POWER GENERATION
MACHINERY RISK ASSESSMENT

Prepared for:

City of Gainesville, Gainesville Regional Utilities
South Energy Center
1390 SW 14th Ave.
Gainesville, FL 32614

July 30, 2014

Attention:

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Scope

The purpose of this Machinery Risk Assessment is to evaluate the critical plant equipment located at this facility with regard to operations and maintenance. Evaluations are risk-based with emphasis on the human element aspects of the loss control programs.

It is understood that each facility has its own specific conditions that characterize its design and operating procedures. Generally, national and industry recognized standards are the basis for the evaluation and suggestions. This is not to preclude a consultant's qualified judgment when evaluating the adequacy of existing programs.

Conferred With

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Mr. Joe Shaw	*Utility Project Leader*
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Executive Summary

A Machinery Risk Assessment was performed at the South Energy Center for the City of Gainesville, FL on July 30, 2014.

A tour of the premises was conducted along with a review of hazards present, protective systems. building construction details, management programs and other related aspects of the facility. Plant management was interviewed to determine operational and maintenance practices at the location.

Site personnel were observed to be knowledgeable and in command of equipment in their charge. Equipment and systems were found in good condition; housekeeping at this generating plant was observed to be excellent from a machinery standpoint.

The South Energy Center was built to supply utility services to a new hospital, Shands UF Cancer, which completed construction in November 2009. Utility services to be supplied include normal and essential electric power, steam, chilled water, medical gas infrastructure, and a backup non-potable water well. The GRU South Energy Center will employ Combined Heat and Power (CHP) to optimize the use of energy and ensure a more reliable source of power to the campus. The CHP system installed consists of a gas turbine, heat recovery steam generator, and steam turbine chiller. The gas turbine will operate in parallel with the local GRU electric distribution grid and excess power produced (0.75 to 1.5 MW) will be purchased by GRU.

Essential power functionally is tested monthly.

A management of change review process is in place. The process ensures operating procedures; maintenance program and P&IDs are kept current following changes in plant equipment or systems. All of the equipment at this facility is of the latest technology.

Overall, equipment conditions were found to meet and exceed industry standards and acceptable for boiler and machinery breakdown insurance purposes.

The primary focus of this survey was to assess various aspects of the facility's risk reduction and loss recovery programs for mechanical and electrical systems and components that are vital to continued operation of the facility. Emphasis was placed on equipment and system reliability, current maintenance practices, equipment control and protection schemes, and contingency action plans to recover from vital equipment/system failure. Due to the criticality of the services provided to the hospital, redundancy was designed and built into the facility's original construction plans.

A tour of the premises was conducted, including a review of observed risks, protective systems, maintenance practices and procedures, management programs and operator training. Plant personnel were interviewed to determine operating and maintenance practices at the location. The cooperation by plant personnel was greatly appreciated and helpful in developing this report.

Major Equipment – Overall rated *Excellent.* A mixture of formal and informal contingency plans exists to mitigate the effects of lost or damaged key equipment. Station management also has a plan to address capital and maintenance projects and expenditures. The only specific area where there is no redundancy is the Deaerator. The Deaerator is required by both sources to produce steam. The plant has established a contingency plan for bypassing the Deaerator for operating purposes. The auxiliary boiler can be fired and supply steam for process and does not require the deaerator. This was discussed with the plant. The plant is aware and a plan is being developed. This will require some minor piping changes and a change in operating procedures.

Major Systems – Overall rated *Good.* Balance of Plant systems and equipment are well maintained and testing exceeds industry standards in many areas. Several programs were reviewed and exceeded industry standards.

Operations – Overall rated *Good.* Factors that have a direct impact on incident likelihood at a generation station relate to operating environment, operating conditions, age and history, maintenance and the employment of experienced well trained operators. Plant operating environment was found to be good from a machinery standpoint.

