Q. Provide a copy of the recently revised business continuity plans.

A. Hydro assumes that this question refers to Integrated Action Plan (IAP) Item #72: "[w]ith respect to the Hydro Place building and its facilities, review Hydro's business continuity plans and contingencies and update as necessary to ensure continued operations and the availability of critical outage response support systems in the event of a supply disruption to the Hydro Place building."

As noted in the commentary with respect to IAP #72, IAP #55 to 58 are the actions that have been completed "to ensure continued operations and the availability of critical outage response support systems in the event of a supply disruption." These items and associated revised documents (if any) are noted below:

IAP #	Action/Activity	Revised Plans
55	Complete all outstanding work in relation to the Hydro Place emergency generation system, and report to the PUB outlining availability risks and revised maintenance procedures.	PUB-NLH-306 Attachment 1, in relation to Hydro Place's emergency generation preventative testing and maintenance program.
56	Execute a 2014 plan for ensuring there is adequate emergency lighting in Hydro Place.	Per the June 16 report to Board, *Report to the Board of Commissioners of Public Utilities Related to Hydro Place Emergency Power,* additional emergency lighting has been installed in the HP stairwells, and diesel generator room.
57	Ensure that documents related to system restoration, including cold start procedures, are readily available in the IS office and in the Hydro Place ECC in hard copy format.	PUB-NLH-306 Attachment 2 is a copy of the blackstart procedures, which are readily available in the Hydro Place ECC in hard copy.

IAP #	Action/Activity	Revised Plans
58	Implement a process for the monitoring of critical alarms from the Hydro Place UPS on a real-time 24/7 basis	Three separate UPS alarm points from the Energy Management System UPS module were combined and wired to the Local Remote Terminal Unit as one alarm called UPS Anomaly. This alarm is monitored 24/7 by the ECC Control Room operations. The alarm is also emailed to the EMS Support Team.

Hydro has also engaged a consultant who will be issuing a report on the Hydro Place Disaster Recovery Plan. The consultant has begun work, and Hydro is in receipt of the first draft version of the "current status" findings of that report. To date, there are no recommendations. Once the final report is issued, any necessary recommendations will be implemented. Hydro anticipates a final report in the Q4 2014.

Hydro Place Emergency Generation

Preventative Maintenance and Testing Program

September 2014

INTRODUCTION

The Hydro Place emergency generation system is designed to provide power to key areas of Hydro Place when power is not available from the Newfoundland Power distribution system. The system was commissioned when Hydro Place opened in 1989.

The emergency generation system is centered on two Caterpillar model 3406B diesel generation sets, designed to provide redundant emergency power supply to the building. Both units are installed in an indoor room on level two, at the southwest corner of Hydro Place. Both units are subject to a comprehensive annual inspection, and six month preventative maintenance plan, carried out by two contractors who are specialists in building backup/emergency generation: Madsen Diesel and Turbine Ltd. and Glenn Nichols Engine Service Ltd.

Fuel is provided by a fuel system including a 9,092 liter above ground tank installed outside of Hydro Place, and a 630 liter day tank in the generator room. The fuel system was commissioned in 2005, replacing a previously installed underground fuel storage system. Fuel dips are carried out on a weekly basis, at which time there is also a visual inspection of the system. Given the low consumption rate, the fuel in the system is tested every two years based on fuel usage/replenishment.

The diesel generation room is kept at a minimum temperature of approximately 20 degrees Celsius during standby to ensure maximum reliability and ease of genset starting as required. Also, the units have on board jacket water heaters installed to assist in maintaining suitable temperature of the units and ease of startup. Once the diesel generator units are running, the room is cooled using forced air, driven by a ceiling mounted fan/ventilation system. The units themselves are cooled by radiators and fans mounted on each unit. The radiators are near an external wall of the building and have a system of louvers installed which open for cooling purposes when the diesel generator units start up.

