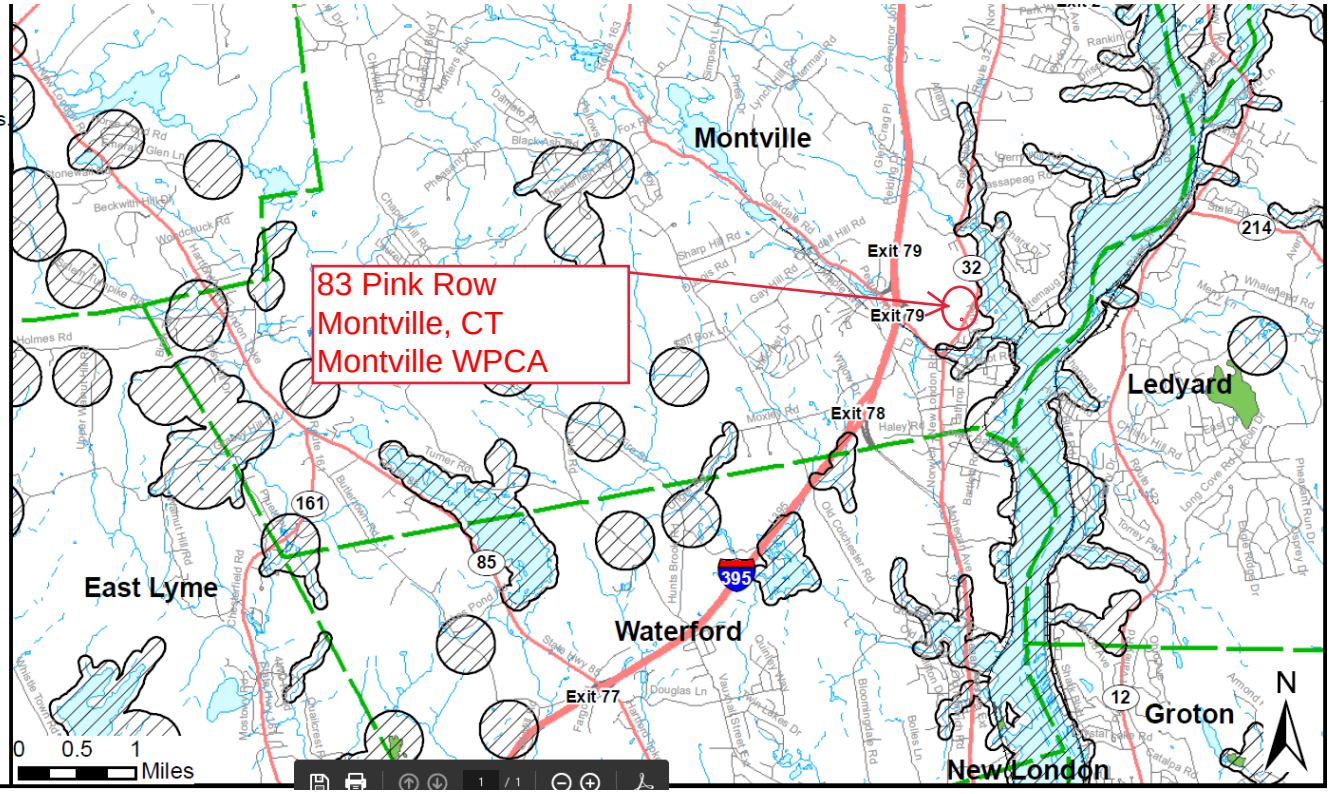
This map is intended for use as a preliminary screening tool for conducting a Natural Diversity Data Base Review Request. To use the map, locate the project boundaries and any additional affected areas. If the project is within a hatched area there may be a potential conflict with a listed species. For more information, complete a Request for Natural Diversity Data Base State Listed Species Review form (DEP-APP-007), and submit it to the NDDB along with the required maps and information. More detailed instructions are provided with the request form on our website.

www.ct.gov/deep/nddbrequest

Use the CTECO Interactive Map Viewers at www.cteco.uconn.edu to more precisely search for and locate a site and to view aerial imagery with NDDB Areas.

QUESTIONS: Department of Energy and Environmental Protection (DEEP)
79 Elm St, Hartford, CT 06106
email: deep.nddbrequest@ct.gov
Phone: (860) 424-3011

Connecticut Department of Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division



Prepared For: **Doosan Fuel Cell America Inc.**

Point of Contact: **Walter Bonola**

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

Subject: **VFS, LLC**
460 KW Fuel Cell
Airborne Noise Assessment
At 83 Pink Row, Montville, CT

Author: **Carl Cascio**

Date: **February 18, 2020**

Revision: **1**

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Summary

This document makes a positive acoustic assessment that should assist in meeting any acoustic noise concerns during the operation of a Doosan 460 KW fuel cell at the Montville Water Pollution Control Authority site at 83 Pink Row South in Montville, CT. An acoustic assessment plan was developed and executed to acquire airborne acoustic information useful in explaining and mitigating the potential airborne noise issues associated with VFS, LLC's operation of the Doosan 460 KW fuel cell. It is important to show that the airborne noise generated by the fuel cell will not significantly impact the facility's neighbors.

The airborne noise levels expected to be generated by the Doosan fuel cell operating at the Montville site were simulated by exciting a set of six co-located speakers at the fuel cell Cooling and Power Module positions. (The Cooling Module is the dominant noise source.) The six speakers produced an overall airborne noise level that was 6 to 7 dB higher than the levels measured for a similar Doosan fuel cell installed at New Britain High School in New Britain, CT. One-third octave band analysis showed the speakers to be near the New Britain fuel cell airborne noise levels at frequencies up to 250 Hertz where the airborne noise levels were low and to exceed the fuel cell signature by 5 to 15 dB at higher frequencies where the fuel cell signature was higher in noise level. Airborne noise levels with the speakers operating were measured at distances from 5 to 200 meters from the proposed fuel cell location at the VFS, LLC site. The speakers produced overall A-weighted sound pressure levels of approximately 86 dBA at 5 meters and 79 dBA at 10 meters (reference 20 microPascals) from the proposed fuel cell Cooling Module location. The airborne noise levels from the speakers at nearby property lines were measured at levels from 43 to 61 dBA. Residential measurement locations to the west were very quiet with levels below 44 dBA with the speakers on. Commercial measurement locations to the south, north and west were higher because of the short distance to the speakers along Pink Row South. Analysis of the speaker data indicated propagation losses from 19 to 40 dB from the fuel cell location to the nearby Commercial property lines. The source level at 10 meters from the operation of a Doosan fuel cell at New Britain High School was then used as a basis for making the Montville fuel cell airborne noise estimates.

Operation of the Doosan fuel cell should produce noise levels below the Commercial Zone noise limit of 62 dBA at all of the nearby Commercial property lines. The highest expected airborne noise level of 51 dBA will be just outside the west property line about 64 meters from the fuel cell. The other Commercial properties should see levels no higher than 41 dBA. All of the nearby residential property lines to the west and south west are expected to be below both the day time and night time residential noise limits with expected airborne noise below 38 dBA with the fuel cell on. The southern residential **property line** close to the fuel cell will see airborne noise levels in the 50 to 54 dBA range. These numbers are below the day time residential noise limit but above the night time noise limit of 45 dBA. This property is Gay Cemetery Pond. Night time use of the pond may expose people to airborne noise levels near the night time noise limit if close to the fuel cell. **No acoustic issues** are expected during operation of the fuel cell.

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 cell is expected to meet all of these requirements at all of the nearby properties.

Introduction

Acoustical Technologies Inc. was tasked as part of a Doosan site permitting process with an assessment of potential acoustic issues associated with fuel cell airborne noise reaching the properties adjacent to the VFS, LLC site at 83 Pink Row in Montville, CT. Responding to a request from Walter Bonola, a site visit was made on February 12, 2020. During the visit, a survey of the airborne noise levels produced by a set of speakers simulating the airborne noise produced by a Doosan 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 speakers off. This document provides an acoustic assessment to assist in meeting acoustic noise concerns during the permitting process for the VFS, LLC siting of a Doosan fuel cell at 83 Pink Row in Montville, CT.

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 a Doosan 460 KW fuel cell at the Montville Water Pollution Control Authority facility. The VFS, LLC site at 83 Pink Row South is located in a Government Zone near CT Route 32 and is surrounded by a Commercial Zone to the north and west, a Residential Zone to the south and south west and the water of Horton Cove to the east. (The Montville zoning map is given below.) It is important to determine whether the airborne noise generated by the Doosan fuel cell will impact these neighbors.

