

1 Q. Regarding the Asset Maintenance Review effort and the maintenance manuals  
2 prepared for Holyrood (2010) and the CTs (2008), please describe subsequent  
3 actions including (a) the nature and degree of changes to maintenance  
4 philosophies, strategies or tactics, (b) any actions taken to assure that the  
5 requirements of the manual were and are being met, and (c) the process used for  
6 dispositioning the many "*observations and recommendations*" including any status  
7 reports or check lists associated with such an effort.

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10 A. The Asset Maintenance Review (AMR) was a focused, tactical level review of  
11 Hydro's maintenance programs. Hydro's preventative maintenance (PM) and  
12 inspections were compared to those of other North American utilities, which  
13 identified differences and leading practices, and considered them in light of Hydro's  
14 specific operational and environmental conditions via facilitated round table  
15 sessions with front line maintainers and technical staff. Hydro's Long-Term Asset  
16 Planning leads then addressed gaps (where appropriate) through a series of  
17 initiatives. In 2011 and 2012, these initiatives were identified in Hydro's annual  
18 strategic plan under Asset Management to ensure completion of high value  
19 recommendations.

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21 a) As a result of the Asset Maintenance Review for combustion turbines (CTs),  
22 the associated maintenance philosophies, strategies and tactics were  
23 aligned to meet the intent of the maintenance manual where value could be  
24 identified. The alignment was completed through an extensive review of the  
25 report and recommendations with the Production Supervisors, Asset  
26 Managers, and Planning and Scheduling Supervisors of the time. From this  
27 review, each section of the report was discussed, with particular focus upon

1 the 130 plus recommendations. Each item was reviewed and a decision was  
2 made to either accept the recommendation for implementation, not accept  
3 the recommendation if it was felt it did not offer any value, or have further  
4 consideration for the recommendation. The recommendations are being  
5 reviewed again in 2014, in light of the supply disruptions. PUB-NLH-154  
6 Attachment 1 shows the current status update for all the CT-related  
7 recommendations, including those identified for follow up during the 2014  
8 review.

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10 The Holyrood process was similar to that performed on the CTs, resulting in  
11 recommended changes to PM tactics and frequencies that have been  
12 applied in the JD Edwards PM Scheduler program (Hydro's maintenance  
13 management software) accordingly. Consideration was given to risk (safety,  
14 environment, and reliability). The systems were reviewed in the order of:  
15 synchronous condenser equipment, gas turbine, common systems, primary  
16 generating units and finally, supporting infrastructure.

- 17  
18 b) Any priority changes identified for PM and inspection tactics from the field  
19 review of the AMR workbooks<sup>1</sup> against the existing PM program were  
20 subsequently made within the JD Edwards PM Scheduler. The PM Scheduler  
21 automatically triggers a work order to complete the required activity at the  
22 prescribed frequency. PM completion is measured to ensure the activities  
23 are getting completed as required. The workbooks then serve as a  
24 reference source only, available for review.  
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<sup>1</sup> These "workbooks" contain all tactical recommendations from the AMR project.

1           c) Long-Term Asset Planning managers created multi-year plans to complete  
2           the workbook reviews and implementation for their areas and managed  
3           progress against the plan at the local level through to completion. In 2011  
4           and 2012, Hydro included this work as initiatives in its annual strategic plan  
5           to ensure high value recommendations were completed. Long-Term Asset  
6           Planning managers reported summary progress against these strategic  
7           initiatives to line management and asset owners as part of normal monthly  
8           reporting. Progress was summarized in terms of green (progressing to plan),  
9           yellow (slightly behind and on track to catch up), or red (behind schedule  
10          and need to address lag). At year end for both 2011 and 2012 (the  
11          completion year), the overall report was green, with all planned, high value  
12          activity completed. The same approach will be taken if there are items  
13          stemming from the 2014 reviews.