Maintenance – Overall rated *Good.* Housekeeping observed throughout the facility, from a boiler and machinery standpoint was very good for this type of risk. Outage and major equipment inspection frequencies meet or exceed industry standards. Station equipment is also protected by appropriately set and adequately-sized safety devices to ensure reliable operation from a boiler and machinery standpoint.

Risk Reduction Suggestions

No new risk reduction suggestions are offered as a result of this survey.

The factors that drive consequences or incident severity, relate to communication, contingency planning and safety devices. This station maintains a fair spare parts inventory.

Assessment Summary

Overall, equipment conditions were found to be *Good* for machinery insurance purposes. Please refer to the **Risk Characteristics Rating** section of this report for details.

Risk Reduction Suggestions

Risk Reduction Suggestions represent opportunities for continued improvement. The suggestions are risk-based and customized to this facility. The suggestions are made using national and industry recognized standards and recommended practices.

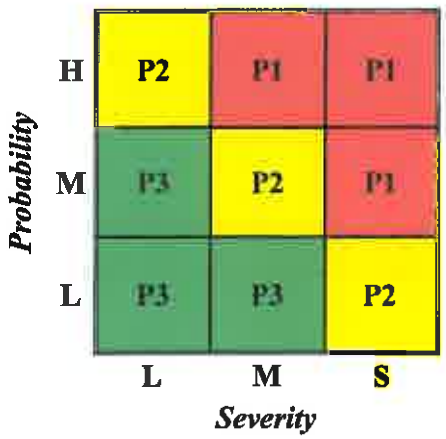
Probability Based on historic information provided by recognized industry organizations and AEGIS loss experience

High	The probability of a loss is greater than average.
Medium	The probability of a loss is average.
Low	The probability of a loss is less than average.

Severity Based on insurable values, deductibles and AEGIS loss experience

Severe	The incident may result in significant financial impact to the facility.
Moderate	The incident may result in moderate financial impact to the facility.
Low	The incident may result in low to moderate financial impact to the facility.

Priority Matrix



No new risk reduction suggestions were made as a result of this risk assessment.

General Plant Information

South Energy Center

Plant Description

The South Energy Center (SEC) was constructed approximately ¼ mile southeast of the new UF Cancer Hospital and opened in late 2009. It is located between Archer and SW 14th Avenue in Gainesville, Florida. All equipment is indoors, in a newly constructed building used solely by the South Energy Center.

A pre-survey meeting was held on July 28, 2014 at the Kelly Generating Plant. Key GRU personnel were present. A post-survey meeting for this location was held at the SEC facility on July 31, 2014.

SEC can function as an island, separate from the traditional electric grid in case of a grid emergency (for example in case of a hurricane). This ability to isolate protects the plant from effects of the grid faults and allows electrical power to be supplied to the Hospital without interruption.

SEC supplies the cancer hospital with all of its heating and cooling requirements. Medical gas storage vessels are located on the SEC site. It also was designed to allow for future expansion as Shands pursues plans for additional medical towers in years to come. If necessary, power can be supplied from the GRU distribution grid by two alternative sources.

Operating Conditions

The GT1 was operating at the time of this Inspection. There were no alarms showing on the computer screens during this Inspection. On July 25, 2014 operating hours for the package was 43,106 and starts for the package were 196. Operating hours for the engine was 12,670 and starts for the engine were 35.

Risk Characteristics Ratings

Area Rated	Rating	Risk Reduction Suggestions/Comments
Major Equipment		
Boilers	G	
Steam Turbines	G	
Generators	G	
Transformers	G	
Major Systems		
High Energy Piping	G	
Feedwater and Condensate	G	
Operations		
Control Room Review	G	
Operating Procedures and Training	G	
Operational Testing	G	
Maintenance		
Maintenance Management and Training	G	
Predictive Maintenance (PdM)	E	
Pressure Vessels	G	
Auxiliary Safety Valve Maintenance	G	
Electrical Maintenance	G	
Emergency Battery	G	

Excellent	The facility has taken measures that exceed industry standards and best practices. Loss potential is considered significantly reduced.
Good	The facility has taken measures that are consistent with industry standards and best practices. Loss potential is considered to be average.
Fair	The facility has taken some measures that approach industry standards and best practices; however, deficiencies exist. Loss potential is considered somewhat increased.
Poor	The facility has major deficiencies and does not approach industry standards and best practices. Loss potential is considered to be significantly increased.

