



SNC • LAVALIN

Technical Data Sheet
EMERGENCY GENSET

PROJECT No. 5194812
PROJECT NAME: HyNet Low Carbon Hydrogen Plant

DOCUMENT No. 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 3 of 8

1	Rev	Applicable To:	<input checked="" type="checkbox"/> Proposal	<input type="checkbox"/> Purchase	<input type="checkbox"/> As Built	<input type="checkbox"/> Manufacturers Std	<input type="checkbox"/> Other
2		Manufacturer	Model		Size & Type	Serial No.	
3		Driven equipment tag no	10-CAB-R-001		Location	Stanlow NW England	
4		Driven equipment type	Generator		Power reqd normal /max, kW	1000 (HOLD 1)	
5		Package mfr			Speed normal/max	STA	
6		Engine mfr			Direction of rotation facing	STA	
7		Max. Sound pressure level	85dB(A) @ 1m Envelope		Cooling Method	Roof mounted Air cooler	
8		Remarks:					
9							
10		ENGINE DESIGN DATA					
11		No of cylinders			Model no		
12		Direction of rotation facing flywheel	CW/CCW		Configuration	Inline/Vee	
13		Bore stroke	mm		No of cycles	4	
14		Turbocharged/supercharged	<input type="checkbox"/> Yes	<input type="checkbox"/> No	No of valves per cyl Inlet/exhaust		
15		Displacement	m ³		Intercooled/aftercooled	<input type="checkbox"/> Yes	<input type="checkbox"/> No
16		Av piston speed @ max speed	m/s		Combustion air flow @ max power	m ³ /hr	
17		Engine speed max/ continuous	1500 rev/min		Compression ratio (mech/overall)		
18		Gross continuous engine output	kW		Max turbocharger speed	rev/min	
19		Deductions			BMEP*	bar a	
20		Jacket water pump	kW		Jacket/aftercooler water pump flows	m ³ /hr	
21		Aftercooler water pump	kW		Jacket water max outlet temp	°C	
22		Radiator fan (if direct)	kW		Exhaust temps aftercooler inlet/outlet	°C	
23		Other auxiliaries	kW		Exhaust manifold	Wet/Dry	
24		Net cont engine output	kW		Governing type	Single/Multiple/All speeds	
25		Max output 1 hr in 12	kW		Governing speed range	rev/min	
26		Specific fuel consumption at loads			Governing accuracy class		
27		100%load	kJ/kWhr	kJ/kWhr	Time to establish controllability	s	
28		75% load	kJ/kWhr	kJ/kWhr	Governor mfr/model		
29		50% load	kJ/kWhr	kJ/kWhr	Governor operation	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Electrical
30						<input type="checkbox"/> Mechanical	
31		* BMEP -brake mean effective pressure			Noise Enclosure Required	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
32		Remarks:			Enclosure Type	See Notes 1,3	
33							
34		HEAT REJECTION DATA					
35		To exhaust @ 100% load	kW		To atmosphere @ 100% load	kW	
36		To cooling system @ 100% load	kW		To oil cooler @ 100% load	kW	
37		Remarks:					
38							
39		LIQUID FUEL SYSTEM					
40		Fuel	"Red" diesel		Filtration absolute particle size	µm	
41		Filter configuration	Simplex/duplex		Differential pressure	Normal	Max
42		Min inlet press	bar a		Fuel day tank by vendor	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
43		Fuel pump driver	<input checked="" type="checkbox"/> Engine	<input type="checkbox"/> Motor	Fuel tank volume	m ³	
44		Fuel tank max/min elevation	m		Fuel tank retention	24 h	
45					Fuel tank data sheet no		
46		Remarks:	One double walled day tank with interstitial leak detection required will fill connection at 1m above grade for filling via standard UK road tanker.				
47							
48		GAS FUEL SYSTEM					
49		Press regulator make/model			Press before/after regulator	bar a	
50		Gas valve make/model			Temp before/after regulator	°C	
51		Remarks:					
52							
53		BASIC CONSTRUCTION					
54		Cylinders			Pistons		
55		Removable	YES		No oil rings		
56		Wet or dry			No compression rings		
57		Integral jacket			Cooling method		
58		Crank shaft			Cam shaft		
59		Forged welded or cast			Type of drive		
60		Heat treated					
61		Remarks:	Skid baseplate shall incorporate drip pan with single, 2" minimum, flanged drain connection.				
62							
63							
64							