The emergency generation system is controlled through the MCC (motor control center) and each unit has a breaker to allow the load to be switched from facility power to emergency power. The system also has (5) transfer switches which allow essential equipment to be switched from facility power to emergency power. The recommended service interval on the breakers is 3 to 5 years. Service on the breakers is performed by the OEM authorized repair center: Schneider Electric Ltd. The transfer switches are serviced annually by Emerson Power Systems/ASCO, the OEM repair center.

The diesel generation system at Hydro Place is tested biweekly by Building Operations personnel. This testing involves initiating a manual test on each of the four transfer switches that starts both diesel generation sets, allowing one of them to take the load, then the second unit to synchronize to the to the first and then share the load on the emergency bus. One unit automatically stops after 15 minutes, entering stand by mode. The diesel generators alternate which unit stays on each time they are operated for testing or actual power outages. This testing procedure lasts approximately 30 minutes. The generator units are used on average 40 hours per year since commissioning in 1989 with the hours consisting of testing and actual power outages.

PURPOSE

The purpose of this document is to describe the preventative maintenance and testing program for the Hydro Place backup generation system and associated equipment. The program is implemented to ensure reliable operation of the emergency/backup generation system.

SYSTEM DESCRIPTION

Hydro Place Emergency Generation - Hydro Place emergency diesel generation system is comprised of two generators (G1 and G2), along with supporting systems. In the event of a loss of building power both generators will start and provide power for building essential services including the UPS systems. After 15 minutes of generator run time, one of the generators will shut down and the power load will be serviced by a single online generator. If that online generator was to fail the standby generator, if available, would start and pickup the building emergency power load.

CATERPILLAR DIESEL GENERATORS

The generation system is centered on two Caterpillar model 3406B diesel generation sets, designed to provide redundant emergency power supply to the building. Both units are installed in an indoor room on level two, at the southwest corner of Hydro Place. Both units are subject to a comprehensive annual inspection, and six month preventative maintenance plan, carried out by Glenn Nichols Engine Service Ltd and Madsen Diesel and Turbine Ltd.

BREAKERS

There are two breakers, one for each unit. They allow the units to synchronize with each other and deliver power to the emergency bus which supports essential equipment and systems in the building.

TRANSFER SWITCHES

Transfer switches automatically control the switch to the emergency generators in the event of the loss of the Newfoundland Power (NP) distribution feeder.

There are five transfer switches incorporated in the Hydro Place emergency generation system. With regard to the operation of the EMS and administrative computer systems four of the transfer switches are relevant.

- Switch #1 supplies unit 1 of the three units in the EMS UPS.
- Switch #2 supplies unit 2 of the three units in the EMS UPS.
- Switch #3 supplies both units of the Administrative UPS.
- Switch #1 or Switch #2 supplies unit 3 of the three units in the EMS UPS depending on the position of switch #5.

When the diesel generators are supplying power to Hydro Place the voltage and frequency from the generators are monitored. If these values are not within an acceptable range the transfer switches will drop load from the generators. The switches are prioritized with regard to the order in which loads will be dropped. If after a load is dropped on a particular switch the voltage and frequency are within acceptable ranges higher priority loads will remain on diesel power. The load in transfer switch #1 which supplies the EMS will never be dropped by this automated system as it is hard wired. The transfer switches are serviced annually by the OEM authorized repair center ASCO/Emerson Power Network.

CONTROLS

Controls related equipment for Hydro Place back up generation consist of the electrically operated actuators for cooling louver operation, a ceiling mounted electrically operated exhaust vent. The generator room temperature is regulated with an electrically operated fan and thermostat control.

ENGINE COOLING

Once the diesel generator units are running, the room is cooled using forced air, driven by a ceiling mounted fan/ventilation system. The units themselves are cooled by externally mounted radiators, and a system of ventilation louvers which are in a normally closed position, but open for cooling purposes when the diesel generation units start up.