The acoustic impact is assessed in the following way. The 460-kW fuel cell is 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 Doosan 400- and 440-KW fuel cells are available (References 2 and 3). The only difference between the 400/440- and 460-kW fuel cells is the electrical output of the cell stacks. The rest of the machine including fans and fan noise remain the same between the models. Using this data, a set of six speakers have been programmed through a set of octave and one-third octave band filters to generate a noise spectrum similar to that of the new fuel cell. (It is assumed that the Cooling and Power Module noise in the two measured units are similar to the new unit.) This spectrum will then be played through an audio amplifier to create the electrical voltage necessary to drive the six speakers. In order to overcome the potentially high background noise at the site the speaker output will be increased to a level more than 5 dB higher than the overall noise level measured on a fuel cell at a distance of 10 meters. With the six speakers on, this approach then follows the traditional “What is the airborne noise level at the neighbor’s property line?”. The six speakers were run and airborne measurements made near the proposed fuel cell locations and at several of the nearest neighbor’s property lines. This measured site data can also be used to estimate noise levels at other neighbor’s property lines. The Town of Montville has yet to adopt a Noise Ordinance so the State of Connecticut’s Noise Code will be consulted to assess the impact of the measured and estimated acoustic levels. Because of the closeness of the VFS, LLC fuel cell site to the nearest property lines noise mitigation may be recommended if the airborne noise estimated for the fuel cell comes near or exceeds the airborne noise requirements at the neighbors’ property lines.

Acoustic Measurement Program

The acoustic data necessary to assess the impact of the 460 KW Doosan Fuel Cell are described below: Airborne sound pressure measurements and audio tape recordings were conducted at the VFS, LLC site on and near 83 Pink Row on February 12, 2020 during the daylight hours. This testing established both background airborne noise levels and simulated airborne noise levels with the speakers 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. The audio tape recordings were made with a Sony Digital Audio Tape Recorder (model TCD-D7 s/n 142000) with microphones on channels 1 and 2. The two PCB microphones (model 130F20 s/n 53933 and 130F20 s/n 53994) were powered by two Wilcoxon P702B power supply/amplifiers (s/n 1992 and 1995 respectively). The PCB microphones were also calibrated prior to and after the test with the Quest model QC-10 Calibrator (s/n Q19080194). All measurements were made with the microphones at a height above ground between five and six feet. A Hewlett Packard model HP3561A Dynamic Signal Analyzer, s/n 2338A00659, was used to perform A-weighted spectral analysis on the tape-recorded data. The tape-recorded data were also used to verify the ExTech sound level meter overall dBA readings.

At the VFS, LLC site "speaker on" and background airborne noise measurements were taken at the following eight nearby property lines in the Commercial and Residential Zones:

Location	**Business**	**Distance**	**Zone Type**
A - 83 Pink Row South	Water Authority	5 &10 meters	Government
B - 83 Pink Row South	Water Authority	5 &10 meters	Government
P1 – 78 Pink Row	Residence	200 meters	Residential R20
P2 – 75-105 Pink Row	Business	159 meters	Commercial C2
P3 – Pink Row North	Silvia Engineering	124 meters	Commercial C2
P4 – Pink Row West	Business	64 meters	Commercial C2
P5 – Pink Row North	Business	92 meters	Commercial C2
P6 – Pink Row South	Gay Cemetery Pond	62 meters	Residential R20
P7 – Pink Row South South East	Gay Cemetery Pond	39 meters	Residential R20
P8 – Pink Row South East	Gay Cemetery Pond	59 meters	Residential R20

See the Google satellite map in Figure 1 for the approximate measurement locations. Measurements near the proposed operating Cooling and Power Module sites at positions A and B were simultaneously taken with the ExTech sound level meter and two microphones recording on the digital tape recorder. Figures 2 and 3 provide photographs of the site locations for the Cooling and Power Modules as well as the sensors at 5 and 10 meters. At locations A and B, a one-minute record of the acoustic noise was stored for the speakers in the "on" condition at the start and at the end of the airborne noise measurements. There is a very slight decrease of about 0.5 dB in sound output from the speakers as they warm up. One minute of background airborne noise data were also recorded at the two speaker positions.

Figure 1. Montville VFS, LLC Site Map from Google Maps

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 at Westerly Airport (closest data to Montville) for the acoustic measurements on February 12, 2020. Measurements were taken over the period from 9:00 am until 1:00 pm. The table below shows the temperature and wind speeds in hourly intervals. Wind conditions were very good for most of the day with a limited number of wind gusts of up to 20 mph until 11 am. Acoustic measurements were suspended during the wind gusts and these short periods did not affect the operating and background airborne noise measurements. There was no rain during the testing on February 12. The compressor systems in the building next to the facility entrance generated most of the background noise near the speaker locations. The other locations were reasonably quiet. Motor traffic along the nearby roads was light and very few of the measurements had to be delayed until no traffic was present. Background noise levels at all of the measurement positions were acceptable with levels from 42 to 52 dBA. The position just outside the facility entrance saw background levels of 57 to 58 dBA due to the closeness of the air compressors

Figure 2. Doosan Fuel Cell Location at the Montville VFS, LLC Site

Figure 3. Sensors at the 5- and 10-Meter Locations at the Montville VFS, LLC Site

Table 1. Approximate Montville Weather Data on February 12, 2020
https://www.wunderground.com/history/daily/us/ri/westerly/KWST/date/2020-2-12

Time (EST)	Temp. (°F)	Humidity (%)	Dew Point (°F)	Barometer (in HG)	Wind Speed (mph)	Wind Direction	Condition
5:53 AM	37 F	59 %	24 F	29.97 in	6 mph	W	Fair
6:53 AM	38 F	55 %	23 F	30.01 in	8 mph	NW	Fair
7:53 AM	39 F	45 %	19 F	30.06 in	8 mph	NNW	Fair
8:53 AM	39 F	43 %	18 F	30.09 in	8 mph	WNW	Fair
9:53 AM	41 F	38 %	17 F	30.09 in	10 mph	NNW	Fair
10:53 AM	43 F	35 %	17 F	30.08 in	12 mph	N	Fair
11:53 AM	44 F	34 %	17 F	30.08 in	6 mph	W	Fair
12:53 PM	45 F	34 %	18 F	30.08 in	5 mph	VAR	Fair
1:53 PM	45 F	36 %	19 F	30.08 in	10 mph	SW	Fair
2:53 PM	44 F	43 %	23 F	30.07 in	12 mph	SW	Fair
3:53 PM	43 F	45 %	23 F	30.08 in	9 mph	WSW	Fair

Data Analysis

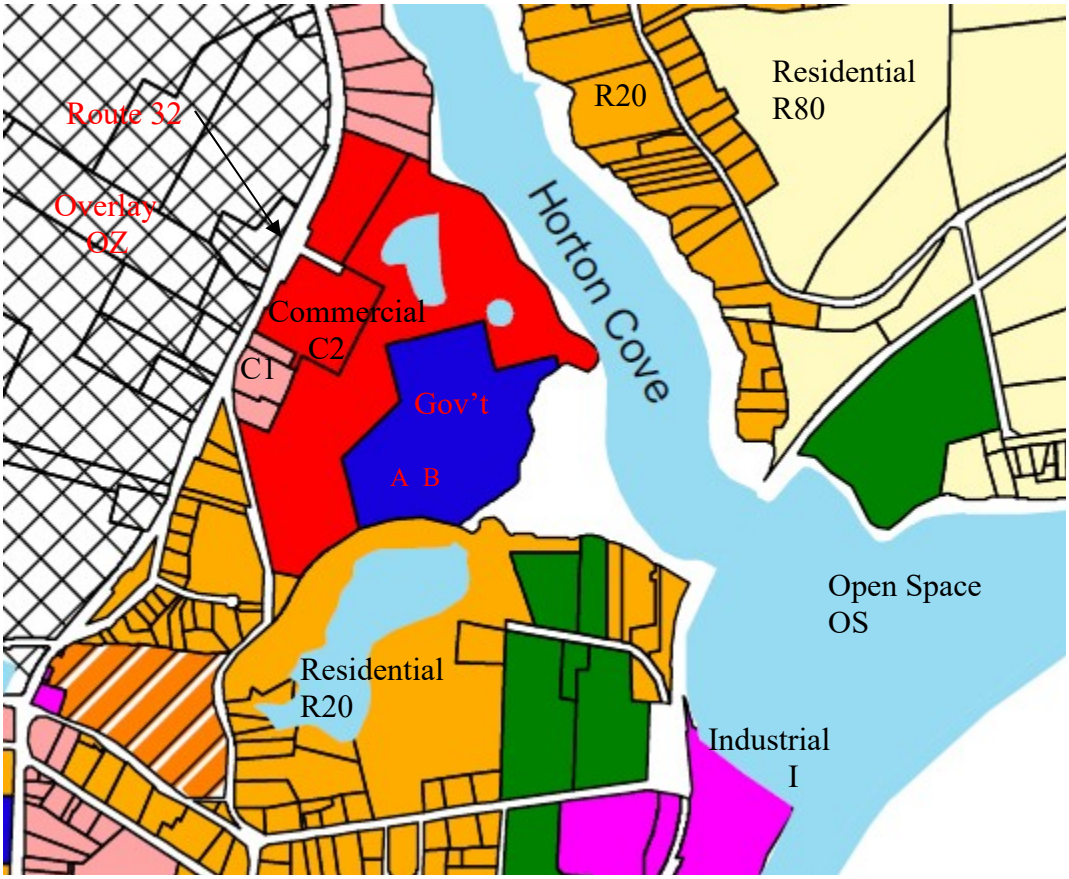
This section analyzes the airborne noise levels measured at the Montville VFS, LLC site and then estimates the source level and transmission loss to nearby property lines expected during actual fuel cell operation. These estimated levels will be compared to the noise limits in the Connecticut noise ordinance. Both background noise levels at the Montville VFS, LLC site and the measured speaker operating noise levels are reported in Table 2. The background data are used to correct the measured operating airborne noise levels providing estimates of only the speaker noise contribution at each location. Table 3 then reports estimated fuel cell equipment operating noise levels. Comparing these VFS, LLC fuel cell estimated levels with the state noise limits will identify which nearby locations do or do not meet the airborne noise requirements.