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
<b>A.1 General Recommendations</b>	
<b>Check Sheets</b>	
1. Re-title all gas turbine check sheets by replacing the word "inspection(s)" with "maintenance".	Low value item, decided not to action.
2. Combine the daily and weekly check sheets into one check sheet. Have four columns for Monday, Tuesday, Thursday, Friday with check boxes and a fifth column for Wednesday with a space for a recorded value, if applicable. In a sixth column, include the expected value or range, if applicable.	Completed
3. For all tactics with the same interval (example six months), consider dividing into two check sheets / model work orders - one for outage related work and one for non-outage related work.	After reviewing it was decided to leave under one model work order and check sheet.
<b>Scheduling</b>	
4. It is recommended that TRO Central and System Operations engage in a general discussion regarding the importance of outages for maintenance work. Frequently outages are not being granted. As an example, in July 2007, it was determined that the alternator cooling air filters were in a deteriorated state and needed replacement. New filters were ordered and received within six weeks. But it was not until April 2008 that an outage was granted for installation of the new filters. This may have put the alternator at significant risk.	Completed and is ongoing each year.
<b>A.2 Gas Turbine - Multiple Systems</b>	
<b>Maintenance Strategy Change Management</b>	
5. Create a model work order with five year interval to notify the asset manager that a review and revision of the entire Maintenance Strategy Workbook and Manual is due.	Gas Turbine Maintenance has a renewed focus in 2014 and this will be reviewed.
6. Create a model work order with one year interval to notify the asset manager that a review is due for identification of triggers as per the maintenance strategy "change management process" (AMS Guide), and to initiate a review and revision of the applicable sections of the Maintenance Strategy Workbook and Manual.	Gas Turbine Maintenance has a renewed focus in 2014 and this will be reviewed.
<b>Black Start</b>	
7. Prove (once only) ability to close on a loaded dead bus. This requires a detailed test plan including, but not limited to: a review of protection circuits; coordination with ECC and Newfoundland Power; and installation of a temporary load bank.	The plan has been develop to start the unit from a black start but it has not been fully proven. Further work is planned in this area for 2014.
<b>Noise Survey</b>	
8. Implement 5 year PM for noise survey.	Not required as surveys being completed under Corporate Hearing Conservation Program.

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
9. Revise the "Project Safety & Health Check List" to include the corporate P&P SAF 7 requirement to conduct "noise level surveys immediately after installation of new equipment, or after modifications, which have the potential to change noise levels."	Covered under Corporate Hearing Conservation Program.
<b><u>Thermography</u></b>	
10. Review what equipment would benefit from a thermography survey and determine interval. The Stantec condition assessment[10] is a good place to start - it includes some specific recommendations for utilizing thermography.	Continue to do outside equipment and selected suspect equipment only inside panel.
<b><u>DCS Data</u></b>	
11. Create monthly PM to save DCS data (alarms, events & trends) to CDs (copy for site, copy for Asset Manager), every month.	PM set up for 90 days to download data to a common drive.
12. Delete "print and file trend data" from monthly test run check sheet.	Decided to keep on form and to have a hard copy of the test run data.
<b><u>Gas Turbine Test Run</u></b>	
13. Add these details to the test run check sheet: (1) record differential pressures for the air inlet filter and MLO filter; (2) check AVR panel for alarms; (3) note any changes in vibration, temperature spread, etc., even if below alarm levels (as per Rolls Royce Service Bulletin 387).	Completed
<b><u>Auxiliary Equipment Vibration</u></b>	
14. Add the following task to the 6 month check sheet: check and record vibration levels on critical auxiliary rotating equipment (compressors, pumps, cooling fans, etc.) using handheld meter and data logger. Operator training and test equipment will be required. Operators should perform checks as need and opportunity arises, but at least every 6 months.	Not implemented to date. Will consider this tactic with the purchase of new portable vibration equipment in 2014.
<b><u>Oil Storage Drums</u></b>	
15. Change frequency of this task from six months to daily. Expand to include all drums of fuel and lubricant, check for leaks, and ensure secondary containment.	Completed
<b><u>Miscellaneous Mechanical Components</u></b>	
16. The condition of grease nipples and pressure gauges has come into question. It is recommended to perform a one-time survey of these components to identify the need of each item. Where not needed, remove from service. Where needed, confirm suitability for the service and condition and replace where necessary.	Decided existing inspections would be suffice.
17. There have been issues with a number of pumps in 2007-2008 which have called into question the level of maintenance. The maintenance tactics for pumps, including pump-motor couplings, are somewhat specific to the type and manufacturer of pump. It is recommended to compile a list of all pumps and establish maintenance tactics.	Pump list has been developed and further work is required in 2014 for this item.