Major Equipment

Boilers

Boiler #	MFG	Boiler Type/Year	Design Rating		
			LB/HR	MAIN STEAM PSIG	Primary/Duct Firing Fuel
HRSG	(ERJ)* Cleaver Brooks	Pressurized/ 2008	44,000/20,000 w/wo duct burners	150	Waste Heat/Natural Gas
Aux. Boiler	Cleaver Brooks	Fire Tube/ 2008		150	Natural gas/#6 Fuel Oil

*Energy Recovery International

There are diverters to allow the combustion turbine exhaust to by-pass the HRSG. This allows the CT to operate in simple cycle mode.

Summary of Major Boiler Maintenance

Boiler weld repairs would be performed by a contractor that has an NBIC "R" stamp for boiler and pressure vessel repairs.

Combustion Turbine

Unit	Year Built	Manu.	MW	Model/ Serial #	Total Fired Hours	Total Starts	EFOR
GT-1	2008	Solar	4.3	Mercury 50/ SNOC07737-10	39,007	179	0.00%

The table above hours was recorded during the Solar CT inspection on January 27, 2014.

SEC CTG1												
Month	Oct 2013	Nov 2013	Dec 2013	Jan 2013	Feb 2013	Mar 2013	Apr 2013	May 2014	June 2014	July 2014	Aug 2014	Sept 2014
Turbine Starts	0	0	0	2	7	0	1	5	0			
Period Hours	744	721	744	744	672	743	720	744	720			
Service Hours	744	721	744	618	658	743	718	735	716			

The table above is for the period of October 1, 2013 to July 1, 2014.

The combustion turbine is equipped with coolers on the air inlet. The coolers are part of the chilled water system.

Power 4.6 MW, Heat rate 9351 kJ/kWh, Exhaust flow 140,000 lb/hr, Exhaust Temperatures 710°F.

It has a "turbotronic 4" control operating system.

Gas turbines are inspected to the Original Equipment Manufacturer (OEM)'s guidelines. The plant has an Extended Service Agreement between SOLAR Turbines Incorporated and the City of Gainesville. Solar will provide a designated technical focal point, InSight System for Remote Monitoring & Diagnostics (RM&D), pre-paid trouble calls, maintenance, package parts and consumables, repair and turbine overhaul coverage.

The InSight System provides RM&D capabilities that collects, stores, and analyzes operational data. The data extracted from the equipment is filtered and automatically analyzed in a central database, where a set of reports is automatically generated and posted to the Solar website. Solar's InSight system may be made available to Customer, and Customer may view data for the Covered Equipment. The RM&D system is expected to provide early warning capability of incipient faults or wear by employing condition trending and diagnostic algorithms in an effort to decrease unplanned downtime.

Gas turbine inspections are based on the Solar's formula on operating hours, and fired starts and trips. Borescope inspections are performed annually. The Solar Mercury 50 Turbine Generator is a high efficiency, high performance unit designed to operate on natural gas fuel only. The engine includes a high efficiency gas to gas recuperative heat exchanger to recover exhaust stream energy. The turbine is coupled to a capacity matched generator via a speed reducing gear box.

There are three centrifugal 900 kW chillers that have R134 and R123. Two are driven by electric motors and one is steam turbine-driven. The two 1500 ton electric chillers were manufactured by Trane. The 1200 ton turbine-driven unit was manufactured by York.

