Doosan Fuel Cell America, Inc.
195 Governor's Highway
South Windsor, CT 06074
T - 860 727 2200

January 20, 2017

RE: PETITION NO. 1263- Response to Interrogatories;
Doosan Fuel Cell America, Inc. petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required to replace an existing customer – side 400 kilowatt (kW) fuel cell with a 440-kW customer-side fuel cell facility located at Mount Sinai Hospital, 500 Blue Hills Avenue, Hartford, Connecticut.

Dear Siting Council,

Please find attached the responses to Council Interrogatories - (along with corresponding exhibits), requisitioned on 12/08/2016 for PE 1263 by the CT Siting Council.

Please be advised that Doosan submitted a Motion for Extension of Time to Respond on January 19, 2017 regarding Interrogatory number 15. We will provide the response to Interrogatory 15 as soon as we have the completed noise analysis report not later than February 17, 2017.

Additional questions may be addressed to:
Walter Bonola
195 Governor's Highway
South Windsor, CT 06074
(860) 727-2010
Walter.Bonola@doosan.com

Sincerely,

Doosan Fuel Cell America, Inc.

Dawn Mahoney, Esq.
General Counsel
Doosan Fuel Cell America, Inc.

VIA ELECTRONIC MAIL

December 8, 2016

Dawn Mahoney, Esq.
General Counsel
Doosan Fuel Cell America Inc.
195 Governor's Highway
South Windsor, CT 06074

RE: **PETITION NO. 1263** - Doosan Fuel Cell America, Inc. petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required to replace an existing customer-side 400 kilowatt (kW0 fuel cell facility with a 440-kW customer-side fuel cell facility located at Mount Sinai Hospital, 500 Blue Hills Avenue, Hartford Connecticut.

Dear Attorney Mahoney:

The Connecticut Siting Council (Council) issued interrogatories on the above-referenced petition on November 9, 2016 and requested responses to be filed not later than November 23, 2016 (see attachment). The Council did not receive any responses to date.

The Council is therefore reissuing these interrogatories and requests your responses to the enclosed questions **no later than December 22, 2016.** To help expedite the Council's review, please file individual responses as soon as they are available.

Please forward an original and 15 copies to this office, as well as send a copy via electronic mail. In accordance with the State Solid Waste Management Plan and in accordance with Section 16-50j-12 of the Regulations of Connecticut State Agencies the Council is requesting that all filings be submitted on recyclable paper, primarily regular weight white office paper. Please avoid using heavy stock paper, colored paper, and metal or plastic binders and separators. Fewer copies of bulk material may be provided as appropriate.

Yours very truly,

Melanie Bachman
Acting Executive Director

MB/CW

c: Council Members

Petition No. 1263
Doosan Fuel Cell America, Inc.
500 Blue Hills Avenue
Hartford, CT
Interrogatories

1. Why is the existing 400-kilowatt (kW) fuel cell proposed to be replaced, e.g. age, more electric power capacity, upgrade to more efficient model, etc.? Would the proposed replacement fuel cell be considered an "upgrade"? If yes, explain why, e.g. because of the higher power output, higher efficiency, etc.

R1. The fuel cell replacement is due to a 10% increases in nameplate capacity (440kW vs 400kW). There are no other changes to the fuel cell other than the nameplate certification. At the time the original fuel cell was installed there was no property tax exemption.

2. What is the age of the existing fuel cell, relative to its service life? What is the projected service life of the proposed fuel cell?

R2. The original unit was commissioned on 06/15/2012. The fuel cell has a 20 year product life with a projected 10-year overhaul for the fuel cell stacks. The replacement fuel cell has the same service life.

3. What would Doosan Fuel Cell America, Inc. (Doosan) do with the existing fuel cell to be removed? For example, would it be refurbished at the factory for resale or recycle as (mostly) scrap metal? Is there significant monetary recovery for some/all of its contents?

R3. The existing fuel cell is returned to the Doosan facility in South Windsor, CT where it is refurbished (cell stacks replaced) and prepared for a new site.

4. Would Doosan replace or upgrade the existing concrete pad and fence to accommodate the proposed replacement fuel cell and its cooling module? Would bollards be used to protect the fuel cell facility from being accidentally struck by vehicles?

R4. There is no need to replace or upgrade the existing concrete pads and fence. Bollards will protect the facility from being accidentally struck by vehicles.

5. Provide a detailed proposed site plan that included but it not limited to the fuel cell, cooling module, concrete pads, fence design and bollards (if applicable), and utility connections.

