Attachment 3

Doosan Fuel Cell America, Inc.

Fuel Cell Emergency Response Guide

Israel Putnam Refectory

2358Alumni Drive

Storrs, CT 06269

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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.

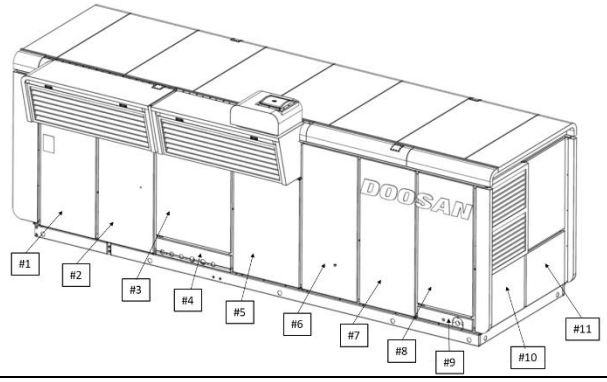
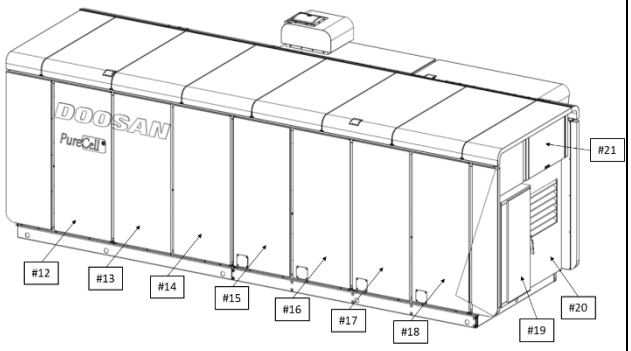
Scope

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	UConn Fire Dept. **(860) 486-4925**
Hospital – Non-emergency number	**Windham Hospital** **112 Mansfield Ave** **Willimantic, CT 06226** **(860) 294-9272**
Electric Utility Name: Eversource Energy	**(866) 924-5325**
Gas Utility Name: Connecticut Natural Gas	**855-645-2427**
Local Oil & Chemical Spill Response Division	**800-645-8265**
CT. DEEP Oil & Chemical Spill Response Division	**860-424-3338**
EPA Region 1 Emergency Response	**(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

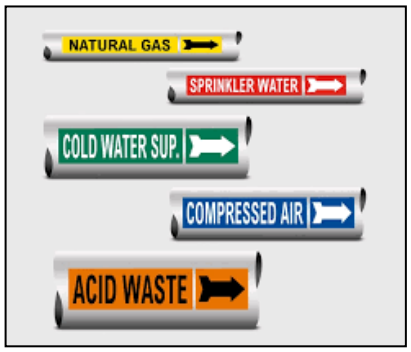
*When applicable

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

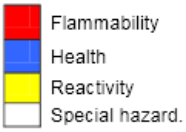
US. Rhode Island RTK
PHOSPHORIC ACID Listed

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.
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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/m^3 (respirable)
7440-50-8	55-62	Copper	1 mg/m3	1 mg/m^3 (dust)
1314-13-2	28-33	Zinc oxide	15 mg/m3 5 mg/m3 (respirable)	2 mg/m^3 (respirable)

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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

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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.

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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

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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.

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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

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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

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