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
18. Review all tools and equipment (chain hoists, shop compressor) to determine if any of these require maintenance tactics.	Completed
<b>A.3 Jet Engines</b>	
<b>A.3.1 Inlet Plenums</b>	
19. Change the interval of the following tasks from six months to one year: “Check condition of bird screens, plenum floor, walls, etc.; Check condition of inlet filters; Check operation of pressure differential switch for inlet filters, check that tubing is not plugged, etc.; Inspect and check operation of blow-in-doors for freedom of movement and operation of alarm limit switches.”	Completed
20. Change the interval of the following task from six months to one year: “Check condition of monocloners, fans, ductwork for cracks.” And note it to be “HWD only”.	Completed
21. Delete “and check ladders for security”, since ladders will be addressed for the entire facility, under the strategy for Buildings & Property.	Completed
22. Add the following to the one year check sheet: “lubricate blow-in door hinges and limit switches”.	Completed
23. Replace “Check inlet compartment for any loose and foreign materials, and outside doors are sealed with no leaks” with “Inspect inlet plenum for rocks, dirt, rust, sand, paint chips, or anything else that could cause blade damage or deterioration. Clean and apply coating as required. Ensure that door gaskets seal sufficiently to prevent egress of dirt into the inlet plenum. Seal until no daylight can be seen. Wear protective coverings over boots and place a mat at the entrance.” This task to remain on the six month check sheet.	Completed
24. It is recommended to always access the lower section of the inlet plenum, for inspections, via the end door, rather than the small access hatch, to avoid a confined space issue and to allow proper cleaning of debris (paint scale, dust) and application of touch up paint.	Completed
25. Install a smaller door within the large door to allow easier entry for inspections.	Completed
26. On the five year check sheet, state “SVL only” for “Change all air filters.” For Hardwoods only, air filter replacement will be determined by condition monitoring - checking the condition of air filters is already on the six month check sheet and checking filter pressure differential has separately been recommended to be added to the monthly test run.	Completed
<b>A.3.2 Gas Generators</b>	
<b><u>Inlet Area Inspection</u></b>	
27. Change the interval of the following tasks from six months to one year: “Check for cracks in nose bullet; Clean entry guide vanes and inspect with extension light and mirror. If indication of cracks, investigate using dye penetrate procedure. Also inspect the first stage compressor shrouded stators.” And add the following: “If damage is found, complete a secondary inspection of first stage stator blades for impact, erosion, corrosion, fatigue damage. This involves removing LP compressor casings and stator blades for secondary inspection and possibly returning to overhaul facility.”	Completed

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
28. Change "Clean entry guide vanes" to "Wipe/clean entry guide vanes with rag and appropriate solvent; do not use wire brush." And add this detail: "check nose cone flange, rubber connector, band clamps, retaining plates and alignment."	Completed
<b>Soak Wash / Borescope</b>	
29. Change interval of borescope inspection from three years to two years (MWOs 480446, 480461).	Completed
30. Add new task to conduct compressor soak wash, as per Rolls Royce Service Bulletin 375, prior to each borescope inspection (every two years).	Due to success of the current tactic of using a dry crank method to push air across the blades this tactic was not adopted.
<b>Gas Generator General Inspection</b>	
31. Change the interval of the following tasks from six months to one year:	Completed
Inspect & lubricate the fuel pressure regulator (LF-4) shaft and check for leaks.	Completed
Inspect & lubricate the fire fuel valve plunger rod to assure freedom of operation.	Completed
Check the security of supplementary fuel pump/motor assembly. Check supplementary fuel filter indicator. Change filter if required.	Completed
Remove the air system strainer screen (ST-CA-1) inspect and clean, check the air regulating system components for leaks, cleanliness, etc.	Completed
Check all junction boxes for security of terminals, tidiness, overheating, etc.	Completed
Check all fuel, oil and airlines for condition and security of connections	Completed
Inspect the liquid fuel valve and actuator for loose bolts, oil leaks, wear, binding & security of mounting.	Completed
32. Change interval of the GG lube oil filter replacement from five years to one year. Clarify on the check sheet that there are two GG lube system filters - one per End.	Completed
33. Add the following to the one year check sheet:	Completed
Check nozzle strainers (screens)	Completed
Replace two air filters - one on the regulator, and one under the floor grating	Completed
Clean fuel nozzles in ultrasonic bath (using sodium hydroxide), only if EGT has been problematic (refer to trending data). Attempt to clean ourselves first, with factory clean as a last resort. Note: We have two styles of fuel injection nozzles - the newer style can not be taken apart on-site for cleaning.	Completed
<b>Thrust Bearing</b>	