SNC • LAVALIN

PROJECT No. 5194812
PROJECT NAME HyNet Low Carbon Hydrogen Plant

DOCUMENT No. 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 4 of 8

1	Re	BASIC CONSTRUCTION (continued)					
2	Conn rods						
3	Forged				Fly wheel		
4	Heat treated						
5	Rifle drilled						
6	Articulated						
7	Valves				Frame (cast) (fabricated)		
8	No per cylinder				Wrist pin (full float)		
9	Removable seats				Couplings & guards		
10	Lifters (hyd) (rollers)						
11	Compression release						
12	Remarks:						
13							
14							
15							
16		MATERIALS					
17	Cylinder heads				Cylinder liners		
18	Pistons				Connecting rings		
19	Crankshaft				Cam shaft		
20	Wrist pin				Valves		
21	Frame				Lube oil tank		
22	Base				Bearings		
23	Main - shell				Main - lining		
24	Crankpin						
25	Out board						
26	Remarks:						
27							
28							
29		WEIGHTS & DIMENSIONS					
30	Bare engine with flywheel				Oil cooler		
31	Dry/operating weight			kg			
32	Length/width/height			kg			
33	Min distance between engines			m	Max maintenance weights		
34	Min height to remove pistons/rods			m		Weight	
35						Weight	
36						Weight	
37						Weight	
38	Remarks:						
39							
40		SITE CONDITIONS					
41	Altitude				Sea Level	Cooling medium	
42	Ambient temp	Min	-15	°C	Max	35	
43	Air humidity	Min	10	%	Max	100	
44	Back press (air cooler/radiator)				Bar	Area class	
45	Electrical supply (For information only as Diesel Generator package is standalone unit with battery starter which self-charges whilst running)					Temp class	
46	Motors		400 V		3 Ph	50 Hz	
47	Heaters/chargers		220 V		1 Ph	50 Hz	
48	Fuel type		Diesel / Gas / Dual			Location	
49	Fuel specification					Outdoors	
50						Winterisation req'd	
51						□ Yes	
52						□ No	
53							
54							
55	Filter mfr					Filtration	
56	Blow in doors		■ Yes		□ No		
57	Inlet duct size					mm	
58	Air intake shut off valve		■ Yes		□ No		
59	Intake SOV actuated by						
60						Diff press indicator	
61						■ Yes	
62						□ No	
63						Weather louvres/shutters	
64						■ Yes	
65						□ No	
66						with centrifugal/inertial first stage.	
67	Remarks:						
68							
69							
70							



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PROJECT No. 5194812
PROJECT NAME HyNet Low Carbon Hydrogen Plant

