Q. Reference: Page 2 – "The Investigation has identified that weekly testing of the DC oil pump set was completed as required consistent with the original equipment manufacturer guidelines." Please describe the weekly testing and provide a copy of the referenced manufacturer guidelines.

A. On a weekly basis, Operations staff follow the manufacturer's instructions for testing the starting of the AC and DC lube oil pumps. The Operator will follow the step-by-step instructions and ensure that each pump starts when called upon in accordance with the proper starting sequence. While performing the test sequence for the pumps, the Operator does a visual check to ensure that the pumps are running and alarms are sounded in the control room – indicated on the check sheet entitled "Turbine and Auxiliaries Weekly Checks" (see attached). The Operator listens for any abnormal sounds and feels for any abnormal vibration. If any test fails, the Operator will initiate an emergency work order and repairs are executed immediately. All completed check sheets are reviewed by the Shift Supervisor as well as the Manager of Operations and filed accordingly.

MAIN LUBE OIL TANK AND LUBE SYSTEM
(Motor Pumps)

TANK ASSEMBLY

The lube oil tank is a compact, simple design. Elimination of the turbine shaft-driven centrifugal oil pump also eliminates the booster pump priming system for the shaft pump as well as the need for a 200 psig lube-hydraulic system pressure. The lube system pressure level is now 65 psi and permits the use of much smaller motor pumps than was possible in the past. Three full-capacity motor pumps are standard - two with AC motors, one with a DC motor. The AC motor pumps normally supply lube oil for the turbine generator. Either pump can supply bearing flow and generator shaft seal flow with the other pump as a standby" or back-up pump.
The DC motor pump is an emergency pump and backs up the two AC pumps.

GRAVITY FLOW HEAT EXCHANGERS

Cooling the lube oil is accomplished by finned tube heat exchangers in the tank. The bearing drains return to the lube tank through a single pipe connection.
Three gravity flow, finned tube heat exchanger units are mounted in a series - flow arrangement in a compartment inside the rank. The returning lube oil passes into the compartment through the heat exchangers and through an orifice plate dam back into the main reservoir of oil. The lube oil in the tank will be about 120°F with the coolers arranged this way. The orifice plate dam is used to provide a level of oil in the cooler compartment to submerge the heat exchanger tubes and establish a uniform flow through the tubes. The finned tubes also are very effective in detraining air and foam.
Each heat exchanger unit is designed with a cooling capacity of 50% of the turbine requirements. Any two units will thus provide adequate cooling capacity, with the third unit as spare capacity. The oil side of each cooler unit is oil tight permitting removal of water boxes on the spare cooler for cleaning and inspection of tubes. Normal cooling water temperature is 95°F max.
The oil pumps are vertical, 20 HP motor-driven centrifugal pumps. Each pump has a suction strainer and is isolated from the lube system header by a check valve in its discharge piping. Two of the pumps have AC motors. One AC pump normally supplies the turbine with lube oil. The other AC pump is on standby or back-up service. Each pump has an automatic start pressure switch which senses pressure in the lube system header. The DC motor pump starting pressure switch is set to actuate at a lower pressure than for the two AC pump switches so that the AC motor pumps normally will take care of the turbine lube oil supply and the DC motor pump will automatically start only on an "emergency basis".

VAPOR EXTRACTOR

A motor driven vapor extractor which includes an oil separator is provided on the tank. The extractor is adjusted to maintain a slight vacuum of about 1"
This vacuum prevents oil vapor from passing out through small openings in the tank structure and wetting external areas of the tank. The extractor also scavenges the turbine generator lube and shaft seal drain piping to remove oil vapors, moisture and any hydrogen which might accidentally pass into the seal drain system oil return to the lube tank. The exhaust from the vapor extractor is piped to a vent which discharges outside the building to atmosphere.

OIL PUMPS

All three pumps discharge into a common header in the tank. Oil for the generator shaft seal system is supplied directly from the header to the hydrogen shaft seal oil unit with its own pressure regulators, filters, etc. Oil for the turbine generator bearings passes through a blocking valve which permits shutting off oil to the bearings during bearing inspection, but still permits the motor pump in service to maintain seal oil pressure at the generator shaft seals. Next the lube oil passes through a diaphragm type, pressure regulating valve which maintains bearing lube oil pressure at 25 psig at turbine centerline and then on to the bearings.

PUMP TEST AND AUTOMATIC STARTING

Provisions are made to test the AC and DC motor pumps which are on "stand-by". An orifice and solenoid valve are included with each starting pressure switch and a "run" pressure switch is included for each pump. The "run" pressure switch senses pressure between the pump discharge connection and its isolating discharge check valve. The test is performed by pushing the pump test pushbutton and energizing the test solenoid valve. The solenoid valve is an open-closed design and causes oil to flow from the header to drain through the orifice in the starting pressure switch sensing line. The orifice drops the oil pressure sensed by the starting pressure switch and causes the switch to close and start the motor pump. As soon as the pump is running, its discharge pressure will rise to normal pressure and the "run" pressure switch will close, lighting the "run" signal lamp. Releasing the test pushbutton closes the solenoid valve and the automatic start pressure switch opens. The motor is stopped by turning the motor control SBI switch or equivalent to the "stop" position.
This feature is not only provided for all three motors on a panel at the tank, but provisions are made for connections to the customer's own central Control Panel.

The motor control switches for these pumps should be three-position SB-1 or equivalent switches. The three positions are "run", "auto-start" or "stand-by" and "stop". A spring return from "stop" to "auto-start" should be used to automatically return the control switches to the automatic start condition and maintain the AC and DC pumps as back-up pumps. The motor-pump starters should have seal-in contacts in parallel with the automatic start pressure switch contacts to prevent cycling and also to require the operator to manually stop the pump. The motor control switches should have a "pull to lock out" or similar feature in order to minimize the possibility that the motor control would be accidentally left in the "off" condition. An additional precaution against leaving the motor pump in the "off" condition is to have a green light lighted when the motor control switch is in the "auto-start" position. When the motor control switch is in the "locked out" position, the green light would go off.

TANK CONSOLE

A metal console is located on the top of the tank along one side. The console contains the pressure switches for the pumps, the pump test pushbuttons and solenoid valves, the lube oil tank thermometer and oil level gage. All the electrical devices are wired to terminal strips in the console and space has been designated for customer Connection conduits and wire. Some of the accessories included are: a remote pressure transmitter for lube oil pressure; a low bearing oil pressure switch and a thermocouple for lube oil tank temperature.

OIL CONDITIONER

For filtration purposes, an oil conditioner is included in the lube system. The oil conditioner is used to dehydrate, clean, and polish the oil and includes such equipment as: a vapor extractor; a polishing filter; and a transfer and by-pass pump system, driven by CGE 1 H.P. - 460 V - 1800 RPM motors. The type of oil conditioner used is a Bowser Model (823-P).