The complete set of overall A-weighted airborne noise levels that were measured in Montville are provided in Table 2 for the conditions with the speakers on and off. Figure 4 is a map showing the Montville zoning districts in the Montville Water Authority area. The position locations were calculated using the Pocket Ranger GPS App from the CT State Parks & Forests. The indicated GPS accuracy varied from 3 to 10 meters. The GPS range from the speakers to the microphone locations that are shown in Table 2 were calculated with an application found at *https://gps-coordinates.org/distance-between-coordinates.php* and then checked with Google Maps. The estimates of the range in meters to each location are given in Table 2 and also in Table 3. Each value is the range to the center of the Fuel Cell. The closest measurement location is P7, which is about 39 meters south to the edge of the Residential Zone abutting the Montville Water Authority property at 83 Pink Row. The next closest measurement location is P8, which is about 59 meters south along this same property line. Neighboring commercial properties along Pink Row are 64 to 159 meters away. P1, the closest residential home is 200 meters away due west at 78 Pink Row. Airborne noise at this residential location could not be heard when the speakers were operating. The residential noise level was below 45 dBA. To the south Gay Cemetery Pond is more than 75 meters away and Gay Cemetery starts at about 150 m.

Table 2. Measured Overall Sound Pressure Levels in dBA reference 20 microPascals

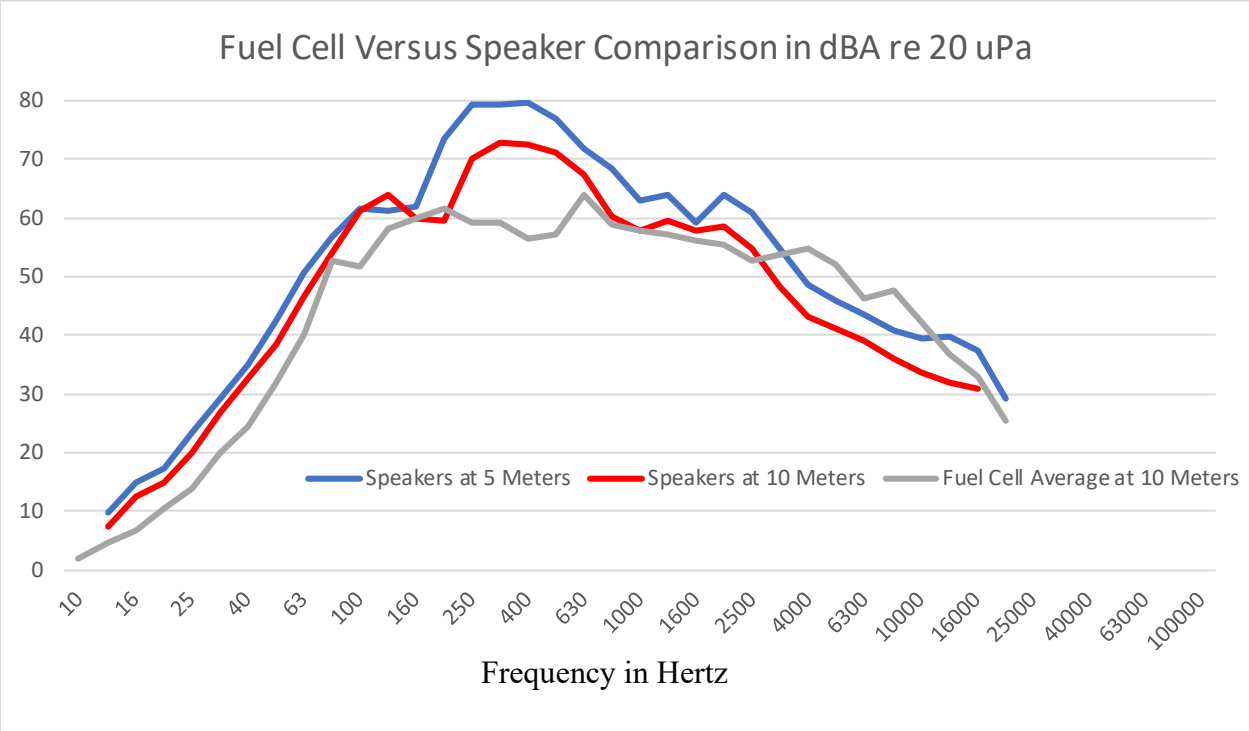
Location	Range in Meters	Speakers A	Background	Bkgd Corrected	Speakers B	Background	Bkgd Corrected
Speaker 5 m	5	85.9	52.2	85.9	86.0	47.6	86.0
Speaker 10 m	10	78.9	52.3	78.9	79.7	49.6	79.7
P1 – 78 PR	200	47.2	47.9	44.0	44.9	45.0	39.4
P2 – 75-105	159	43.5	42.6	38.5	46.5	44.3	44.3
P3 – Silvia	124	47.5	45.7	44.0	48.5	45.3	46.2
P4 – PR West	64	59.9	57.8	56.8	58.8	57.5	53.7
P5 – PRNorth	92	47.3	48.3	39.7	49.8	45.4	48.0
P6- PR South	62	57.8	48.3	57.4	55.3	46.0	54.8
P7- PR SSE	39	na	na	na	60.9	49.5	60.7
P8- PR S East	59	57.6	53.2	56.2	56.3	49.5	55.4

Figure 4. Montville Zoning Map Showing Speaker Location at Positions A & B



A comparison of the airborne noise produced at 10 meters by the Doosan fuel cell at the New Britain High School site with the airborne noise produced by the speakers at the Montville VFS, LLC site is shown in Figure 5. The speakers slightly exceed the fuel cell airborne noise for frequencies below 250 Hertz and greatly exceed the fuel cell airborne noise at the middle frequencies where the fuel cell airborne noise levels are the highest. The speaker levels are lower above 2.5 kHertz. The overall airborne noise levels are 6.3 and 7.1 dB higher for the speakers at Site A and Site B locations, respectively, as compared to what is expected from the Doosan 440 KW fuel cell that was measured at New Britain High School in New Britain, CT. The 6 to 7 dB differences in level were subtracted from the Montville measured levels to estimate the expected fuel cell's acoustic signature at each location. These noise calculations are displayed in Table 3 below. The 10-meter New Britain fuel cell airborne noise levels were used with the Montville transmission loss data to estimate the expected VFS, LLC fuel cell airborne noise for nearby neighbors at the Montville Water Authority property lines.

Figure 5. The Six Speakers Generate Airborne Noise Above That of a Single Fuel Cell



The estimated airborne noise levels to be produced by the Doosan fuel cell are shown in Table 3. For each of the eight locations the Montville measurements are corrected to account for the higher speaker levels. The fuel cell noise correction at the Site A Cooling Module location is estimated to be 6.3 dB because the speaker levels are that much higher than the New Britain fuel cell levels. The speakers at the Site B Power Module were estimated to be 7.1 dB higher. (These estimates are based on the overall dBA readings for the two sets of measurements. If individual one-third octave band values were calculated and then averaged over the frequencies of interest, the result would be numbers about 1 dB smaller. The higher, more conservative overall noise level values were used in this report to scale the speaker data.)