DOCUMENT No 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 5 of 8

1	Rev	LUBRICATION SYSTEM			
2		Main oil pump drive	<input type="checkbox"/> Engine	<input type="checkbox"/> Motor	Cooling <u>Jacket water</u>
3		Auxiliary pre lube oil pump	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Cooler mfr _____
4		Pump driver power	_____ kW		Cooler in / outlet temp _____ °C
5		Engine sump capacity	_____ m ³		Oil filter configuration _____
6		Oil press to engine, normal / min	_____ bara	<input type="checkbox"/> Full flow	<input type="checkbox"/> Simplex
7		Sump heater	_____ kW	<input type="checkbox"/> _____ % flow	<input checked="" type="checkbox"/> Duplex
8		Heater rating	_____ kW	Filter mfr _____	
9		Pump mfr	_____	Filtration _____	
10		Pump type/model	_____	Absolute particle size _____	_____ μm
11		Pump capacity	_____ m ³	Filter element type _____	
12		Remarks: _____			
13		_____			
14		_____			
15		COOLING SYSTEM			
16		Jacket water cooler	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	Cooler mfr _____
17		Cooler configuration	<input type="checkbox"/> Simplex	<input type="checkbox"/> Duplex	Air cooler fan drive <input type="checkbox"/> Direct <input type="checkbox"/> Motor
18		Turbocharger aftercooler	<input type="checkbox"/> Air	<input type="checkbox"/> Water	Fan drive by belts type/quantity _____
19		Cooling system normal operating press	_____ bara		Cooler mfr _____
20				Cooler circuit <input type="checkbox"/> Combined	<input type="checkbox"/> Separate
21		Circulating pump mfr	_____	Water temp @ inlet to jacket _____	_____ °C
22		Pump model/type	_____	Jacket water heater <input type="checkbox"/> Yes	<input type="checkbox"/> No
23		Pump rated power	_____ kW	Heater rating _____	_____ kW
24		Remarks: 50/50 water & ethylene glycol			
25		_____			
26		_____			
27		STARTING SYSTEM			
28		Battery start	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	No of battery sets <u>TWO</u>
29		Capacity per set	_____ A/hours		No of starts per set rated/actual _____
30		Battery charger	_____ Alternator/and/Static		Time to recharge _____ h
31		Hydraulic start	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Auxiliary	Recharging pump drive <input type="checkbox"/> Engine <input type="checkbox"/> Motor
32		Air start	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Air compressor drive <input type="checkbox"/> Engine <input type="checkbox"/> Aux Engine
33		Start system	<u>2 x electric motor starters</u>		<input type="checkbox"/> Motor
34		Air receiver design press	_____ bar a	Air receiver capacity _____	_____ m ³
35		Air compressor mfr	_____	Air receiver design code _____	
36		Compressor installed power	_____ kW	No of starts _____	
37				Receiver operating press normal / min _____	_____ bar a
38		_____			
39		_____			
40		EXHAUST SYSTEM			
41		Exhaust ducting supply	Vendor/Purchaser _____	Ducting layout refer sheet _____	
42		Exhaust duct surface temperature, °C _____			
43		BARRING SYSTEM			
44		Type	<input type="checkbox"/> Manual	<input type="checkbox"/> Power assisted	Air operated <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
45					Electrically operat <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
46		_____			
47		TESTS			
48		Inspection	<u>YES</u>	Witness performed test	<u>YES</u>
49		Certified brake data	<u>YES</u>	Noise Test	<u>YES</u>
50		_____			
51		_____			
52		_____			
53		AUTO SHUT DOWN CONTROLS			
54		Lube oil failure	<u>Yes</u>	Lube oil temp	<u>Yes</u>
55		Water failure	<u>Yes</u>	Water temp	<u>Yes</u>
56		Method of Shutdown	_____		
57		_____			
58		Remarks: _____			
59		_____			
60		_____			



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Technical Data Sheet
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PROJECT No 5194812
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DOCUMENT No. 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 6 of 8

PURCHASER'S DATA

Table with 5 columns: Item No., Description, Value, Description, and Value. Rows include Rated Output (KW), Rated Power Factor, Service Voltage, Rated Frequency, No. of Phases, Duty Type, Fault Level, Generator Neutral Earthing, Earth Fault Current, Neutral Earth Resistor Rating, Excitation, Reactance values, Parallel Operation, Unbalanced Load, Surge Overvoltage Protection, Mains Terminals, and Neutral Terminals.

NOTES

- 1) Air cooling design temperature 35C
2) Neutral Earthing Transformer / Resistor is to be supplied by the Supplier
3) Generator power output shall be connected to a 6.6kV Switchboard by the Purchasers Step-Up Transformer (if required).