R5. Please see attached Mt. Sinai -1 Detailed Site Plan.

6. Is the project located outside of the 100-year and 500-year flood zones? If so, would the proposed replacement fuel cell and cooling module be elevated as a flood mitigation measure, e.g. one foot above the 100-year flood elevation.

R6. Please see attached Mt. Sinai -2 Flood Zone Map with a black circled dot representing the location of the proposed site. The map highlights that the proposed site is not in any flood zones.

7. Is the fuel cell located within any environmentally sensitive areas?

R7. The location of the fuel cell installation is not in an environmentally sensitive area.

8. Would any trees six inches in diameter or greater be removed to install the replacement fuel cell facility?

R8. No trees are required to be removed for this replacement installation of the fuel cell.

9. Would Doosan utilize the waste heat from the proposed replacement fuel cell facility? If yes would the waste heat be used for, e.g. heating and domestic hot water?

R9. The waste heat from the unit will be used for boiler pre-heat.

10. Would the facility only consume water during the initial commissioning start-up or every time the unit cycles on? How much water is used for the start-up? Would the fuel cell run on mostly a 24/7 basis as a baseload facility and thus have infrequent start-ups?

R10. The PureCell® unit operates in water balance below 86°F. The initial fill requires 350 gallons. The amount of make-up water above 86°F increases linearly from 0gpm to 1gpm at 110°F. Once the unit is started it will run in a 24/7 basis with infrequent start-ups.

11. Would the fuel cell facility provide backup power in the event of a power outage? If yes, would the fuel cell first shut down then automatically "black start" to restore power, or would it continue running seamlessly despite the loss of grid power (i.e. provide uninterruptable power)? Please explain.

R11. The proposed site will not be configured to provide backup power.

12. Would any surplus power be sold to the grid?

R12. Surplus power will not be sold to the grid on a regular basis. The host facility will use all the power produced. No power will be sold back to the grid.

13. Please provide an Emergency Response Plan for the proposed facility in accordance with Public Act 11-101, An Act Adopting Certain Safety Recommendations of the Thomas Commission.

R13. Please see attached Mt Sinai Emergency Response Plan.

14. Please identify media to be used for pipe cleaning procedures at the proposed facility in accordance with Public Act 11-101, An Act Adopting Certain Safety Recommendations of the Thomas Commission.

R14. Atmospheric air under pressure will be used – no solvents or cleaners will be used.

15. Please submit a noise analysis report to demonstrate compliance with the Connecticut Department of Energy and Environmental Protection (DEEP) noise control standards. In the Petition, Doosan predicts a noise level of not more than 62 dBA at 100+ feet away for the fuel cell. Is the cooling module included in this noise prediction? If no, please update this noise prediction and ensure compliance with DEEP noise control standards.

R15. Doosan filed a Motion for Extension of Time to respond to this interrogatory on February 19, 2017. A detailed noise analysis report will be provided as soon as completed not later than February 17, 2017.

16. Which National Fire Protection Association (NFPA) or other codes and standards apply to fuel cell construction, installation and/or modifications?

R16. ANSI FC-1 2014: American National Standard for Stationary Fuel Cell Power Systems. This certification calls out all codes and standards for stationary fuel cell applications.

17. Provide a table showing state criteria thresholds and projected emissions from the proposed facility for all greenhouse gasses listed in the Regulations of Connecticut State Agencies Section 22a-174-1(49) with and without the use of waste heat.

R17. The small emissions are highlighted below in Table 1 for the unit operation with and without heat.

Table 1: PureCell® Model Emissions Data

	PureCell Output electric only (lb/MWh)	PureCell Output with heat (lb/MWh)	State Emission Standards (lb/MWh)
NO_x	0.01	0.01	0.15
CO	0.02	0.02	1
VOC	0.02	0.02	Not Listed
CO_2	1050	815	1650

18. Quantify the amount of phosphoric acid in the proposed replacement fuel cell.

R18. Phosphoric acid is bound within a matrix within the fuel cell stacks and the quantity is proprietary. The amount does comply with the State and Federal regulations.

19. Which emissions rate in pounds of CO2 per megawatt-hour (MWh) did Doosan use for the eGRID non-base load generation for the ISO New England, Inc. electric system? Doosan estimates that annual carbon emissions would be reduced by about 300 metric tons per year. Is this only for displacement of non-base load electric generation, or would the total carbon reduction be potentially higher because the used of waste heat would reduce the runtime of the building's boiler(s)?