PREVENTATIVE MAINTENANCE AND TESTING PROGRAM

INTRODUCTION

This section notes the testing and maintenance carried out on the core system components, the frequency of testing and maintenance and the logs that are to be used to record the date work was completed. Also, detailed below is information on critical spares for supporting systems and a listing of service and support contractors that are used in execution of the maintenance and testing program.

ELECTRICAL EQUIPMENT PM PROGRAM

Madsen Diesel and Turbine are the local specialists for service on the Hydro Place emergency generation system. They have the tools and expertise to perform the electrical tests as noted in Appendix 1. Electrical and Associated Equipment PM check sheet. Required testing is scheduled by Building Operations as required in order to meet the testing frequency noted in the check sheet.

BIWEEKLY TESTING AND VISUAL INSPECTIONS

Biweekly generator system testing and visual inspections are performed by Hydro Place Building Operations. During the testing, Building Operations simulate a power failure in the building using the transfer switches. The units will start up and take the load from the emergency bus and after 15 minutes one unit will shut down and sit as standby should the operating unit fail. The units are run through the full process and the test takes approximately 30 minutes.

Biweekly Testing and Visual Inspections continued.

Building operations will observe the units running, perform a general inspection of the units and associated hardware and observe all instrumentation on the units and MCC (motor control center). Date and time of testing will be recorded on a PM check sheet and any observations or items needing attention will be recorded and actioned as required. Please see Appendix 2. for the Building Operations, Biweekly Preventative Maintenance Check Sheet.

Weekly fuel dips and fuel tank and associated equipment visual inspections. During this process Building Operations will measure the fuel in the exterior fuel tank to ensure a suitable quantity is on hand. The tank will be checked for water during the fuel dip using a water detection paste. All exterior lines, fittings and tank hardware are visually inspected as part of this process and recorded on the PM check sheet with any observations or items needing attention being recorded and actioned as required. The fuel measurement and temperature is recorded on a weekly fuel log/reconciliation.

DIESEL ENGINE PM PROGRAM (6 MONTH & ANNUAL)

The diesel engines on the generation units are manufactured by Caterpillar and are serviced twice per year at 6 months and year end. If maintenance items are noted during biweekly testing service will be arranged and performed as required. All diesel engine service is performed by Caterpillar certified technicians. Please see Appendix 3. 6 Month and Annual Preventative Maintenance Check sheet - Diesel Engines, to view the listing of items checked, inspected and tested.

CRITICAL SPARES (SUPPORTING SYSTEMS)

After consultation with our key suppliers, service companies and management, who are familiar with our redundant generator installation, we have rationalized a list of critical spares to be kept onsite. As our backup generation system consists of two units, the premise is that should the worst case scenario be realized, parts from one unit (diesel or generator), or supporting system (with the assistance of the appropriate service company) could be used to get a unit operational. Some parts which are labour intensive, or may not be conducive to being removed and reinstalled consist of those components of our two key power management systems (transfer switches and breakers). OEM's (original equipment manufacturers) for both these systems who perform our regular preventative maintenance have supplied a list of critical spares that they advise should be kept on site and would allow expediting of a repair should some of the noted components fail. The only other supporting systems for the units not covered elsewhere in this document are the ventilation louvers and actuators that allow unit cooling and those that allow air flow for the generator room to keep it at a desired temperature. These systems were recently switched from pneumatically operated actuators to electrically operated actuators. Should these actuators fail, all required louvers can be manually held in the appropriate position as required. Please see Appendix 4. Critical Spares Listing for the suggested critical spares as noted by the system OEM's.

SERVICE AND SUPPORT CONTRACTOR LISTING

Glenn Nichols Engine Service Ltd. – Diesel engine and associated equipment semi-annual maintenance and testing. All other engine related equipment, testing and diagnostics.

Madsen Diesel and Turbine Inc. – Generator units, MCC, battery chargers and all other associated electrical equipment. All other electrical related equipment, testing and diagnostics.