Generator

Large table with 4 columns: Parameter, Value, Generator Parameters (All), and Generator Parameters (>1MVA only). Rows include Type, Frame Designation, Degree of Protection, Synchronous Speed, 1st Critical Speed, Direction of Rotation, Rated Voltage, Rated Frequency, Rated Output at 40°C Base kVA, Rated Output at Driver Site Maximum Power, Power Factor, Duty Type, Rated Current, Thermal Rating, Max. Allowable Neg. Phase Seq. Current, Max. Allowable Content of Overharmonics, Efficiency, Field Current No Load, Field Current Full Load, Insulation Class, Temp Rise Class, Overload Capability, Substained Short-Circuit, Moment of Inertia of Rotor, Cooling Method, Cooling Water Flow Rate, Cooling Water Design Pressure, Leak Detection System, Positive Sequence Resistance, Zero Sequence Resistance, Negative Sequence Resistance, Zero Sequence Reactance, Negative Sequence Reactance, Direct Axis Synchronous Reactance, Direct Axis Transient Reactance, Direct Axis Sub-Transient Reactance, Short Circuit Ratio, Quadrature Axis Synchronous Reactance, Quadrature Axis Transient Reactance, Quadrature Axis Sub-Transient Reactance, Direct Axis O.C. Transient Time Constant, Direct Axis S.C. Transient Time Constant, Direct Axis O.C. Sub-Trans. Time Constant, Direct Axis S.C. Sub-Trans. Time Constant, Quad. Axis O.C. Transient Time Constant, Quad. Axis S.C. Transient Time Constant, Quad. Axis O.C. Sub-Trans. Time Constant, Quad. Axis S.C. Sub-Trans. Time Constant, Potier Reactance, Damping Factor, Saturation Factor, Basic Impulse Level, Overall Dimensions, Weight of Machine, Weight of Stator, Weight of Heat Exchanger, Weight of Coolant.



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PROJECT No. 5194812
PROJECT NA HyNet Low Carbon Hydrogen Plant

DOCUMENT No. 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 7 of 8

SUPPLIER'S DATA

1	System Response			Bearings	
2	Voltage Response :			Radial - Drive End	
3	- Load Change From 50 To 0%	% , secs		Radial - Non Drive End	
4	- Load Change From 100 To 50%	% , secs		Thrust Bearing	
5	- Load Change From 0 To 50%	% , secs		Bearing Vibration Detector Type / Manufacturer	
6	- Load Change From 50 To 100%	% , secs		Number in Each Bearing	
7	Frequency Response :			Bearing Temperature Detector Type	
8	- Sudden Load Change From 50 To 0%	% , secs		Number in Each Bearing	
9	- Sudden Load Change From 100 To 50%	% , secs		Method of Bearing Lubrication	
10	- Sudden Load Change From 0 To 50%	% , secs		Lubrication Oil Flow Rate	m3/h
11	- Sudden Load Change From 50 To 100%	% , secs		Lubrication Oil Pressure	barg
12	Exciter			Windings	
13	Type			Stator Connection	
14	Full Load Current (40°C)	A		Number of Stator Winding Terminals	
15	Full Load Voltage	V		Winding Temperature Detector Type	
16	Ceiling Current (40°C)	A		Number in Each Phase	
17	Ceiling Voltage	V		Heater Ratings	
18	Nominal Exciter Response			Alternator	kW
19	Current at alternator base kVA	A		Exciter	kW
20	Insulation Class - Stator / Rotor	/		Aux. Cooling Fans	
21	Temp Rise Class - Stator / Rotor	/		Rating	kW
22	AVR			Manufacturer	
23	Model No			Frame Design	
24	Manufacturer			Number Off	
25	Range of No Load Adjustment			Duty	%
26	Steady State Accuracy	%		Neutral Earthing Resistor	
27	AVR Data (>1MVA only)			Type	
28	Forward Gain (KA)			Resistance	Ohms
29	Feedback Gain (KF)			Resistor Rating	A , secs
30	Regulator Amplifier Time Constant (TA)	secs		Degree of Protection	
31	Regulator Feedback Time Constant (TF1)	secs		Neutral Earthing Transformer	N.A.
32	Maximum Regulator Output (VR MAX)			Type	
33	Minimum Regulator Output (VR MIN)			Rating	kVA
34	Max. Rate of Change of Reg. Output (VR MAX)				
35	Input Filter Time Constant (TR)	secs			
36	Exciter Gain (KE)				
37	Exciter Time Constant (TE)	secs			
38	Exciter Output (E MAX)				
39	Exciter Output (E MIN)				
40	Exciter Saturation at 75% E MAX (SE75)				
41	Exciter Saturation at 100% E MAX (SE100)				
42	IEEE Model Type				
43	Regulator Feedback Time Constant (TF2)	secs			
44					
45	REMARKS:				
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					



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DOCUMENT No. 5194812-000-45ED-4-0002
REVISION 03
ITEM NUMBER 10-CAB-R-001
PAGE 8 of 8