R19. We use the 2012 grid "Fossil fuel output emission rate (CO_2 lb/Mwah)" of 980.27 with a grid loss of 9.17% for a total of 1070 lb/Mwah for the NEWE Region. We account for the CO_2 offset to natural gas heating fuel using avoided heat efficiency of 80% in our carbon emissions.

20. Could offsets be used to mitigate air emissions impacts from the facility?

R20. Current control technologies are not commercially available to reduce the greenhouse gas emissions from the facility. The utilization of the waste heat in the facility into the buildings on site reduces the greenhouse gas emissions impact on the environment.

21. Discuss other mitigation techniques that could be used to offset air emissions from the proposed facility e.g. planting trees. If planting trees is listed as an option, estimate the number and size of trees required.

R21. Planting trees is not an option for this project. Further CO_2 offsets are achieved through increased utilization of waste-heat but vary on a site-by-site basis due to existing heating and cooling system designs and operating parameters. To affect the utilization of waste-heat from Doosan's advanced

combined heat and power (A-CHP) product, architectural engineers would benefit from updated building practices that introduce technologies like fuel cells that have the ability to significantly reduce energy costs and meet sustainability goals.

22. Natural gas has sulfur dioxide injected as an odorant. Is desulfurization required, e.g. to protect the fuel cell stack from sulfur? Explain. If yes, please submit a desulfurization plan narrative for the proposed fuel cell facility containing the following information:

a) Chemical reaction overview concerning what substances are produced from the desulfurization process, as well as plans for their containment and transport;
b) How much solid sulfur oxide would result from the desulfurization process, and methods and locations for containment, transport, and disposal;
c) Whether any of these desulfurization substances are considered hazardous, and if so, plans for the containment, transport, and disposal of hazardous substances;
d) Anticipated method of disposal for any other desulfurization substances; and
e) Whether any gaseous substances resulting from desulfurization can be expected to vent from the fuel cells, as well as the applicable DEEP limits regarding discharge of these gasses.

R22a. The Model 400desulfurizer system removes sulfur used as an odorant in natural gas. 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. At no time is sulfur or zinc-sulfide accessible or removed during the operation or service of the fuel cell. When the desulfurized system is overhauled, it is sealed and transported back to the manufacturing facility for recycling.

R22b. There is no solid sulfur oxide result from the desulfurization process; all natural gas odorant, as noted above, converts to zinc-sulfide and remains sealed within the fuel cell.

R22c. The by-product, zinc-sulfide, is sealed within the fuel cell system, and as noted above, when the desulfurized system is overhauled, it is sealed and transported back to the manufacturing facility for recycling.

R22d. As noted above, the only by-product is zinc-sulfide, which is transported back to the manufacturing facility for recycling.