Gas Turbine Maintenance Strategy Update	Comments
34. Review OEM recommendation to inspect thrust bearing surfaces, ring assemblies, plates, shoes, & measure axial clearances every year, which is currently not being done.	This tactic has not been adopted to be completed each year. However bearing inspections were completed in 2013. Further review is required in 2014 to determine frequency.
<b>Fuel Lines</b>	
35. Add new task to the one year check sheet: "For fuel lines to the nozzles, inspect piping & clips (brackets) for security & wear; replace clips if cracked or worn packing; ensure no metal-to-metal contact between pipe & clip; ensure there are no plastic bands or tape on flex lines."	Completed
<b>Fire Valve</b>	
36. The present fire valve test is inadequate in that it may not be verifying fire valve operation. In fact, it is suspected that the valve currently may not be functioning properly – i.e. may not be stopping fuel. Design a new test and determine appropriate interval.	No new test has been designed to date.
<b>Engine Removal / Overhaul</b>	
37. For each engine, ensure that overhaul is on the 20-year capital plan and that subsequent annual reviews consider any condition assessments, corrective work, and (if necessary) calculations of cyclic lives.	Complete
38. Add the following Rolls Royce Service Bulletin references to the applicable work method / work plan for removal of a gas generator / overhaul:	
SB 343 - inspect the 16 'D' headed bolts that secure the two lifting eyes, prior to each engine removal.	Not adopted to date, plan to update in 2014.
SB 369 - regarding exposure to Viton	Not adopted to date, plan to update in 2014.
SB 367 - regarding shipping engines	Not adopted to date, plan to update in 2014.
SB 353 - regarding correct installation of fuel piping and hoses	Not adopted to date, plan to update in 2014.
SB 383 - regarding reinstallation of #8 bearing oil supply	Not adopted to date, plan to update in 2014.
SB 360 - regarding inspection of bolts securing exhaust annulus rear diaphragm plate.	Not adopted to date, plan to update in 2014.
<b>Combustion Chamber Drain Valves</b>	
39. The task to "check combustion chamber drain valves on Engine A and B" is conducted every two years at Stephenville (MWO 428448). Although there was no similar work order found for Hardwoods, this task is presently being done annually. Change the frequency for Hardwoods to two years and create the necessary PM.	Completed
<b>A.3.3 Power Turbine</b>	
40. Move all checks under "Power Turbine" sections of the six month check sheet to the one year check sheet, except the deflector ring inspection should remain on the six month check sheet.	Completed



<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
41. Add to the one year check sheet to check security of power turbine fasteners at inter-turbine duct to stator casing, stator casing to bellows, and bellows exhaust volute, as per Rolls Royce Service Bulletin 423.	Completed
<b>A.3.4 Clutches</b>	
<u>Clutches</u>	
42. Review is required to determine maintenance strategy for the clutches. Currently there are no inspections or maintenance being completed. The OEM has specific recommendations that should be considered (Hardwoods Curtiss-Wright O&M Manual, Volume 1, Section 3, starting on Page 3-77). Also consider comments by Stantec Consulting Limited[11]. It is proposed to complete this during maintenance strategy development for Happy Valley Gas Turbines.	After review it was decided that this work would be left to the OEM. Clutches were inspected at HWD in 2013 and planned to be inspected SVL in 2015.
43. Change the following task from six months to one year: "Check the clutch hold down bolts. Inspect grounding brush."	Completed
44. Review the design of the proximity switch to fix (or rule out) the suspected physical interference problem, as reported in Stantec Consulting Limited[12].	Ongoing issue and new design has not been developed.
<b>A.3.5 Exhausts</b>	
<u>Deflector Rings</u>	
45. Review the interval of the deflector ring inspection (currently 60 days) in 2009, after some experience has been gained with the new inspection/repair procedure.	latest repair procedure from FERN engineering is working. Inspection moved out to annual.
46. Copy the detailed inspection/repair procedure from the six month check sheet to the two month model work orders.	Completed
<u>Exhaust</u>	
47. Change the interval of the following task from six months to one year: "Check the exhaust stack inside walls for security of insulation, plates etc.".	Completed
<b>A.4 Electrical</b>	
<u>Alternator</u>	
48. Alternator rotor and stator condition is largely unknown and represents a significant reliability risk. Further review is required to determine maintenance strategy. It is proposed to complete this during maintenance strategy development for Happy Valley and Holyrood Gas Turbines.	Alternator at SVL was rewound in 2012 and HWD was replaced in 2013. Plan is to complete future alternator inspection every 5 yrs.
49. On the six month check list, change "Check earth fault indication brush" to "Replace earth fault indication brush".	Completed
50. Under the heading "Generator" on the weekly check sheet, delete "Temperature (Stator and Air)", since it is continuously monitored.	Completed