A contract with a vendor for monthly maintenance inspections is in place for the Trane and York Chillers. Every three years NDE (eddy current) inspections of the condenser and evaporator tubes are performed. In 2012 the chiller tube sheets were epoxied to prevent erosion at the tube ends. The steam turbine driven chiller is scheduled for an annual maintenance inspection and every three years the steam turbine will be disassembled and inspected. This is due again in January 2015.

There are four Evapco cooling cells installed at SEC. These are grouped into two logical cooling towers for operational purposes.

Generators

Internal Combustion Engine/Generator

DG 2

Unit #	MFG	Year Built	Type	Volts	Fuel	Nameplate Rating (kW)
DG 2	Caterpillar	2007	ICE	12.47	Fuel Oil	2,250
DG 1	Caterpillar	2007	ICE	480	Fuel Oil	500

An aggressive inspection criterion from the Caterpillar operation and maintenance manual will be performed as part of annual maintenance on the diesel engines. The DG2 is started monthly and run for a period of at least 30 minutes minimum and with a minimum load of 30%.

As part of the maintenance program, the batteries will be replaced (DG 2 only) every two years. These batteries were replaced in 2012. Every three years the cooling system water temperature regulator will be replaced and the turbo-charger and rotating rectifier will be inspected.

The DG 1 has black start capabilities. It is capable of providing electric power to provide start-up for the Solar Turbine. This engine is started monthly and run for 45 minutes.

CT Generator

Unit #	MFG	Year Built	Model Type	Volts	Cooling	Nameplate Rating (kVA)
GT1	Kato	2008	Mercury 50, 2 Pole, 3PH/60 Hz, Air Cooled	12.47	Air	5,375

Additional nameplate information:

Continuous duty rating, salient pole, 3 ph, 60 cycles, 'Wye" connected, synchronous with brushless exciter. This is a single skid package, turbine, gear reduction drive and generator alignment.

Summary of Major Generator Maintenance

This generator has been in operation for five years. The proposed generator maintenance will follow these guidelines:

1. Check the generator windings insulation resistance to ground annually.
2. Check the generator space heaters for proper operation annually.
3. Check the tightness of rotating rectifier connections annually.
4. Every 3 years remove the generator end brackets and visually inspect generator end windings for oil or dirt contamination and clean with air or solvent if required.
5. Every 5 years, disassemble the generator and perform the following:
    a. Clean the generator windings.
    b. Replace the roller bearings.
    c. Inspect the bearing journals for wear and or scoring.

The generator and exciter both stator and rotor windings were electrically tested with good results in January 2013. A visual inspection was performed also. No problems have been encountered with the generator at this time.

Gas Turbine Protection

The plant has purchased an Easton Power/ware 9355 UPS system rated at 30KVA @ 208 VAC. This unit provides 11 minutes of backup power under full load conditions. This double conversion unit provides for normal operation, battery upon supply failure, static bypass and maintenance bypass operation. This unit was provisioned with a Service Contract.

The generator is an air cooled brushless exciter design. Details of maintenance requirements can be found in the SOLAR service contract. The plant has an Extended Service Agreement between SOLAR Turbines.

Summary of Combustion Turbine Maintenance

The OEM recommends the next borescope inspection in 4000 hours of operation. SOLAR is scheduled to replace the turbine component in the next two months as per the service contract. As a result of inspections and OEM's guidelines the turbine will be changed out around the OEMs planned interval of 30,000 hours.