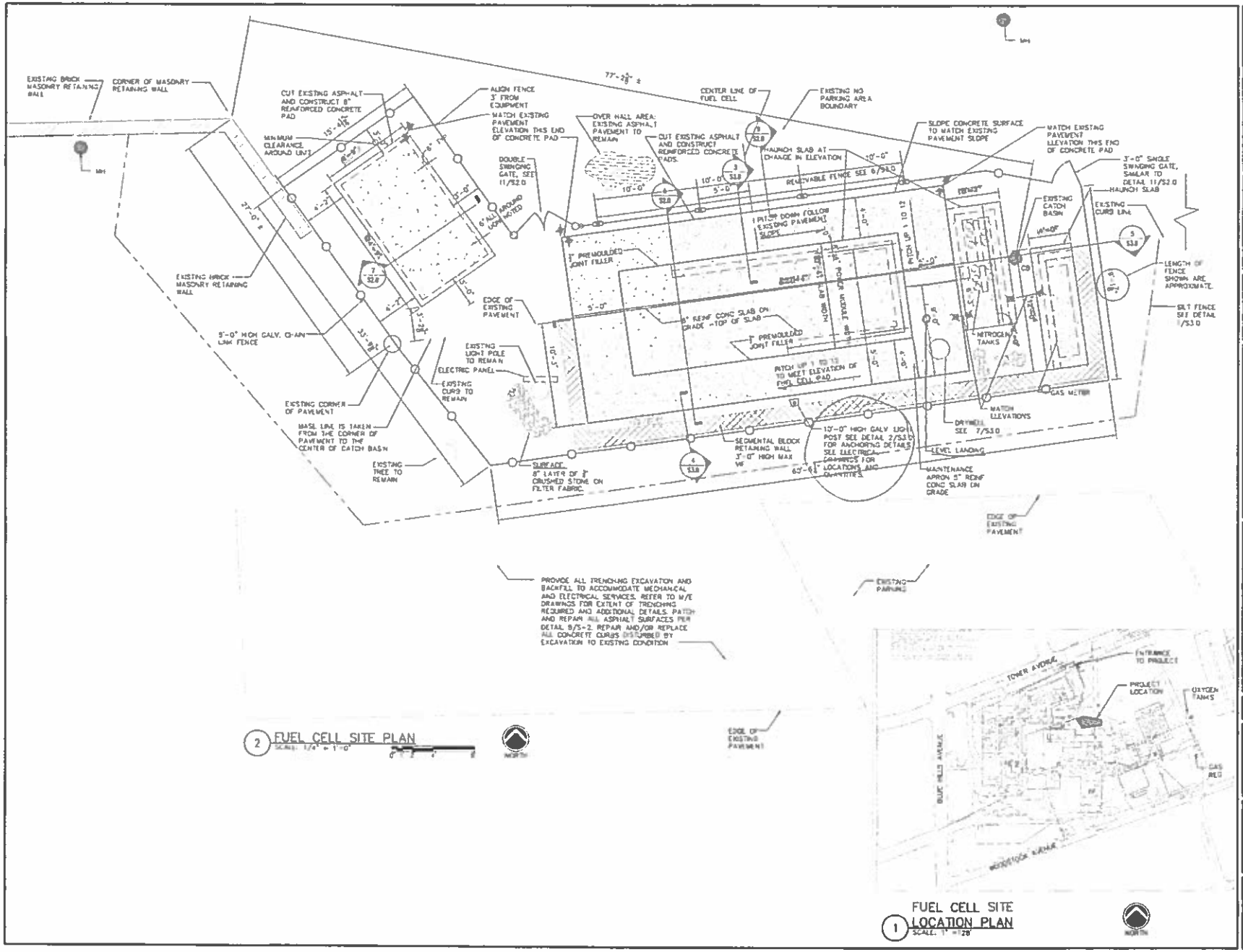
R22e. No gaseous substances resulting from desulfurization are expected to vent from the fuel cell – as noted above, the desulfurization process is sealed within the fuel cell system.

23. If the project is approved by the Council, approximately when would construction commence and when would it be completed? What are the estimated work hours and days of the week, e.g. Monday through Friday 7:00 a.m. to 5:00 p.m.?

R23. We plan to start construction work by February 2017. The work is to be completed and commissioned by the end of April 2017. Regular work hours are Monday through Friday 7:00am to 5:00pm.

MT.SINAI -1

DETAILED SITE MAPS



2 FUEL CELL SITE PLAN
SCALE: 1/4" = 1'-0"

1 FUEL CELL SITE LOCATION PLAN
SCALE: 1" = 20'

O'DEA LYNCH ABBATTISTA
CONSULTING ENGINEERS
80 Broadway Hawthorne, NY 10532
tel 914.747.2800 fax 914.747.0464
www.olaa.com

UTC Power
A United Technologies Company
195 GOVERNOR'S HWY
SOUTH WINDSOR, CT, USA
866-900-POWER(7693)
www.UTCPOWER.COM

Structural Engineer
CJSJ
Building Structural Engineering Services, LLC

KEY PLAN

No	ISSUE OR REVISION	DATE
2	ISSUED FOR CONSTRUCTION	12/16/11
1	ISSUED FOR SDS REVIEW	11/14/11

UTC POWER FUEL CELL
MOUNT SINAI HOSPITAL
500 BLUE HILLS AVE
HARTFORD, CT

FUEL CELL LOCATION AND SITE PLANS

SCALE: AS NOTED
DRAWN BY: MEJ
CHECKED BY: JR
DATE: 11/14/11
PROJECT NO.: UTC0002.00
DRAWING NO.: S1.0

MT. SINAI -2

FLOOD ZONE MAP

od insurance is available in this community, contact yo
onal Flood Insurance Program at (800) 638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0362F

FIRM

FLOOD INSURANCE RATE MAP

HARTFORD COUNTY, CONNECTICUT (ALL JURISDICTIONS)

PANEL 362 OF 675

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BLOOMFIELD, TOWN OF	090122	0362	F
HARTFORD, CITY OF	095080	0362	F
WEST HARTFORD, TOWN OF	095082	0362	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 09003C0362F