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
51. Operation of alternator heaters is currently verified using a clamp-on ammeter, with exposure to 600 V hazard. The risk should be designed out, by installing an ammeter on the door.	Has not been designed out to date. With proper PPE this task can be done safely.
<b><u>AVR / Exciter</u></b>	
52. AVR and exciter maintenance strategy has not been determined - further review required. It is proposed to complete this during maintenance strategy development for Happy Valley and Holyrood Gas Turbines.	Decision to continue with existing tactics.
53. Add new task to annual check sheet: internal inspection of exciter - remove covers and check tightness of bolts, fuse clips, brackets, etc.; test diodes. Review interval of this inspection after each inspection.	Completed
54. Delete "Exciter area (burn marks, etc.)" from daily check sheet.	Completed
<b>A.5 Gas Turbine AC Service</b>	
<b><u>Station Service Transformer</u></b>	
55. Maintenance strategy has not been determined - further review required. It is proposed to complete this during maintenance strategy development for Happy Valley and Holyrood Gas Turbines.	Added megger transformer to 5 yr. check sheet.
<b>A.6 Gas Turbine DC Service</b>	
56. Remove entire section titled "Battery Bank Semi-Annual Inspections" and the related battery forms from the six month check sheet and adopt the Terminal Stations check sheet(s) and interval(s) for batteries (which are currently under review by the Terminal Stations Maintenance Committee). Review applicability of MWO 255434.	Completed
<b>A.7 Unit Switchgear, Protection, Metering &amp; Control</b>	
<b><u>13.8 kV Bus</u></b>	
57. Add to the MWOs for dole testing (HWD – 359327; SVL – 123698) a new task to inspect and clean the 13.8 kV bus duct.	Completed
<b><u>Breakers G1T1 &amp; G1T5</u></b>	
58. The MWOs (HWD - 123720;SVL – 123717) need to be revised regarding the needed tools & equipment: delete the cherry picker / bucket truck; add a half-ton chain hoist.	Completed
<b><u>P&amp;C Inspections</u></b>	
59. Delete transducers and panel metering from the P&C 6-year Inspection (and run to failure).	Completed
60. Change interval of electromechanical relay checks from six years to one year.	Adopted for 51 N relay due to iron filing issue.
61. The P&C 6-year Inspection check sheet needs additional detail for clarity; for example, "transformer" should be "station service transformer". Consult P&C Supervisor, Whitbourne who has a complete list of relays that are tested.	Completed

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
<b><u>Turbine Protections</u></b>	
62. More clarity is needed on MWO 268797 (SVL) regarding the “turbine protection tests” to be performed - what tests on what equipment? A similar MWO for Hardwoods is required.	Completed
<b><u>Control System</u></b>	
63. Provide one spare computer at each site. Create a PM to initiate a review with manufacturer, every three years, the need for software version upgrades. If software upgrade is determined to be needed, confirm compatibility with existing hardware, and upgrade as required.	Purchased spare computer for each site.
64. Consider implementing routine services as specified in the “Maintenance” sections of the 19 product instruction books in Eltag Bailey Instruction Book, Volume 2 for the DCS system. It is assumed that no such services have ever been undertaken. Pull a sampling of devices and check condition with respect to the need for routine services such as tightening connections, vacuuming dust, and cleaning or replacing filters. Establish need for these tasks and associated interval at this time. Consult P&C Engineering prior to removing MFP from service. AMS Document 43 is a copy of these maintenance recommendations.	Will be completed from inspection as required.
65. Review is required to determine maintenance strategy for DCS power supply. Review and consider OEM recommended maintenance, including replacement every 5 years. Contact manufacturer to establish mean time between failures. Consider procurement of a spare power supply.	Spare power supply has been purchased and new power supply installed at HWD and new power supply planned for SVL in 2015.
<b><u>Vibration Equipment</u></b>	
66. Change interval of check of vibration equipment from six years to three years. (Remove from 6 year check sheet and create new PMs at 3 years.) Change “check” to “test and calibrate”.	With new vibration equipment installed at both HWD and SVL it was decided to leave at 6 years.
67. Procure necessary test & calibration tools for each site (Druck, shaker tables).	Completed
68. Conduct a study to evaluate our approach regarding vibration protection.	With upgrades at both SVL and HWD this was a low priority item and was not completed.
<b><i>A.8 Fuel</i></b>	
<b><u>Fuel Actuator</u></b>	
69. Add new task to annual check sheet to verify fuel servo stroke characteristic.	Completed
70. Conduct study to consider installing feedback capability for the fuel actuator.	New Fuel valve with feedback installed at HWDs and plan to be installed at SVL 2014.
<b><u>Miscellaneous</u></b>	
71. Install sight glass on pressure relief outlet lines from the coalescer, filters & re-circulation line, to allow identification of fuel leakage. (These lines lead to the sump.) Then add to the daily check sheet to check for leaks through these sight glasses.	Not required due to sump having an alarm level for indication.