The measurements at the VFS, LLC site were taken at various distances from the speakers and then background corrected. Close to the speakers at 83 Pink Row the maximum airborne noise values to the south are expected to be below 54 dBA, which is slightly below the residential day time noise limit but above the residential night time noise limit. All the commercial properties are expected to be below the 62 dBA noise limit, the amount depending on how close the locations are to the fuel cell. The residential properties to the west are all expected to have airborne noise levels due to the fuel cell that are below 40 dBA.

Table 3. Estimated VFS, LLC Overall Sound Pressure Levels in dBA ref. 20 microPascals

Location	Range in Meters	Speakers at A	Correction	Cooling Estimated SPL in dBA	Speakers at B	Correction	Power Mod. Estimated SPL in dBA
P1 – 78 PR	200	44.0	-6.3	37.7	39.4	-7.1	32.3
P2 – 75-105	159	38.5	-6.3	32.2	44.3	-7.1	37.2
P3 – Silvia	124	44.0	-6.3	37.7	46.2	-7.1	39.1
P4 – PR West	64	56.8	-6.3	50.5	53.7	-7.1	46.6
P5 – PRNorth	92	39.7	-6.3	33.4	48.0	-7.1	40.9
P6- PR South	62	57.4	-6.3	51.1	54.8	-7.1	47.7
P7- PR SSE	39	na			60.7	-7.1	53.6
P8- PR S East	59	56.2	-6.3	49.9	55.4	-7.1	48.3

Red indicates locations above the residential night time noise limit of 45 dBA – there are three

Allowable Noise Levels

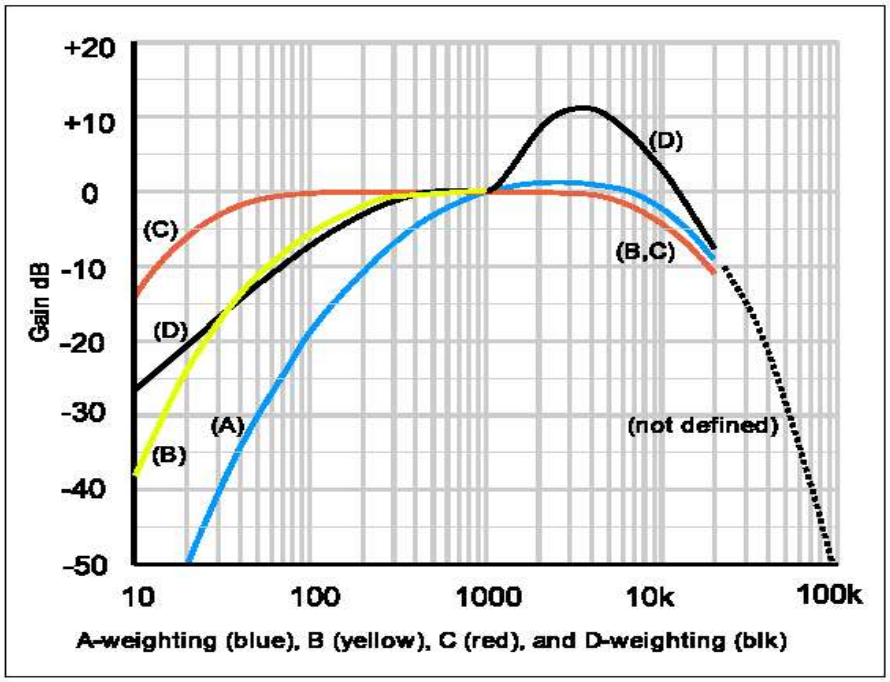
The Connecticut regulation for the control of noise provides in *CT section 22a-69*-3 (Ref. 1) the requirements for noise emission in Connecticut. *CT section 22a-69*-3.1 states that no person shall cause or allow the emission of excessive noise beyond the boundaries of his/her Noise Zone so as to violate any provisions of these Regulations. This ordinance will be used to evaluate the noise generated by the Doosan Fuel Cell. Following sections discuss each type of noise using the results obtained from the New Britain and Mount Sinai fuel cell measurements as well as the Montville speaker measurements.

The southern part of the Montville zoning map is given in Figure 4. As stated above, the Montville VFS, LLC site at 83 Pink Row is located in a Government Zone. This site is adjacent to a Residential Zone to the south and south west and a Commercial Zone to the north and west, respectively. The closest home is 200 meters away at 78 Pink Row in a R-20 Residential Zone. The acoustic estimates from positions P2 and P3 show that the speaker noise is expected to drop below 45 dBA between distances of 124 and 159 meters. The fuel cell noise (6 to 7 dB lower) should be below the 45 dBA night time residential noise limit at about 78 meters from the fuel cell. Using the Montville speaker measurements, the airborne noise level expected at the 78 Pink Row property line (at a distance of 200 meters) should be below 38 dBA. Other nearby

residential properties at greater distances are also expected to be well below the night time Residential Zone noise limit of 45 dBA for an emitter in a commercial zone.

Figure 6. Acoustic Airborne Noise Weighting Curves

http://upload.wikimedia.org/wikipedia/commons/3/39/Acoustic_weighting_curves_(1).svg



1 of 1 1/25/2013 9:35 PM

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.

Impulse noise in excess of 80 dB was not observed on the tape-recorded data during any of the measurements of the Doosan 440 KW fuel cell made at the New Britain High School on 30 July, 2018. This fuel cell design is similar to the unit that will be installed in Montville. Given the steady state nature of the fuel cell's noise signature there should be no acoustic issues with the State of Connecticut'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 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.

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, 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 Water Pollution Control Authority is a Class B emitter in a Government Zone. The noise zone standards in *CT section 22a-69-3.5* state that a Class B emitter cannot exceed the following overall sound pressure levels:

To Class C 62 dBA To Class B 62 dBA To Class A 55 dBA (day) 45 dBA (night)

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

To Class C 57 dBA To Class B 57 dBA To Class A 50 dBA (day) 40 dBA (night)

To address the discrete tone issue, we use measured data from the testing of a similar Doosan fuel cell (Reference 3). This data does not have A-weighting. The photo in Figure 7 plots the airborne noise measured 10 meters from the Mount Sinai Cooling Module (Reference 3) for frequencies from 0 to 1000 Hertz. This curve shows the two largest discrete tones produced by the Doosan Fuel Cell Cooling Module. The first tone is at 86 Hertz at a level of 65 dB reference 20 microPascals. The second tone is at 630 Hertz at a level of 56 dB reference 20 microPascals. (88.6 dB added to the dBV values in the figure.) The A-weighting corrections are -21.5 dB at 86 Hertz and -1.9 dB at 630 Hertz. Incorporating these corrections gives A-weighted levels of 44 dBA at 86 Hertz and 54 dBA at 630 Hertz (for the fuel cell) both at a distance 10 meters from the Cooling Module. The minimum transmission loss to the residential property lines to the south and west is at least 19 dB so the maximum possible discrete tone would be about 35 dBA at the property lines. This level is below the 40 dBA requirement in a Residential Zone. The minimum transmission loss to the Commercial property lines to the west and north is at least 22 dB so the maximum possible discrete tone would be 32 dBA at position P4 just outside the property line to the west. This level is well below the 57 dBA requirement in a Commercial Zone. Operating the Doosan fuel cell should produce airborne noise levels well below the CT discrete tone requirement at all the property lines. There should be no acoustic issue with the CT discrete tone noise requirements.