This was completed in March 2013 and took approximately 4 to 5 days to complete. A borescope was performed on January 27, 2014, package hours 39,007, and engine starts 179. Some carbon build up in the area of the main and pilot injection ports was noted. The results of the inspection verified a loss in efficiency of the unit during operation. As a result of the inspection the first stage nozzle erosion/cracks are a concern due to possible cracks propagating to allow a large piece to impact the first stage turbine blades which could cause heavy damage. The OEM is monitoring the unit monthly. The next engine overhaul will be scheduled in 30,000 hours. Inspection through various access ports for a borescope inspection on 1/2014 included:

- Combustor liner (including dome, TBC, exit cones, nozzle leading edges, torch tube, and clamp ring), first-stage turbine blade leading =edges and first-stage turbine nozzle.
- First-and second-stage blade tip ends and tip shoes, second-stage nozzle leading edges, and axial rubs.
- Inside of air inlet duct, inlet guide vanes (IGV) variable guide vanes, 1st, 2nd, and 3rd stage compressor blades.
- Outlet guide vanes.
- Aft side of second-stage turbine blades, honeycomb seal, #3 bearing seal oil leakage.

The gas turbine borescope inspection is an internal inspection performed by a trained specialist who assesses the condition of the gas turbine from the air inlet, diffuser housing, fuel injector, nozzle caseport, and exhaust, using an instrument specifically designed to examine the gas path via the access ports positioned along the engine. Both rigid and flexible fiberscopes are used in conjunction with specially formed guide tubes to inspect the internal stationary and rotating components and to detect early signs of wear or impending failure. The major benefits of the inspection include equipment condition awareness and effective scheduling of any necessary maintenance interventions. In addition, greater reliability/longevity can be achieved through internal inspections, as well as reducing the potential of severe equipment damage.

The operating gas turbine engine by design is exposed to high temperatures (2000°F) and rotates at high speeds. Internal inspections are thus necessary to determine if wear or thermal erosion is evident. In addition, these inspections will quantify if any foreign object damage (FOD) or corrosion has occurred, as well as assessing internal components for thermal deterioration, cracking or distortion.

Water wash of the turbine is done offline only on a quarterly basis. There is inlet cooling for the SOLAR unit.

In the air inlet, the first stage compressor inlet guide vanes (IGV) and blades were inspected with cracks and foreign object damage (FOD) found. There was some erosion, corrosion and minor pitting found. On the second stage stator at the rotor hub some cracks, missing metal and severe dents were found.

The diffuser housing access to the exit guide vane and shroud, the 11 stage compressor blades were inspected for missing vanes, corrosion and pitting, cracks, tears FOD, and dents. The recommendation was to re-inspect in 4000 hours.

There was a Factory Service Representative from the OEM who assisted in the inspections of the Solar Turbine.

The scope of generator stator testing and examination, when performed, will include inspection of end winding spacers, inspect for looseness and the condition of the parallel ring clasping assembly, and inspect end winding insulation for cracks, abrasion, or mechanical damage.

Electrical tests of the stator for Unit 1 will include:

1. Megger test of all stator through bolts at 1000 VDC
2. Stator winding resistance
3. Insulation resistance test and calculation of the Polarization Index (PI) at 2500 VDC
4. Perform an EL-CID test of the stator core
5. RTD resistance verification and 500 VDC megger
6. DC leakage and one minute Hi-Pot test (48,000 VDC)
7. Transposition test

Transformers

There are no GSU type transformers at this location. Electrical power from the combustion turbine and the essential diesel is generated at 12.47 kV. The feeds from the GRU distribution system are also supplied at 12.47 kV.

The two feeds from GRU connect to the normal bus. Any transformers associated with these connections are part of the GRU distribution system and not South Energy Center.

It was noted that the transformers use vegetable-based insulating oil. DGA is a valid monitoring technique for alternative insulating oils; however it should be understood that the relative gas concentrations should not be compared to mineral oils. The gas production rates for similar energy events vary significantly between mineral and vegetable based transformer oils. Initial DGA samples have been taken.

The voltage generated feeds directly into the substation owned by GRU. Our meeting with the Sub-Station personnel indicated that the testing is adequate for the transformers as indicated in the Deerhaven and Kelly reports. The tests and inspections are the same and are listed below.