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
72. Add to the six month check sheet to clean Y-strainers in the fuel system.	Completed
73. Change interval of “check diesel generator tank level” from six month to one week.	Completed
74. To ensure fuel supply integrity for the back-up diesel generator, design and install a piping system to allow manual drainage of the fuel storage tank into the gas turbine fuel supply, for consumption. Then refill the tank. Once this feature is designed and installed, create a PM to complete this task every 6 months.	Low Priority item and was not completed.
75. Create a PM to sample fuel at the next fuel delivery and send for analysis, to verify it meets spec, once per year (not every delivery).	This is being updated in current engineering spec to incorporate fuel sampling.
76. New task – check pressure differential across the filter for the fuel off-loading pump at every use of the pump. To capture this task, add it to the relevant work method or environmental Standard Operating Procedure. Create a procedure if one does not already exist.	With other inspections and changing of filters, it is decided this was deemed be low priority.
77. Change the interval of filter replacement from five years to one year for the last chance fuel filter and supplementary fuel pump filter, and add to clean out the bottom of the housings at the time of filter replacement.	Completed
78. Add a list of the fuel filters to be replaced to the five year check sheet, and delete the word “all”. There is some duplication and discrepancy of information on the 5 year MWOs and the associated check sheet. It is suggested to leave the details on the check sheet and remove them from the MWOs (HWD - 155890 & SVL – 123690).	Sites are manned and filters known to operators, thus determined to be low priority.
79. At SVL, pressure differential was removed from service. Fuel is filtered twice. The need for filter replacement is triggered only by low pressure alarm. This may not be acceptable and should be reviewed.	Due to filters being replaced on another tactic this was considered to be acceptable.
80. The fuel flow meter is not performing properly. It is suspected that the meter drifts when the fuel system is in re-circulation mode. Study required.	Issue was not considered to be significant and was not completed.
81. New tasks to be added to the daily/weekly check sheet:	
Check double wall fuel piping vacuum gauges.	Completed
Put two main fuel pumps in manual mode and run briefly to confirm no leaks and proper operating pressure. Include expected operating pressure on the check sheet, and record actual pressure weekly.	Completed
82. New task to be added to the six month check sheet: “Verify DC pump operation and pressure.”	Completed
<b>Fuel Storage</b>	
83. Change the interval of the following tasks from six months to one year. “Check drain valve main tank for water and dirt contamination; check tank sides, roof, & associated piping for excessive rust, etc.; check & grease all fuel valve stems & associated equipment.”	Completed

Gas Turbine Maintenance Strategy Update	Comments
84. An Engineering study is planned for 2008 to review overall maintenance strategy for tanks and dykes - revisit maintenance strategy when study is complete.	Tanks are now to be inspected in accordance with API 653. SVI is planned for 2014 and HWD planned for 2015.
<b>A.9 Lube Oil</b>	
85. Change interval for the actuator filter replacement and clean out the bottom of the housing from five years to one year. (Other lube oil filters to remain on five year check sheet.)	Completed
86. Add new task to the five year check sheet to clean MLO Y-strainer.	Completed
87. Change the interval of the following tasks from six months to one year.	Completed
Jacking Pumps - Check motor brushes; Check operation pressures and shaft lift (both ends) with a dial indicator. Check hold down bolts and grease motor bearings if required.	Completed
Main Lube Pumps - Check general condition. Grease bearings as required; check brushes DC motors.	Completed
Main Lube Oil Tank - Drain condensation from main tank. Use valve at bottom of tank; Check level of oil in tank (dipstick), add as required.	Completed
<b>A.10 Cooling</b>	
<b><u>Air Cooling Systems</u></b>	
88. Study the problem of water being drawn into the alternator cooling filters at Hardwoods.	This item was not considered high priority but will revisited in 2014.
89. Add to the daily/weekly check sheet: "Check condition of air filters (front end), alternator cooling system – HWD only".	Completed
90. On the six month check list, change "Check condition of filters" to "Check condition of air filters (front and back ends), alternator cooling system – HWD only".	Completed
91. Change the interval of the following tasks from six months to one year (i.e. remove from the Alternator section of the six month check sheet and add to the annual check sheet) and note that both items are "HWD only":	Completed
Check filter blockage switch (check hose is not pinched)	Completed
Check <u>and lubricate</u> alternator louvers, make sure they are free to move. (Underlined words are new words to add.)	Completed
92. Change the interval of the following task from six months to one year (i.e. remove from the Inlet Plenum sections of the six month check sheet and add to the one year check sheet):	Completed
Check louvers <u>and lubricate</u> for freedom of movement, etc. on enclosure fans 1 & 2. <u>Verify noise-free operation of the fans.</u> (Add the underlined words.)	Completed
<b><u>Glycol Cooling Systems</u></b>	