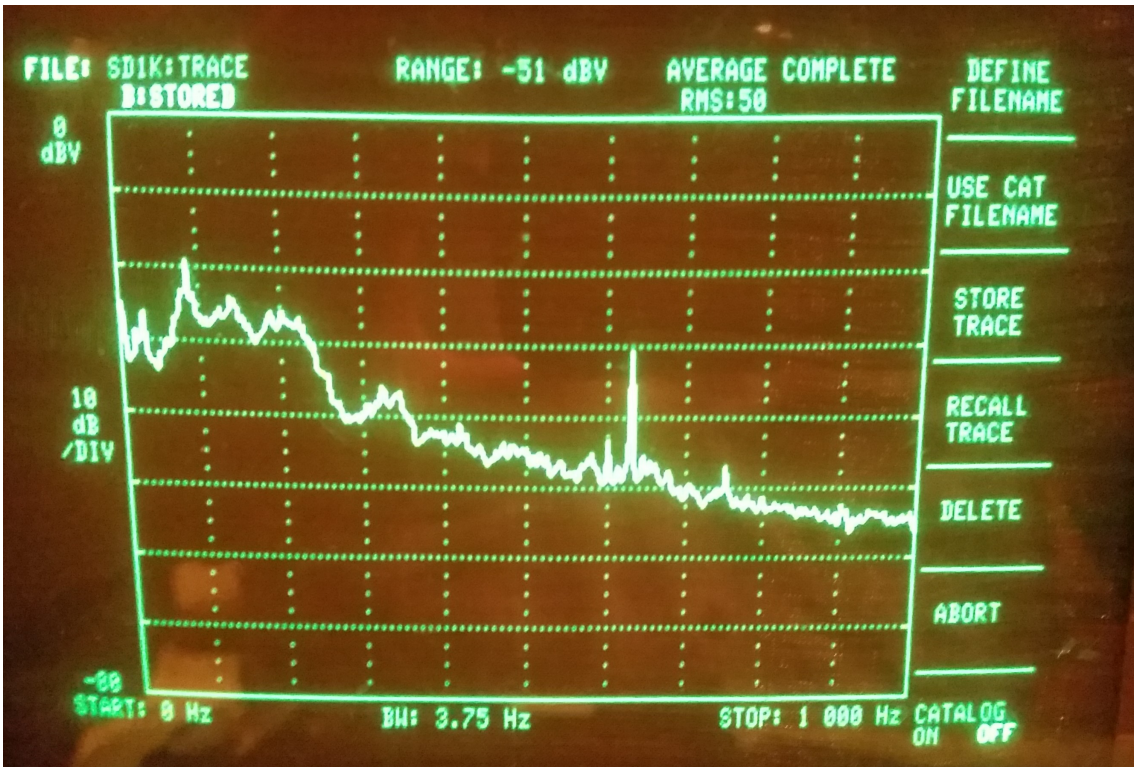
Infrasonic and Ultrasonic Noise

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.

Narrow bandwidth sound pressure spectrums in dB reference 20 microPascals at the 10-meter Cooling Module location given in Reference 3 can be used to compare with these Infrasonic and Ultrasonic noise requirements. Mount Sinai Hospital airborne noise data were processed in the 0 to 100 Hertz and 0 to 100,000 Hertz frequency ranges. The bandwidth of each data point is 0.375 Hertz for the 100 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. The maximum level at 10 meters is 57 dB reference 20 microPascals for one fuel cell. The entire 20 Hertz band can be power summed and equals 66 dB reference 20 microPascals, well below the requirement at 10 meters. The minimum transmission loss to the nearest property line is at least 19 dB so the maximum possible infrasonic noise would be 47 dBA at the southern property line.

The ultrasonic noise for frequencies up to 100 KiloHertz is given in Figure 9. The maximum level at 10 meters is 20 dB reference 20 microPascals for one fuel cell. The entire 80 KiloHertz band from 20 to 100 kiloHertz has been power summed and equals a noise level value of 31 dB ref. 20 microPascals. Both of the infrasonic and ultrasonic noise levels will fall well below the 100 dB limit at a distance 10 meters from the Cooling Module. The ultrasonic airborne noise at all the Residential property lines will be at least 19 dB lower. The noise levels at the residential neighbors will be much lower based on the analysis in the previous section and there should be no issue with either infrasonic or ultrasonic noise at any of the neighboring properties.

Figure 7. Discrete Tones Produced by Fuel Cell Cooling Module (0 dBV = 88.6 dB re20µPa)



It should be noted that while the spectrum analysis covers frequencies up to 100 kiloHertz, the microphone sensors lose some sensitivity above 25 kiloHertz. There is a gradual roll off that reduces the amplitudes measured at higher frequencies. Fortunately, the measured noise levels

are very low at 20 kiloHertz and decrease with higher frequencies and thus, no ultrasonic acoustic issues are expected above 25 kiloHertz.

Overall Sound Pressure Levels

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

To Class C 62 dBA To Class B 62 dBA To Class A 55 dBA (day) 45 dBA (night)

The Montville VFS, LLC site is in a Commercial Zone that is surrounded by Residential Zones to the south and south west and Commercial Zones to the north and west. Other Residential Zones to the east are too far away (greater than 550 meters) to be affected by noise from the VFS, LLC site. The nearby neighbors are classified as either residential or commercial with residential noise limits of 55 dBA during the day and 45 dBA at night. The airborne noise limit at the commercial locations is 62 dBA.

Figure 8. Infrasonic Noise from the Fuel Cell Cooling Module (0 dBV = 88.6 dB re 20µPa)

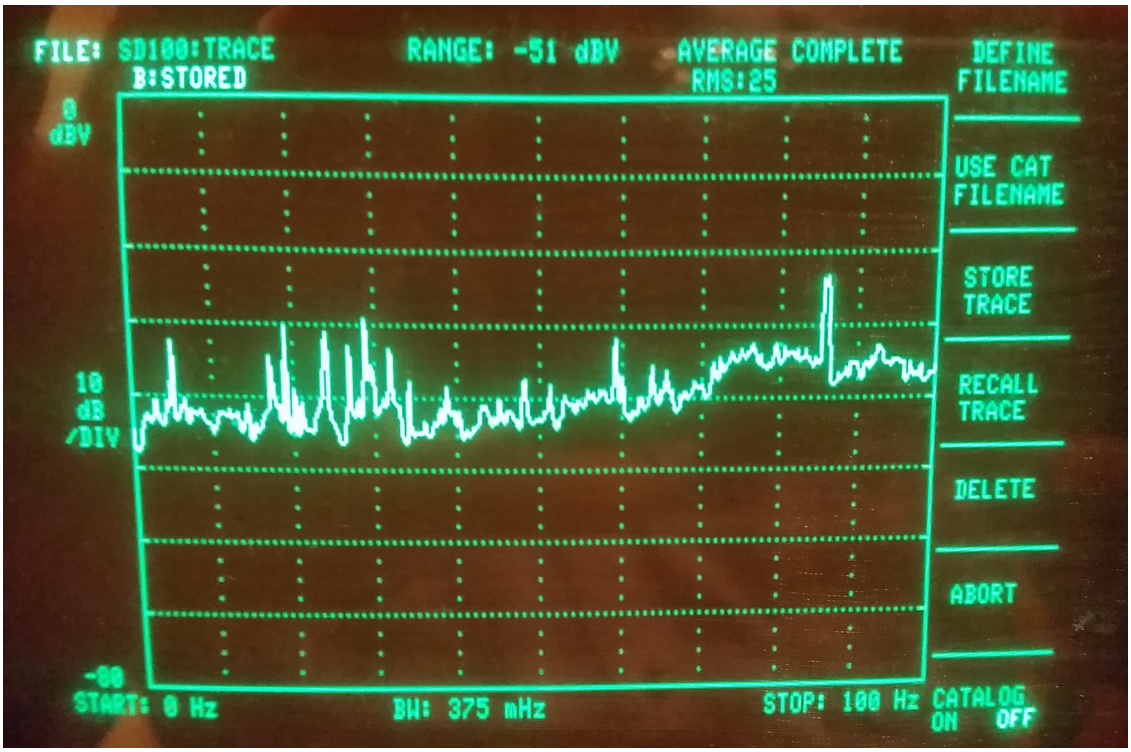
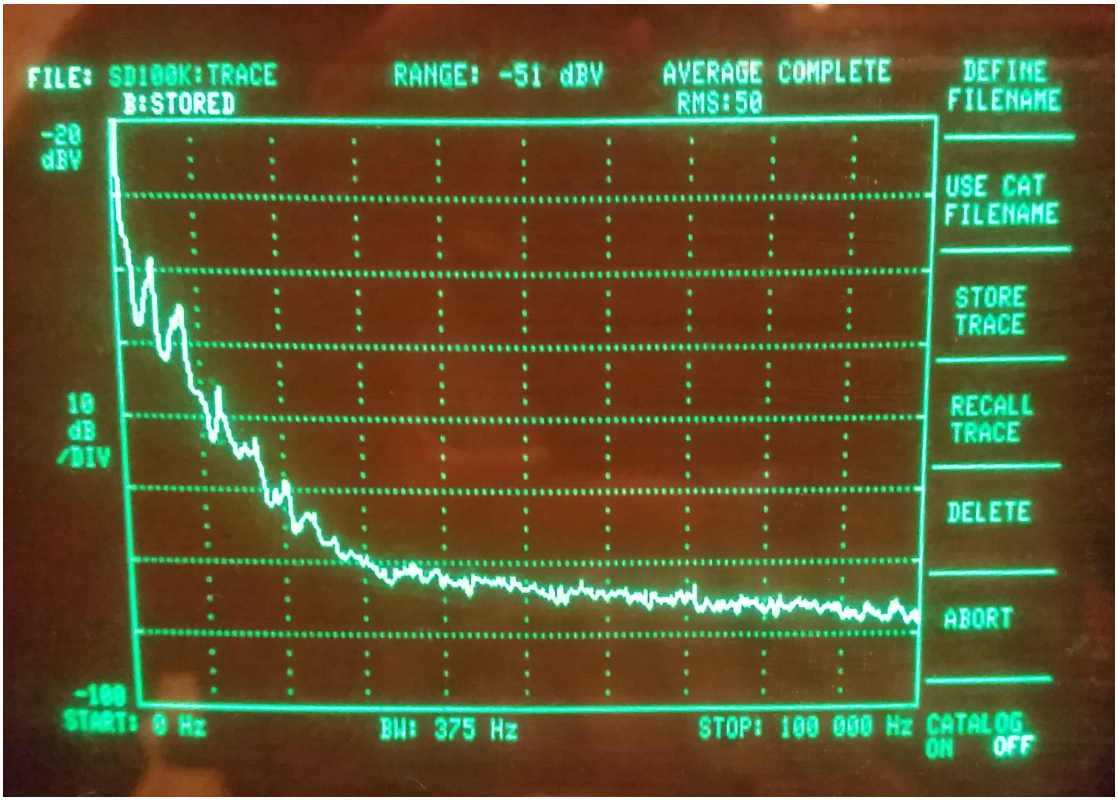