Johnson Controls Inc. – Inspection, testing, repair and maintenance of controls equipment specifically: electric actuators, mechanical connections, ceiling mounted fan/exhaust vent and thermostat control.

SGS Canada Inc. – No.2 Diesel testing and analysis (every 2 years as required).

Emerson Power Systems/ASCO Inc. – Transfer switch (annual) maintenance and testing.

Schneider Electric Canada Inc. – Generator breaker (3-5 yr) maintenance and testing.

Valero Inc. – Supplier for No.2 Diesel

APPENDIX 1.

Electrical and Associated Equipment PM check sheet

HYDRO PLACE GENERATION - ELECTRICAL AND ASSOCIATED EQUIPMENT PM CHECK SHEET

DATE: _____

TECHNICIAN: _____

DESCRIPTION	CHECK/TESTED (Y/N)	TESTING CYCLE	SATISFACTORY	UNSATISFACTORY	COMMENTS
Inspection of Stator Units		ANNUAL			
Instrumentation and Safety Shutdowns		ANNUAL			
Megger Generator Insulation		QUINQUENNIAL			
Simulation of Power Outage		ANNUAL			
Inspection of Electrical Connections		ANNUAL			
Test and Inspect Battery Chargers and Associated Equipment		ANNUAL			
Infared Survey of Electrical Connections Under Load		ANNUAL			
Testing of Available Alarms		ANNUAL			
MCC (Motor Control Center)		ANNUAL			
Resistive Load Bank Testing		ANNUAL			
Cranking Cycle Testing		ANNUAL			
Operation of Units Under Load		ANNUAL			
Alternator Connections and Operation		ANNUAL			
Check Battery Strength		ANNUAL			
Inspection of Starter		ANNUAL			
Test Units and Transfer Switch Operation		ANNUAL			
Inspect Insulation of Generator Windings		QUINQUENNIAL			
Test Voltage Regulator for Proper Operation		ANNUAL			
Inspect Auxiliary Equipment for Proper Operation		ANNUAL			
Conduct a Full Load Test		ANNUAL			

APPENDIX 2.

Building Operations, Biweekly Preventative Maintenance Check Sheet

2014

BUILDING OPERATIONS, BIWEEKLY PREVENTATIVE MAINTENANCE AND TESTING CHECK SHEET

DATE COMPLETED:	
COMPLETED BY:	

DESCRIPTION	CHECKED/OK	INITIAL	OBSERVATIONS/COMMENTS
GENERATOR STARTUP NORMAL			
COOLING LOUVERS OPENED			
BREAKER OPERATION NORMAL			
UNITS SYNCHRONIZED NORMAL			
TRANSFER SWITCH OPERATION NORMAL			
MCC - INSTRUMENTATION CHECKED/NORMAL			
NO ALARMS PRESENT ON MCC			
VISUAL INSPECTION OF UNITS AND EQUIPMENT			
VISUAL INSPECTION INTERIOR FUEL LINES AND EQUIPMENT			
GENERAL VISUAL INSPECTION OF EQUIPMENT/AREA			
UNITS SHUTDOWN AND IN STANDBY READY MODE			
FUEL DIP PERFORMED			
WATER DETECTION PASTE USED DURING DIP			
WATER OBSERVED IN FUEL			
INSPECTION OF TANK, EXTERIOR LINES AND EQUIPMENT			
FUEL TANK AND TANK AREA GATE LOCKED			
MEASUREMENT DATA RECORDED ON FUEL FORM			

APPENDIX 3.