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
93. Provide redundancy - install a second pump and regulator for the MLO cooling systems.	Being designed for SVL for 2015/2016.
94. Further review is required to determine maintenance strategy for the glycol system heat exchangers (HWD - 2; SVL - 4). Consider recording and trending pressure and/or temperature differential across each exchanger and clean when trends dictate. Determine gauge / data collection needs. Alternatively, implement time-based cleaning of internals of the heat exchangers.	Still under review.
95. Change the interval of the following tasks from six months (under "Glycol System") to one year:	Completed
Check cooling fans pitch angle and setting and general condition of blades.	Completed
Check expansion tank glycol level. Make note of tank level. Check low level alarm switch.	Completed
Drain off some glycol and check contamination content and protection level.	Completed
Check heat exchanger cooling tubes and vanes for leaks, rust, etc.	Completed
Check the condition and operation of the three-way thermostat (lubricate all moving parts).	Completed
96. Add the following new task to the annual check sheet: "Clean the Y-strainers in the glycol systems". Review interval of cleaning strainers after a couple years of experience.	Completed
97. For SVL only, replace buried glycol piping with double-wall piping, with vacuum gauges.	Planned to be completed in 2016.
<b>A.11 Compressed Air</b>	
98. Trend compressor run time as a method to monitor the overall condition of the compressed air system. Review is required to determine if this should be done manually or automatically with an alarm.	Hours are recorded and will be used for asset management.
99. On the weekly check sheet, change "drain water trap" to "operate all manual condensate drain valves; confirm operation of all automatic condensate drain valves (on dryer, compressors, receivers, after coolers, etc.)"	Completed
100. Consider replacing manual drain valves with automatic condensate drainage. Consider installing a condensate drain downstream of the after-coolers at Hardwoods.	Decision was made not to implement this recommendation and keep with manual valves.
101. Remove Compressor / Dryer / Air System section from the six month check sheet, since these checks are now redundant - we are using the Terminal Station check sheets.	Completed
102. Add this note to the compressed air system annual and bi-monthly check sheets (for Terminal Stations): "Not all components on this check sheet exist for all compressed air systems. For example, systems for HWD & SVL gas turbines do not have flow switches, limit switches, and thermostat."	Decision was made not to implement this recommendation.
103. Add to the annual compressed air system check sheet (for Terminal Stations) to clean the filter in the oil-water separator.	Decision was made not to implement this recommendation.
104. Add to the daily check sheet to check the oil-water separator for leaks and levels.	Completed

Gas Turbine Maintenance Strategy Update	Comments
105. Create a PM for HWD gas turbine similar to that for SVL gas turbine (MWO 468178) for ultrasound inspection of compressed air system.	Completed
106. Create a PM for HWD gas turbine similar to that for SVL gas turbine (MWO 577502) for cleaning unloaders and draining condensate.	Completed
107. Create a PM for HWD gas turbine similar to that for SVL gas turbine (MWO 329880) for bi-monthly inspection.	Completed
<b>A.12 Stand-by Diesel Unit</b>	
108. Change frequency of mechanical and electrical PMs (per check sheets) for the back-up diesel units from six months to one year. See MWO 161808 for HWD. There does not appear to be a similar MWO for SVL - create one.	Tactic frequency left at 6 months and M set up for SVL.
109. Add new task to change engine oil every one year. This can not be added to the existing check sheet, since that check sheet is for isolated systems diesel generators, for which oil change is based upon hours. It is suggested that the MWOs contain two annual tasks: (1) complete the check sheet; and (2) change oil.	Considered low priority due to tactic present. Will revisit in 2014.
110. We are presently using the isolated systems diesel generator electrical and mechanical check sheets. However, this may be ineffective because of the number of differences as compared to the gas turbine back-up diesels. Consideration should be given to developing new check sheets specific to the gas turbine back-up diesel generators.	Considered low priority due to existing check sheets being deemed acceptable.
111. Delete the Diesel Generator Charger and Batteries section from the six month check list, since this is now redundant.	Completed
112. Create 30 day PMs for test run of the back-up diesel generator systems. Include the following details: Start up diesel (open breaker to force auto-start). Check all four chargers (visual inspection & verify functioning - shut off chargers in control module, plus apply load to one compressor). Check voltage & interval of diesel unit via 3720 while under load. Check fuel level in day tanks and oil level. Check for leaks. Verify shutdown of diesel. Check diesel starting batteries.	Unit tested during 180 day PM.
<b>A.13 Fire Protection</b>	
113. Add the following task to the weekly check sheet, for all Inergen-protected spaces: "Verify that all enclosure openings (doors, louvers, etc.) are well sealed and that automatic closers are functioning properly."	Completed
114. Create a 5-year PM to reflect the current practice of swapping Inergen flexible discharge bends (i.e. hoses) in service with those in inventory as follows: Prior to Inergen annual maintenance, retrieve hoses from inventory and deliver to contractor for shop testing and re-certification. If any fail, procure new. Instruct contractor to install re-certified and/or new hoses during Inergen annual maintenance. Send removed hoses to Stores. An 8-digit part number in JD Edwards is needed for this item.	Identified on annual PM and completed by Certified Fire Protection Contractor as required.
115. Create a 5-year PM for room integrity "door fan" testing of all Inergen protected spaces, as per NFPA 2001.	Completed as commissioning test but not completed since. Plan to review in 2014.
116. Revise the corporate "Project S&H Check List" to include the need to ensure room integrity is not compromised, if the space is protected with Inergen or carbon dioxide, and to conduct a room integrity test after significant alterations.	No changes made to date and further review is required on this item in 2014.