Figure 9. Ultrasonic Noise from the Fuel Cell Cooling Module (0 dBV = 88.6 dB re 20µPa)



The estimated overall A-weighted sound pressure level measurements in dBA reference 20 microPascals are given in Table 3 above for the background corrected measurements made on February 12, 2020. The second column gives the approximate distance from the speakers to the measurement location, with locations identified by a P number in Figure 1. Column 3 gives the noise levels measured with the speakers "on" at site A while column 6 gives the noise levels measured with the speakers "on" at site B. Background levels before the speakers were turned on can be found in Table 2. Background corrections were applied in creating the values in Table 3. The background corrected speaker noise at 5 and 10 meters is also given in Table 2. The airborne noise values in Table 3 with the background noise removed are then corrected to estimate the contribution provided by the new fuel cell at both Cooling and Power Module locations. Column 5 has the site A Cooling Module estimates while column 8 has the site B Power Module estimates. Values shown in red would be above the commercial or residential night time noise requirements. The values at three of the locations are above the requirements.

Reviewing Table 2 and Table 4 below, it is clear that the airborne noise levels drop significantly in propagating to the nearby properties as the range increases. The highest property line background corrected speaker level was measured at 61 dBA at Position 7, the property line right adjacent to the speakers. The P7 residential property line should see airborne noise levels no higher than 54 dBA with the fuel cell operating by itself. Because of the increasing loss with distance to the commercial property lines the expected fuel cell noise levels will fall below 51 dBA for the commercial properties. The residential properties to the west should all be lower

than 38 dBA. All the expected maximum values (worse case between speaker locations) are shown in Table 4 below. All of the property line estimates will meet the 62 dBA Commercial and 55 dBA day time residential noise limits.

Table 4. Expected Airborne Noise Levels from Operating a Doosan Fuel Cell (ref. 20 μPA)

P2	P3	P4	P5		
37 dBA	39 dBA	51 dBA	41 dBA	←	Commercial
P1	P6	P7	P8	←	Residential
38 dBA	51 dBA	54 dBA	50 dBA		

Operation of the Doosan fuel cell will have no acoustic impact at all of the residential properties adjacent to the VFS, LLC site on Pink Row. The commercial property next to the VFS, LLC site on Pink Row should see airborne noise levels from the fuel cell up to 11 dB below the commercial noise limit. Maximum background airborne levels of 58 dBA from the facility compressors were measured during a normal working day just outside the entrance to the site (Position 4). Commercial properties further away from the fuel cell along Pink Row are expected to be below 45 dBA and all the commercial properties should not be affected by the operation of the fuel cell.

The southern residential property line close to the fuel cell will see airborne noise levels in the 50 to 54 dBA range. These numbers are below the day time residential noise limit but above the night time noise limit of 45 dBA. This property directly to the south of the site is Gay Cemetery Pond. The closest edge of the pond is 75 meters from the fuel cell so the highest airborne noise levels actually on the pond should be about 45 dBA. Night time use of the pond may expose people to airborne noise levels near the night time noise limit. Gay Cemetery is at least 150 meters away and airborne noise levels at the cemetery should be much less than 45 dBA. No acoustic issues are expected during operation of the fuel cell.

Conclusions

The purpose of this effort is to evaluate the acoustical environment at the proposed VFS, LLC fuel cell site in Montville, CT. This has been accomplished and the results show that the operation of a Doosan 460 KW fuel cell will meet all of the State of Connecticut airborne noise requirements at all the commercial properties to the west and north. Residences to the west and south west are also expected to meet all the noise requirements because they are at least 200 meters away from the new fuel cell. Residential properties to the east are even further away and will not be affected by the fuel cell ‘s airborne noise. The adjacent Residential Zone property to the south can be as close as 39 meters from the new fuel cell. Airborne noise from the fuel cell will meet the day time noise requirement but exceed the night time noise requirement at this property line. The property contains Gay Cemetery Pond and the airborne noise levels expected at 75 meters and further distances that are actually on the pond should be at or below the night time airborne noise requirement of 45 dBA. Night time use of the pond is not expected to become an acoustic issue.

Acoustical Technologies Inc.

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) New Britain High School Fuel Cell Acoustic Assessment, Acoustical Technologies Inc., August 8, 2018

3) Mount Sinai Rehabilitation Hospital Airborne Noise Assessment, Carl A. Cascio, Acoustical Technologies Inc., January 26, 2017

Attachment #10

The Venture Funding Specialists

January 24, 2020

RE: Petition For a Declaratory Rulling That No Certificate of Environmental Compatibility and Public Need is Required ("Petition") for the Installation of One on-site, 460 KW Fuel Cell at Montville WPCA 83 Pink Row, Montville, CT 06382.

Dear Recipient,

Pursuant to Section 16-50j-40 of the Connecticut Siting Council's (the "Council") Rules of Practice, we are notifying you that VFS, LLC. intends to file a petition for declaratory ruling with the Connecticut Siting Council ("Council") on or about February 15, 2020. The petition will request the Council's approval of the installation of one (1) 460kW fuel cell and ancillary equipment in support of a customer-side, distributed generation project at 8888888883 Pink Row Montville, CT 06382. The fuel cell will be powered by natural gas and generated electricity will be consumed on-site.

The proposed placement of the fuel cell is located within confines of the facility directly adjacent to the back-up diesel generator. The proposed new construction will be approximately 29 feet long, 8 feet wide and 10 feet high.

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

VFS, LLC.