1 Rev
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
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19
20
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NOTES

1. The Emergency Diesel Generator shall be supplied as a package, complete with a weatherproof fully ventilated acoustic enclosure. The enclosure shall be fabricated from corrosion resistant materials and attenuate noise levels to 85dBA @ 1m.
2. The Package shall be supplied complete with its own control panel, radiator cooling system, starting system, air intake filtration, exhaust silencer and all accessories. The diesel engine shall be close coupled to the generator on a common baseplate. Baseplate shall include drip tray sloped to one common drain flange for connection to OWNER drain system.
3. The protection rating of the acoustic enclosure shall be IP 55 minimum. AC generator shall be IP44 minimum.. Instrumentation shall be IP66 minimum.
4. Batteries and chargers shall be supplied for starting and control panel power. The charging and battery system shall contain adequate protection against complete depletion. Primary starting system shall be electric, secondary system shall be a separate starter/battery.
5. An electronic speed governor shall be provided, and a separate overspeed device shall be installed on the engine.
6. The engine shall be provided with an air intake shutoff, operated by a gas detection system supplied by Others.

7 Project emission standards are as follows: (HOLD 2)

Maximum allowable limits for emissions (mg/m3) @ ref conditions of 273K and O2=15%				
Fuel Type	Total Solid Particles (TSP)	Carbon Monoxide (CO)	Sulphur Dioxide SO ₂	Nitrogen Oxides NO _x
Diesel	100	250	400	500

8. Engine protection shall be provided as follows: (SUPPLIER to confirm)

	ALARM	SHUTDOWN
Fuel oil leak from high pressure jacketed pipe	X	
Lube oil low pressure	X	
Lube oil low low pressure		X
Lube oil high temperature	X	
Turbocharger speed	X	
Water cooling high temperature	X	X
Water cooling low pressure	X	
Exhaust gas cylinder high temperature	X	X
Exhaust gas turbocharger high temperature	X	
Hydraulic oil leak from jacketed pipes	X	
Engine speed	X	
Engine overspeed	X	X
Crankcase oil mist detection (if provided)	X	X
AC generator winding temperature	X	X
Failed Start	X	

9. SUPPLIER shall provide the exhaust system comprising silencer, bellows and spark arrestor, fabricated in stainless steel.

10. SUPPLIER shall complete all data in this datasheet with their proposal.

ATTACHMENT 2: Technical Note Red Line Mark-Up

(Technical Note – Secondary Containment)

Technical Note

Project:	HyNet Hydrogen Production Plant		
Subject:	Secondary Containment		
Author:	Jon Perez		
Date:	22/06/2021 (Rev 03)	Project No.:	5194812
Distribution:	Internal	Representing:	SNC-Lavalin

Introduction

This note is to confirm secondary containment philosophy on the HyNet Hydrogen Production Plant.

General Philosophy

Secondary containment is required to provide emergency protection against discharges of liquids if they are hazardous (flammable / toxic) or may cause damage to the environment.

Secondary containment may take the form of:

- Bunds
- Drip Trays (for equipment)
- Interceptors Sumps
- Expansion Vessels
- Double Skinned Tanks / Vessels
- Concentric Pipes
- Building Structures / Ventilation
- Screeding and Kerbing (for tanker unloading connections)

Approach:

SNC-Lavalin have reviewed the storage inventories on the plant, and in each case reviewed what the substance is, how it is stored, whether the Safety Data Sheet considers the substance to be flammable, toxic or damaging to the environment, and proposed a secondary containment arrangement. Note that, where a bund is specified, it shall hold at least 110% of the maximum inventory (to provide a margin e.g. rain water). The margin should be increased if it is foreseeable that there be additional liquids (e.g. fire water) which could lead to an overflow beyond the secondary containment.

Drip trays to be considered beneath potential seepage from equipment and within vendor packages as required, in the next phase.

Usage of drip trays, screeding, kerbs, along with local sumps in tanker fill points to be considered in next phase.