<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
117. For SVL only, create a 5-year PM to pressure test Inergen piping (apply nitrogen or compressed air at 40 psi for 10 min and verify <20% loss). Work to be done by contractor during annual maintenance of the Inergen systems.	Completed as required by Certified Fire Protection Contractor.
<b>A.14 Buildings and Property</b>	
118. Verify if both safety inspection forms (Planned General Inspection & TRO - Fire & Life Safety Inspection in the TRO standard in 02.01) of the S&H Program are supposed to be used. Only the former is presently being used.	Only Planned General Inspection is used.
119. For SVL only, add to the one year check sheet to test the three fire alarm pull stations and associated alarm devices. If the TRO - Fire & Life Safety Inspection form (mentioned in recommendation 118) is adopted, this would be covered off.	Completed
120. There appears to be a deficiency with respect to the TRO standard in 02.02 of the S&H Program in that there does not seem to be a list of special safety systems for the gas turbines, as there is for other TRO locations. It is recommended to create the list of special safety systems for the gas turbines and ensure that inspection and maintenance tasks and their intervals are identified, and responsibility assigned.	Completed
121. Review fire detection and alarm needs for all non-Inergen protected spaces at the gas turbines.	Currently considering applying fire protection to relay panels in 230 kV stations, which will include Hardwoods and Stephenville.
122. Change interval of portable fire extinguisher inspections (MWOs 403704 & 255437) from one year to 30 days. Verify adequacy of the inspection check sheet by comparing to the requirements in NFPA 10, 7.2.2.	Annual inspection of Fire Extinguisher is required, model work order will remain.
123. Create new annual task: "Annual maintenance of portable fire extinguishers, as per NFPA 10, 7.3.2, to be performed by permit holder."	Completed
124. The SVL MCC Room portable air conditioner is ineffective and requires a properly sized and designed unit.	Unit is scheduled to be replaced in 2016.
125. Change interval of the following tasks from six months to one year:	
Check forced air heaters, lubricate motors if required.	Completed
Check mounting bolts, fan, fan coupling, louver free to move, etc.; verify operation.	Completed
Check lighting tank farm (operate photocell for lighting)	Completed
Check steps and handrail on tank & over dyke for security	Completed
126. Change interval of the environmental spill kit check (MWO HWD – 436274, SVL – 436276) from one year to one week. Change the task description to: "verify spill kit seal is intact. If not, complete a full inventory of contents." Revise ENV-SOP-20 to clarify that confirmation of seal intact is adequate.	Completed
127. Delete the ladder checks from the Alternator and Inlet Plenum sections of the six month check sheet and add new annual task - inspect all ladders & climbing systems per fall protection program checklist, available in Lotus Notes.	Completed



<b>Gas Turbine Maintenance Strategy Update</b>	<b>Comments</b>
128. Create new 5-year PM to check drainage piping integrity: cap the piping at the inlet into the sump, fill piping with water, let stand for one hour to confirm no leaks.	Completed
129. Investigate extent of problem associated with egress of rain water into the sumps. Is it resulting in additional alarms and pump-outs? If so, consider designing and installing covers on the sumps to prevent egress of rain water.	Completed and cover installed.