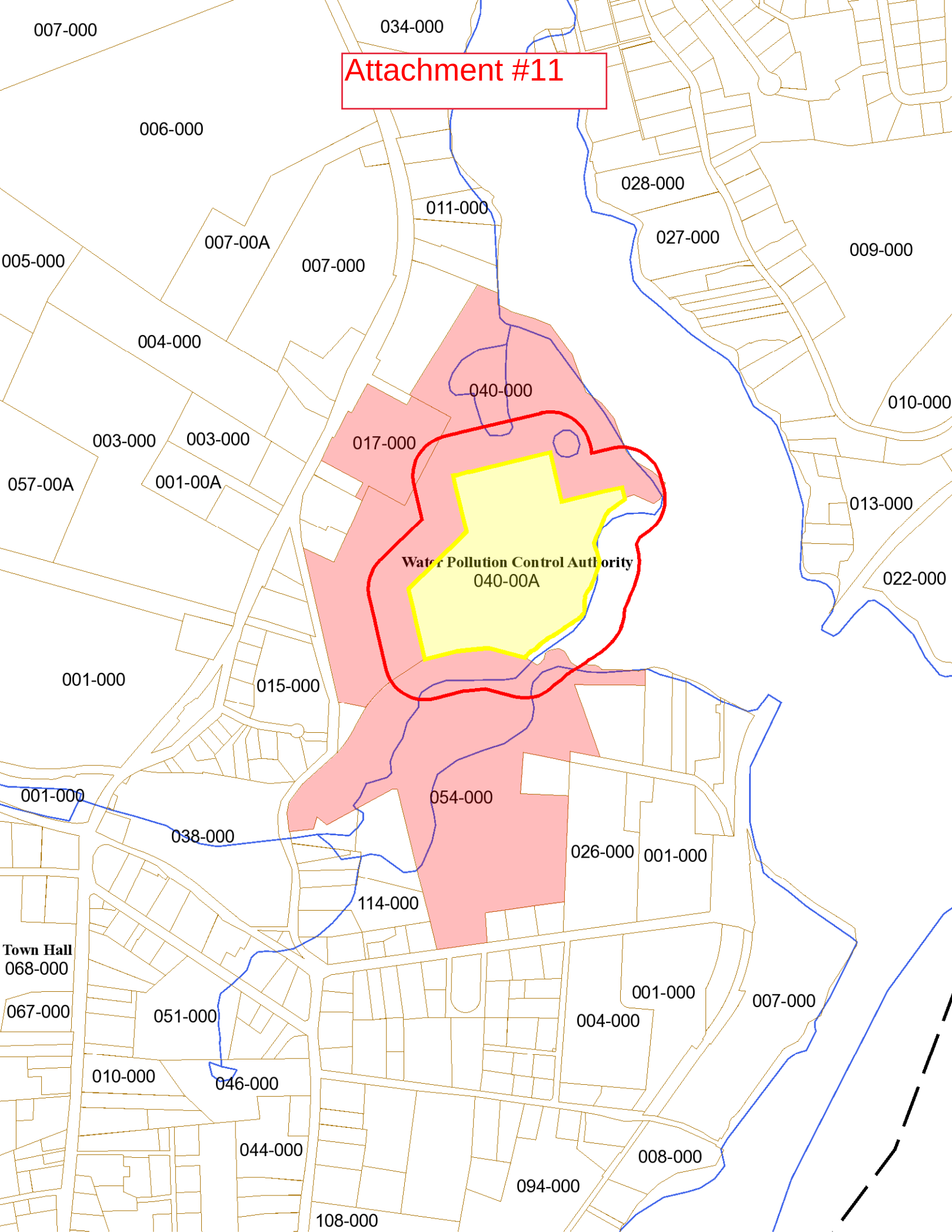
Steve Pearson

5827 Terex
Clarkston, MI 48346
248.657.4600
spearson@vfsmi.com

Connecticut Siting Council

10 Franklin Square

New Britain, CT 06051
Tel: 860.827.2935


Attachment #11
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200 foot Abutters List Report

Montville, CT
January 29, 2020

Attachment #12

Subject Property:

Parcel Number:	074-040-00A	Mailing Address:	MONTVILLE TOWN OF WPCA WASTE WATER TREATMENT PLANT 310 NORWICH NL TPKE UNCASVILLE, CT 06382
CAMA Number:	074-040-00A		
Property Address:	83 PINK ROW		

Abutters:

Parcel Number:	074-040-000	Mailing Address:	G L & C CONSTRUCTION LLC 105 PINK ROW UNCASVILLE, CT 063822400
CAMA Number:	074-040-000		
Property Address:	75 PINK ROW		
Parcel Number:	074-054-000	Mailing Address:	ROCKTENN CP LLC WESTROCK CP LCC 3950 SHACKLEFORD RD DULUTH, GA 30096
CAMA Number:	074-054-000		
Property Address:	82 DEPOT RD		
Parcel Number:	079-017-000	Mailing Address:	LONGSHORE GROTON I LLC & CARSON & GEBEL ENTERPRISES LLC 893 PEQUOT AVE NEW LONDON, CT 06320
CAMA Number:	079-017-000		
Property Address:	601 ROUTE 32		

Officials List

Attachment #13

Councilman Scott William Rosado
472 Stafford Ave.
Bristol, CT. 06010

Councilman David J. Preleski
193 Hollyberry RD.
Bristol, CT 06010

Councilman Peter Kelley
44 Southdown DR.
Bristol, CT 06010

Councilman David Mills
185 Oakland St.
Bristol, CT 06010

Councilman Mary Fortier
163 Goodwin ST.
Bristol, CT 06010

Chief Brian Gould
131 North Main St.
Bristol, CT 06010

Chief Jay Kolakoski
181 North Main St.
Bristol, CT 06010

Fire Marshal Robert Grimaldi
181 North Main St.
Bristol, CT 06010

Cara Christine Pavalock-DAmato
Legislative Office Building Room 4200
300 Capitol Ave.
Hartford, CT 06106

Whit Betts
Legislative Office Building Room 4200
300 Capitol Ave.
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Chris Ziogas
Legislative Office Building Room 4016
300 Capitol Ave.
Hartford, CT 06106

Henri Martin
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300 Capitol Ave.
Hartford, CT 06106

Rep. John Larson
221 Main St. 2nd floor
Hartford, CT 06106

Therese Pac
Town and City Clerk
111 North Main St.
Bristol, CT 06010

Officials List

Sen. Christopher S. Murphy
Colt Gateway
120 Huyshope Ave. Suite 401
Hartford, CT 06106

Sen, Richard Blumenthal
90 State House Square
10th floor
Hartford, CT 06103

State Dept. of Economic and Community Development
David Lehman, Commissioner
505 Hudson St.
Hartford, CT 06106-7106

State Dept. of Agriculture
Melody A. Currey, Acting Commissioner
165 Capitol Ave.
Hartford, CT 06106

Office of Policy and management
Melissa McCaw, Secretary
450 Capital Ave.
Hartford, CT 06106-1379

Raul Pino, M.D, M.P.H.
State Dept. of Public Health
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Hartford, CT 06106

Congressman Joseph Courtney
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Norwich, CT 06360

Ct. State Dept. of Energy and Environmental Protection
Kaite Dykes, Commissioner
79 Elm St., Hartford, CT 06106

William Tong, Attorney General
Office of the Attorney General
55 Elm St
Hartford, CT 06106

State Council on Environmental Quality
79 Elm St.
Hartford, CT 06106

Capitol Region Council of Governments
Marcia Leclerc, Chair
241 Main St. #4
Hartford, CT 06106

Senator Paul Formica

20 Bush Hill DR. #A

Niantic, CT 06357-1805

Officials List

Representative Mike France
17 Garden Drive
Gales Ferry, CT 06335

Representative Kathleen McCarty
226 Great Neck Rd.
Waterford, CT 06385

Representative Kevin Ryan
21 Terrace Dr.
Oakdale, CT 06370

Mayor Ronald McDaniel
Montville Town Hall
310 Norwich- New London Tpke.
Uncasville, CT 06382

Timothy May - Chair
310 Norwich- New London Tpke.
Montville Town Hall
Uncasville, CT 06382

William "Billy" Caron - Deputy Chair
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Montville Town Hall
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One Goodwin Sq 225 Asylum St
Hartford, CT 06103

Vernon D. Vesey II, *Building Inspector*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

William Bundy, *Fire Marshal/Director, Emergency Management*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

Officials List

William Bundy, *Fire Marshal/Director, Emergency Management*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

Pamela Bonanno, *Treasurer*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

Nancy Woodlock, *Zoning/Wetlands Officer*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

Donald Bourdeau, *Public Works Director*
225 Maple Ave.
Uncasville, CT 06382

Katie Sandberg, CCTC, *Town Clerk*
310 Norwich – New London Tpke.
Montville Town Hall
Uncasville, CT 06382

Patrick McCormack, *Director of Health*
372 W. Main St., 2nd Floor
Norwich CT 06360

Marcia Vlaun, *Director of Planning*
310 Norwich – New London Tpke.
MontvilleTown Hall
Uncasville, CT 06382

Lieutenant Dave Radford, *Montville Police Department*
911 Norwich-New London Tpke
Uncasville, CT 06382

CLA Engineers, *Town Engineer*
317 Main Street
Norwich, CT 06360
Phone: (860)886-1966 | Fax: (860)886-9165