Transformer Insulating Oil

Dissolved gas analysis and screen testing is completed annually. The samples are analyzed by Alternative Technologies, Inc. The last DGA analysis was performed in May 2014 with satisfactory results. These results were reviewed by this Inspector.

Transformer Electrical Testing

Electrical testing is performed on a 5 year frequency. Doble testing and other electrical testing on the transformers was performed on July 2014.

Transformer Protection and Monitoring Systems

The transformers are provided with electrical isolation that includes over-current protection, winding temperature indication, sudden pressure relay and lightning arrestors.

Transformer Oil Analysis

For transformer dielectric failures, the failure precursor or incipient state is the appearance of various dissolved gasses in the oil. While the industry has significant successful experience of detecting and mitigating slowly evolving dielectric failures using traditional DGA sampling techniques, it has less favorable experience with quickly developing failures. It is this latter set of failures that multi-gas online monitors will detect at an early stage and prevent the occurrence of a major failure. Dissolved gas analysis (DGA) of plant transformers is conducted annually.

Major Systems

High Energy Piping

As this station is new, no testing has been performed at this time. The station operates at a low steam pressure and temperature and is not subject to creep.

Main Steam – Main steam piping is 4 years old and no specific piping inspections have been performed to date.

Piping Hanger Program – Hanger inspections are conducted at maintenance outages. A hot survey is performed prior to the start of scheduled outage and follows this up with a cold walkdown after the outage is started. Operators daily walk the units down looking for situations out of the ordinary.

Feedwater and Condensate Systems

The inspection criteria will follow the guidelines established by the City of Gainesville as the other plants that have operated in the past. The Deaerator inspections will follow the National Association of Chemical Engineers (NACE) recommendations outlined in NACE Standard RP0590-96. This Deaerator is new and no problems have been found at this time.

Flow Accelerated Corrosion (FAC)

Flow Assisted Corrosion (FAC) inspections have not been performed at this station. The operating conditions of the units are not in the range of FAC.

Water Treatment System

Make up water is provided from demineralizer units, cation, and anion and mixed bed filters. The water is received from the city. The water treatment has a Reverse Osmosis (RO) filter. The plant has a contract with NALCO for monitoring of the plant and boiler water.

This facility is considered a zero discharge facility. There is no release of a liquid effluent from the plant. The plant receives all of the required water from the city. Waste water is treated at the plant.

Operations

Operating Procedures

The station has five technicians (operators) reporting to a Production Manager. There are not separate operations and maintenance departments. There is also an asset manager. Personnel at the plant consist of 4 operators from within the GRU system from other plants. Some of the personnel have been at the plant since the early construction phases.

The station is in the process of taking OEM documents and experience from operating and generating Standard Operating Procedures (SOP) for future training of operators and to provide a consistent basis of operation.

Operator Training

The operators at this station are experienced and well trained. This station utilizes on the job training, class room training using a combination of a Job Task List, OEM equipment manuals during the commissioning of the equipment. The formal training program that includes on-shift progression, written and practical, will be developed to address future hires.

Operating procedures have been developed and are accessible for operators. They include the normal evolutions of equipment start up and shutdown, as well as emergency procedures.

Control Room Review

Operation and control of equipment in the plant is accomplished from the Control Room. Monitoring of equipment is performed with computer screens, meters, gages, digital read-out devices and other devices. Continuous vibration monitoring systems are installed on each turbine generator. Narrative logs of daily activities are kept in the Control Room. The Control Room is constantly attended.

There are computer screens located in the Control Room that are easily visible for the critical equipment. Direct remote visual water level indication is located in the control rooms for the boilers. Equipment monitoring and control utilizes a Distributive Control System (DCS). The Control Room operator and shift supervisor have the authority to trip the units if conditions warrant.

Operational Testing

Overspeed Trip Testing

Overspeed testing is performed every 6,500 operating hours as part of the control logic. The last overspeed (electronic) test was performed in 2014. This is an automatic test (notification by alarm) by the system at 6,500 hours.