6 Month and Annual Preventative Maintenance Check sheet - Diesel Engines

6 Month and Annual Preventative Maintenance Check sheet - Diesel Engines

Six Month (Diesel Engine only)

	Semi- Annual checklist	**Date:**	
	Lubrication	**Satisfactory**	**Unsatisfactory**
1	Check engine crank case oil level		
2	Clean crankcase breather		
3	Lubricate fan hub		
4	Lubricate fuel pump linkages		
	Cooling System	**Satisfactory**	**Unsatisfactory**
5	Check engine coolant level and strength		
6	Clean radiator core (external)		
7	Inspect coolant connections and hoses (tighten if loose)		
8	Check fan/alternator belt tension and wear		
9	Check cooling system inhibitor (DCA)		
10	Inspect water jacket heater hoses and wiring		
11	Check water jacket heater(s) for correct operation		
12	Check motor operated louvers		
	Fuel system	**Satisfactory**	**Unsatisfactory**
13	Check sediment bowls and open drains		
14	Inspect all fuel system components for evidence of water, sludge, and rust		
15	Check fuel level in day tank		
16	Inspect and test fuel level floats switches		
17	Inspect and test contaminant alarm		
18	Inspect and test transfer pump		
	Air Induction & Exhaust	**Satisfactory**	**Unsatisfactory**
19	Check air cleaner service indicator		
20	Check/clean dust collector cap		
21	Inspect manifold and air piping for leaks		
22	Check all intake system hoses and connections (tighten)		
23	Open condensation drains		
	Electrical System	**Satisfactory**	**Unsatisfactory**
24	Check battery electrolyte		
25	Clean terminals and check/adjust connections for proper torque		
26	Check condition of battery and add water as needed (if applicable)		

27	Check alternator output and drive belt		
28	Check shutoff controls		
29	Inspect starter		
30	Check cold weather starting aids		
31	Engine safety controls- check gauges switches		
32	Control panel- check annunciation lamps		
	General	**Satisfactory**	**Unsatisfactory**
33	Visually check engine mounts, tighten if loose		
34	Visually check integrity of entire unit		
35	Check engine room lighting		
36	Check fire extinguisher date		
37	Control panel, inspect panel settings to ensure generator is in AUTO mode		
38	Control panel-operate all moving parts to ensure they move freely		

Annual (Diesel Engine only)

All items noted above (1-38) and including those listed below:

		Satisfactory	**Unsatisfactory**
39	Change crankcase oil		
40	Change oil filter(s)		
41	Change fuel filter(s)		
42	Change water filter(s)		
43	Replace air filter(s)		
44	Sample oil and submit for analysis		

APPENDIX 4.

Critical Spares Listing for Backup Generation Supporting Systems

CRITICAL SPARES LISITING
HYDRO PLACE BACKUP GENERATION SYSTEM

SUPPORTING SYSTEM	DESCRIPTION	PART NUMBER	QUANTITY	SUPPLIER
POWER TRANSFER SWITCHES	MAIN CONTACT KIT	343515	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	CONTROL CONTACT KIT	353582	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	MINIATURE SWITCH	291525	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	COIL KIT	343501-026	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	GP5 CONTROL PANEL	601800-002	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	RECTIFIER	629570	1	EMERSON NETWORK POWER
POWER TRANSFER SWITCHES	COIL KIT FOR SN: X17692 208VAC	343501-022	1	EMERSON NETWORK POWER
GENERATOR BREAKERS	120 VAC MOTOR OPERATOR WITH CUT OFF SWITCH	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	SPRING LIMIT SWITCH	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	LATCH CHECK SWITCH	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	120 VAC CLOSING COIL	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	BREAKER RELAY KIT	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	STATIONARY CONTACTOR	TBD	1	SCHNEIDER ELECTRIC CANADA
GENERATOR BREAKERS	CONTACTOR (OPERATOR)	TBD	1	SCHNEIDER ELECTRIC CANADA

Version 1.0

ECC Blackstart

Check both PDUs to verify that power is available the ES Computers. If not, go to UPS room to see if UPS units are not in bypass. If UPS units are in bypass, select "Normal" to get power thru UPS units.

All AIX Servers are set (in BIOS) to automatically boot to the OS once AC power is restored.

This process usually takes about 13 minutes from power restoration.