Attachment #14

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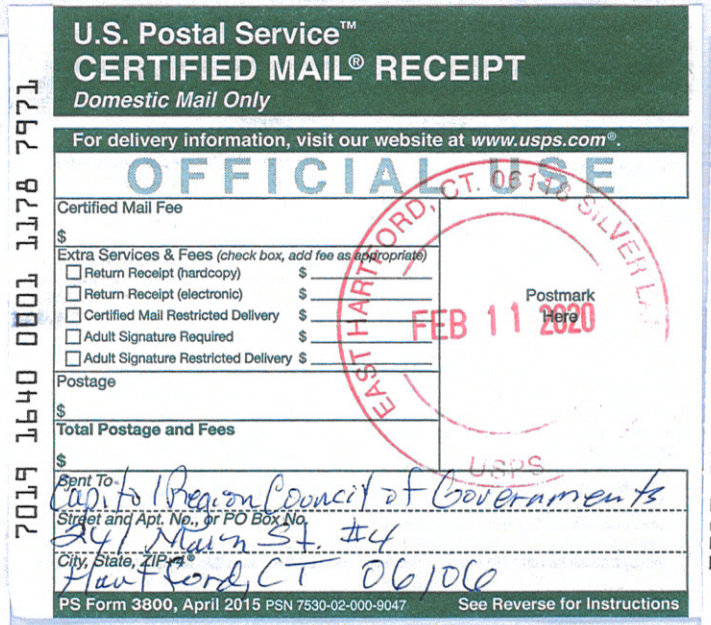
7019 1640 0001 1178 7971



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505 Hudson St.
City, State, ZIP+4®
Hartford, CT 06106

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- Adult Signature Restricted Delivery $

Postage $0.55
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Total Postage and Fees $4.10
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Mayor Ronald McDaniel
Street and Apt. No., or PO Box No.
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City, State, ZIP+4®
Uncasville, CT 06382

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Postage
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Sent To: Marcia Vlavn Director of Planning

Street and Apt. No., or PO Box No.: 310 Norwich-New London Tpke

City, State, ZIP+4®: Uncasville, CT 06382

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Sent To: Patricia McCormack D.P. Health

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City, State, ZIP+4®: Norwich, CT 06360

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Street and Apt. No., or PO Box No.: 310 Norwich-New London Tpke

City, State, ZIP+4®: Uncasville, CT 06382

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Street and Apt. No., or PO Box No.: 3450 Shackleford Rd.

City, State, ZIP+4®: Duluth GA. 30096

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Street and Apt. No., or PO Box No.: One Goodwin Square 225 Asylum St.

City, State, ZIP+4®: Hartford, CT 06103

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Sen. Richard Blumenthal

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City, State, ZIP+4®
Hartford, CT 06103

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City, State, ZIP+4®
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Joseph Crangarosso Fire Chief

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2029 Norwich-New London Tpke

City, State, ZIP+4®
Uncasville, CT 06382

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Lieutenant Dave Ballard, Montville Police

Street and Apt. No., or PO Box No.
911 Norwich-New London Tpke,

City, State, ZIP+4®
Uncasville, CT 06382

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Sent To
Sen Paul Formica

Street and Apt. No., or PO Box No.
20 Bush Hill Drive #A

City, State, ZIP+4®
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Sent To: Katie Sandberg, CCTC/Town Clerk
Street and Apt. No., or PO Box No.: 310 Norwich-New London Tpke.
City, State, ZIP+4®: Uncasville, CT 06382

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Sent To: C+A Engineers, Town Engineer
Street and Apt. No., or PO Box No.: 317 Main St.
City, State, ZIP+4®: Norwich, CT 06360

PS Form 3800, April 2015 PSN 7530-02-000-9047 — See Reverse for Instructions

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Street and Apt. No., or PO Box No.: 450 Columbus Blvd.
City, State, ZIP+4®: Hartford, CT 06103

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Sent To: Reg. Mike France
Street and Apt. No., or PO Box No.: 17 Garden Drive
City, State, ZIP+4®: Gales Ferry, CT 06335

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City, State, ZIP+4®: Uncasville, CT 06382

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City, State, ZIP+4®: Uncasville, CT 06382

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City, State, ZIP+4®: Uncasville, CT 06382

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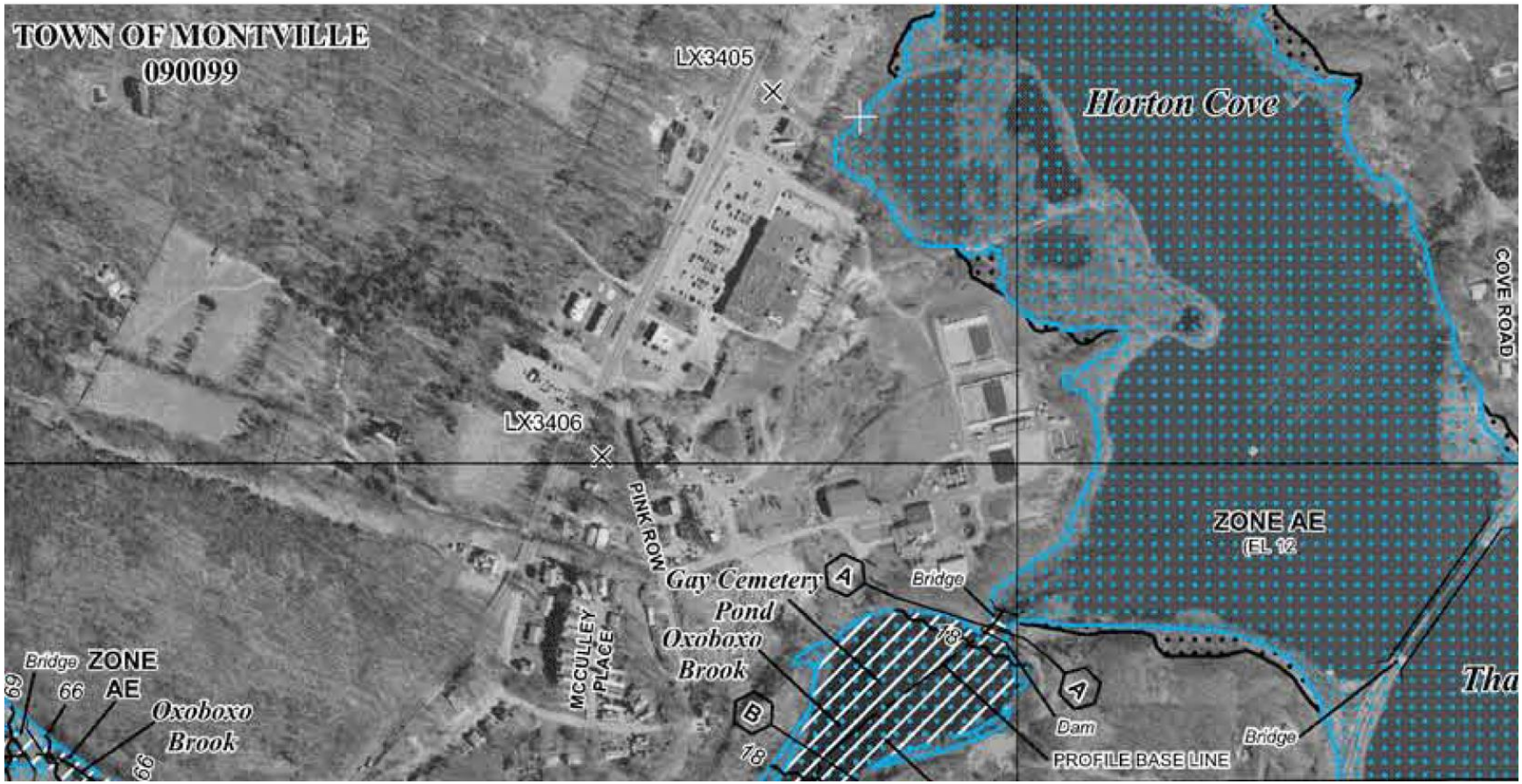
Attachment #15



Attachment #16

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*

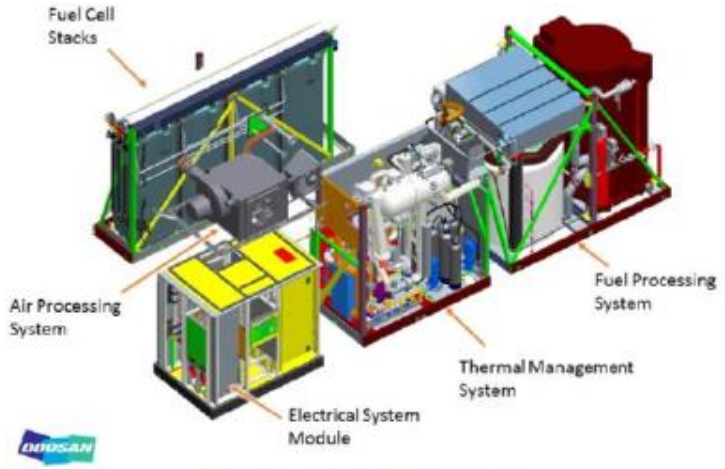


Figure 1. PureCell Model 400 Subsystems