EFFECTIVE DATE: SEPTEMBER 26, 2008

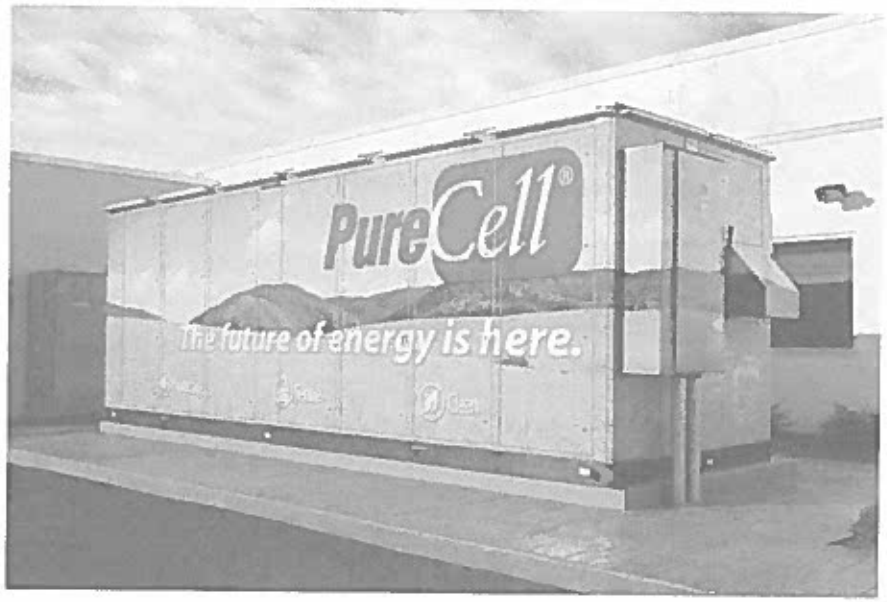
Federal Emergency Management Agency

MT.SINAI -3

DOOSAN FUEL CELL EMERGENCY RESPONSE PLAN

Doosan Fuel Cell America, Inc.
Fuel Cell Emergency Response Guide

Mount Sinai Hospital
500 Blue Hills Avenue,
Hartford, CT 06002



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 May 30, 2015.

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.

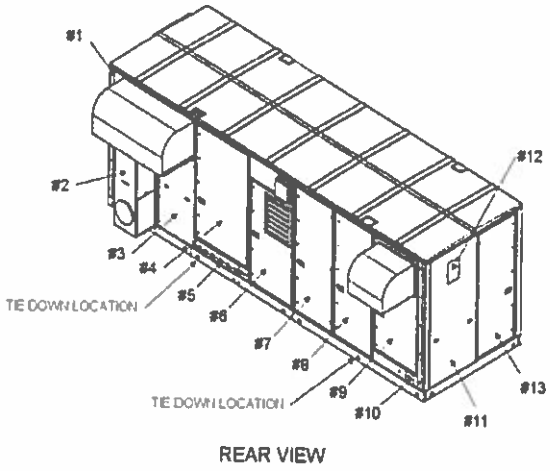
Scope

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

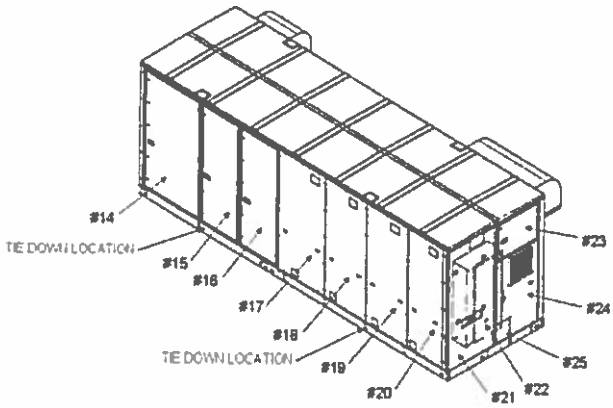
Emergency Contacts and Numbers

Local Emergency Number	**911**
Doosan Fuel Cell America Control Center	**(860) 727-2847**
Clean Harbors Emergency Cleanup Response	**(800) 645-8265**
Fire Department – Non-emergency number	Blue Hills Fire Department (860) 243-8949
Hospital – Non-emergency number	Hartford Hospital 80 Seymour St, Hartford, CT 06102 860-545-5000
Electric Utility Name: Eversource	**800-286-5000**
Gas Utility Name: Eversource	**800-286-5000**
Local Oil & Chemical Spill Response Division	**800-645-8265**
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