The SNC-Lavalin review can be seen in the following table:

Tag Number	Equipment Name	Duty / Capacity (m3)	Duty / Capacity Unit	Type of Fluid	Type of Hazard	Is Secondary Containment Required?	Type of Containment	Is Secondary Containment Drain Required?	Is Secondary Containment Leak Detection Required?	Is Local Level Gauge for Secondary Containment Required?
10-FAA-T-101	Amine Storage Tank	110	m ³	Amine solution (70% w/w)	Health hazard	Yes	Bund	No	No	No
10-FAB-T-001	TEG storage tank	72	m ³		Environmental hazard	Yes	Bund	No	No	No
10-BAF-T-001	Filtered Water Tank	246	m ³	Water	Not hazardous-	No				
10-BAF-T-002A	Aluminium Sulphate Storage Tank	6	m ³	Aluminium Sulphate solution (8% w/w)	See note **	Yes	Bund	No	No	No
10-BAF-T-003A	Sulphuric Acid Storage Tank	0.4	m ³	Sulphuric Acid solution (33% w/w)	See note **	Yes	Bund	No	No	No
10-BAF-T-004	Clarified Water Tank	257	m ³	Water	Not hazardous	No				
10-BAF-T-005	Raw Water Balance Tank	300	m ³	Water	Not hazardous	No				
10-BAF-T-006	Backwash Settlement Tank	15	m ³ /h	Water and Sludge	Not hazardous	No				
10-BAF-T-007A	Sodium Hypochlorite Storage Tank	6	m ³	Sodium Hypochlorite solution (10% w/w)	See note **	Yes	Bund	No	No	No
10-BAB-T-001	Demin Water Storage Tank	2264	m ³	Water	Not hazardous	No				
10-BAB-T-002A	Sodium Hydroxide Storage Tank	6	m ³	Sodium Hydroxide solution (32% w/w)	See note **	Yes	Bund	No	No	No
10-BAB-T-003A	Sodium Bisulphite Storage Tank	2	m ³	Sodium Bisulphite solution (20% w/w)	See note **	Yes	Bund	No	No	No
10-BAC-T-001	Fire Water Storage Tank	4000	m ³	Water	Not hazardous	No				
10-BAG-T-001	Waste Water Blending Tank	1039	m ³	Waste	Not hazardous	No				
10-BAG-T-002	Sludge Blending Tank	148	m ³	Sludge	Not hazardous	No				
10-BAG-T-003	Dewatered Sludge Holding Tank	333	m ³	Sludge	Not hazardous	No				
10-BAG-T-004A	Phosphoric Acid Storage Tank	5	m ³	Phosphoric Acid solution (various conc)	See note **	Yes	Bund	No	No	No

Tag Number	Equipment Name	Duty / Capacity (m3)	Duty / Capacity Unit	Type of Fluid	Type of Hazard	Is Secondary Containment Required?	Type of Containment	Is Secondary Containment Drain Required?	Is Secondary Containment Leak Detection Required?	Is Local Level Gauge for Secondary Containment Required?
10-BAG-T-005A	N Supplement & Micro-Nutrient Storage Tank	30	m ³		Not hazardous	No				
10-BAA-T-001	Cooling Medium Storage Tank	4206	m ³	Propylene glycol solution (33% w/w)***	Not hazardous (poss. Environmental)	Yes	Bund	No	No	No
	11-33kV Transformer			Oil	Environmental	Yes	Bund	No	No	No
	Liquid oxygen tank	670	m ³		Major accident hazard	Yes	Double Skin	Yes	No	No
	Liquid nitrogen tank	300	m ³		Asphyxiant	No	Double Skin****			
	Emergency Generator Diesel Tank			Diesel	Flammable	Yes	Double Skin	Yes	No	Yes

Notes:

** Please note that is the philosophy of the project is that small quantities of chemicals that are required for continuous injection or batch mixing will be delivered to site in suitable IBC's. These containers will be delivered to a propriety chemical injection package area, when in use, each IBC will sit on a dedicated bund.

*** Propylene glycol

Classification of the substance or mixture

Classification (EC 1272/2008)

Physical hazards Not Classified

Health hazards Not Classified

Environmental hazards Not Classified

(Ref: REACH registration number 01-2119958801-32-0000 for PEG)

**** The double skin on the LOX tank is for insulation not containment.