If this fails, the Green power LED will be blinking on the Servers after the servers have completed the hardware POST. Press the White power button to initiate the OS.

DAC Servers

The MAIN DAC Servers come up with the OSI software and databases in backup mode on both servers. After a short time, one of the servers will take over as the ONLINE server.

On each DAC Server

- log onto console
- check to be sure that the size of the DB files in /home/osi/monarch/db folder. (A hard shutdown will sometimes cause the DB files to get written with 0 bytes) If this is the case, additional steps are required to retrieve the latest non-zero Database files.
- launch OpenView. If the domain controller NDC1 is not available, then a Kerberos-authenticated account will not work. There is a monarch-authenticated admin account – information is available in the password databases on ES.
- verify that all DAC processes are heartbeating on Process Monitor page – especially the .NET processes that will give access to the OpenViewNET clients
- verify that all FEP processes are running and heartbeating on the FEP Monitor page
- On FEP / RTU Data page, check to be sure that all RTU's are scanning

APP Servers

The MAIN APP Servers come up with the OSI software and databases in backup mode on both servers. After a short time, one of the servers will take over as the ONLINE server.

On each APP Server

- log onto console
- check to be sure that the size of the DB files in /home/osi/monarch/db folder. (A hard shutdown will sometimes cause the DB files to get written with 0 bytes) If this is the case, additional steps are required to retrieve the latest non-zero Database files.
- run command "ps –ef " to see if all OSI processes are running
- on the DAC Server in Openview, check to be sure that all the APP server processes are running .

Version 1.0

Windows Server

NVM1	NVM2	NVM3
NHIS1	NHIS2	NSQL1
NPISERVER	NPISERVER2	NSEP1
NWEB1	NWEB3	NMAN1
NWEB2	NSQL2	NSCCM
NVMA	NVCS	NENV1
UIVM		NLEM
		NVPN1
		NVDP
		NNOSTD
		NNOSTDEM

HIS Servers

The MAIN HIS Servers come up with the OSI software and databases in backup mode on both servers. After a short time, one of the servers will take over as the ONLINE server. For the HIS Servers,

- check in D:\osi\monarch\db to see if the .DB files are non-zero in size. The problem of a hard shutdown causing DB file corruption is less likely on a Windows server.
- these servers are located on NVM1 and NVM2 so to access the servers, either RDP from an ES workstation or launch the VMWare Client from an ES Workstation, connect to NVCS1 using windows authentication, and connect to the console of the server in question.

(If you cannot connect to NVCS1, it may be that the order of boot was incorrect. If you can ping NCVS1, then remotely reboot it.)

- When connect to NVCS1, check to be sure that the HIS servers are active.
- Also, check all other VM guests (especially NPISERVER and NPISERVER2) even though the HIS servers are the priority.

Workstations

All ECC workstations perform Windows authentication against either NDC1 (currently a physical server but soon to be Virtual) or NFILE1. Verify that these Domain Controllers are available.

If not, most windows account credentials are cached on the workstation so ECC Operators should be able to log on successfully.

OpenViewNET is setup for all ECC Operator accounts to be Kerberos-authenticated. If NDC1 is available, the operators should be able to log on successfully.

If NDC1 is unavailable, then the operators will have to use the Emergency Operator account logon. This information is found in an envelope attached to the bulletin board in ECC.

Version 1.0

Additional Services / Servers

NPISERVER and NPISERVER2 – PI Data Servers

These servers are located on NVM1 and NVM2 respectively and are configured to boot to Windows when power is restored. All PI data should be buffered on the collector nodes until one of these servers is actively receiving PI data.

NWEB1 – Primary Emsview web page server

This server is located on NVM1 and this server is set up to boot to the OS upon power restoration.

NSEP1 – Symantec Endpoint Protection

This server is located on NVM3 and is configured to automatically boot to Windows when power is restored. The SEP Database resides on NSQL1 so this VM should be up and running so that SEP can function properly.