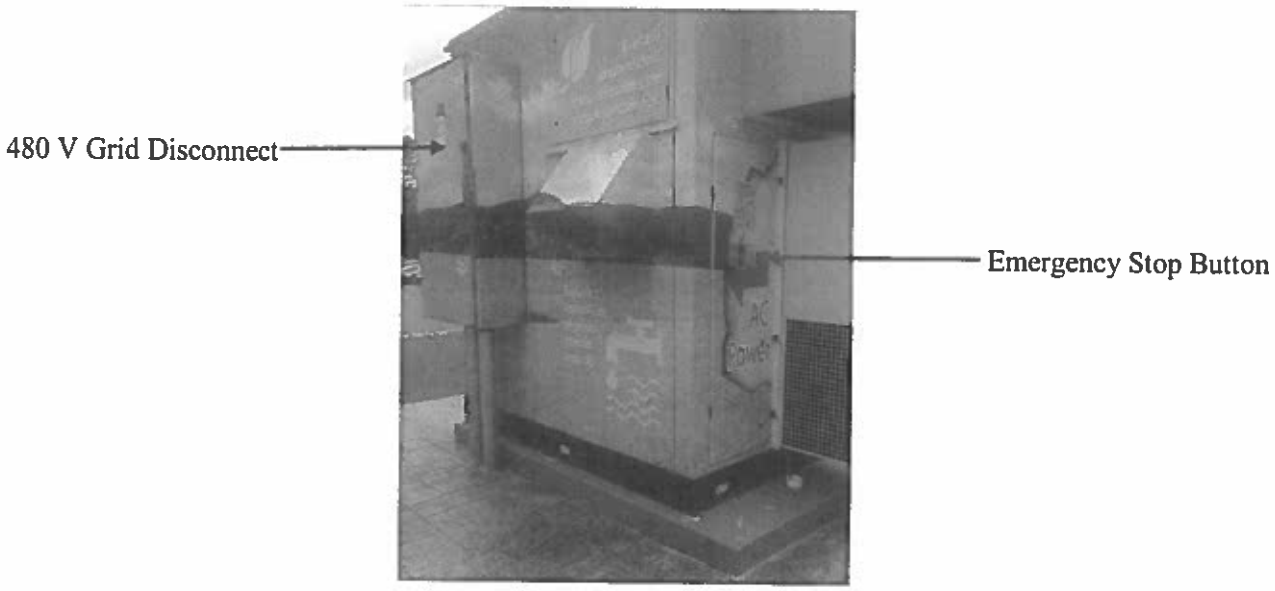
Fuel Cell Hazard Overview



REAR VIEW



FRONT VIEW



Rear View Panel	Primary Hazard	Front View Panel	Primary Hazard
1 (Computer Terminal)	Electrical = 120 VAC	14 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
2 (Air Conditioner)	Electrical = 480 VAC Chemical = Refrigerant	15 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
3 (Swing Door)	Electrical = 480 VAC	16 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam
4 (Mechanical Entry)	Electrical = 480 VAC Chemical = Propylene Glycol Thermal = 350°F Steam Pressure = 150 psi Steam	17 (DC Cell Stack)	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
5 (Mechanical Entry)	Chemical = Propylene Glycol Thermal = 350°F Steam Pressure = 150 psi Steam	18 (DC Cell Stack)	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
6 (TMS)	Electrical = 480 VAC Chemical = Propylene Glycol / Deionized Water / Resin Thermal = 350oF Steam Pressure = 150 psi Steam	19 (DC Cell Stack)	Electrical = 300 VDC Chemical = Solid phosphoric acid / combustibles
7 (ILS)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	20 (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	21	Not accessible
9 (Fuel Processing Area)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	22 (Grid Connect Disconnect)	Electrical = 480 VAC
10 (Gas/Nitrogen Inlet)	Chemical = combustibles	23 (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	24 (Inverter)	Electrical = 1400 VDC / 480 VAC
12 (Reformer)	Electrical = 480 VAC Chemical = Air sensitive catalyst / combustibles Thermal = 600°F Reformer Pressure = 150 psi steam	25 (Grid Independent Circuit)	Electrical = 480 VAC
13 (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 Material Safety Data Sheets (MSDS)

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

External service lines will be clearly identified. Labeling will be in accordance with ANSI A13.1. Labeling will be similar to example below:

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.