Emergency Lube and Seal Oil Systems

The DC emergency lube oil pump is tested as part of the start-up logic. There are no thermal overloads that will trip the motor and the motor has a normally energized start-up circuit.

Maintenance

Maintenance Management

Station management utilizes a computerized preventative maintenance management system MP2 Enterprise package. All maintenance activities were moved to this MP2 Enterprise program which is used to schedule, coordinate, prioritize, complete and track all aspects of preventative, predictive and corrective maintenance activities. The system tasks are prioritized. Overall scheduling includes annual review and planning meetings to discuss issues and capital expenditures.

The plant utilizes a combination of Preventive and Predictive maintenance practices. Most preventative tasks are performed at calendar-based intervals versus condition-based maintenance intervals.

Maintenance Training

All major maintenance will be contracted out. The plant personnel can do preventive and routine maintenance as required.

Predictive Maintenance (PdM)

Thermographic Inspection

Infrared scanning is conducted annually by an outside contractor on station electrical transmission and distribution systems. This includes all mechanical and electrical equipment to and including the switchyard. Findings are immediately dispositioned and handled accordingly. Scanning would be performed prior to scheduled maintenance outages.

Infrared testing is performed by McCabe & Associates of various components. This includes all electrical circuits and equipment at the South Energy Center Station. This includes the electrical circuits and equipment. The last thermographic inspection was performed in 2014.

Vibration Monitoring and Analysis

The station has a comprehensive predictive maintenance program in place monitoring vibration of rotating equipment. This includes a monthly route-based vibration analysis program performed by an outside contractor. The inspection list includes all rotating equipment in the plant.

Lube Oil Analysis

CT 1 oil samples are analyzed quarterly. Lubricating oil will be sampled monthly for the turbine and generator at this station. Samples will be drawn by plant personnel and sent to contract laboratories for analysis. There have been concerns lately with moisture in the oil. The oil is being analyzed more frequently at this time. A turbine component, resin based filter, was installed. The OEM is aware of this condition with the oil and a cause and action to correct it is ongoing. The test results have been good and the plant is considering going to a quarterly analysis.

Safety Valve Maintenance

Plant boiler steam safety relief valves are tested annually by National Board "VR" certified repair concerns.

The plant has developed a list of every safety and relief valve and a schedule for testing valves is in place.

Protective Relay and Circuit Breakers

The plant preventative and predictive maintenance program is quite comprehensive relating to electrical testing. All equipment is visually inspected annually. Protective relays are tested and calibrated annually. Circuit breakers receive energized and de-energized maintenance. The dielectric strength of fluid in oil circuit breakers is tested during outages.

Circuit breakers are trip-tested and exercised during outages. Primary current injection testing is utilized. Doble power factor testing is performed annually. Insulation resistance measurements are also taken.

Protective relay testing is performed every six years for the microprocessor-based relays. This list and test dates were reviewed by this Inspector.

Emergency Battery Systems

Operators perform daily visual inspections of the battery rooms.

Weekly checks are conducted for abnormal/unusual conditions, corrosion, and etc.

Monthly checks include Pilot Cell readings for cleanliness, temperature, specific gravity and voltage. The charger output voltage and charging current is also noted.

The batteries have only been impedance tested at this time. Discussions about full load capacity testing after 5 years were held with plant personnel. The intent of the plant is that IEEE-450 will be followed for inspection and testing of the batteries.

Loss History

No losses have been reported for this location within the last five years.

Loss Estimates

Probable Maximum Loss (PML)

The Probable Maximum Loss (PML) is defined as the physical damage and time loss expected to occur assuming the failure of a primary operating control and the failure of at least one safety or protective device. In addition, the affected equipment experiences a delayed shutdown or isolation.

The PML is calculated using percentages of the equipment value and is expressed as a specific total dollar amount.

PML Scenario

The PML scenario for this location is a high cycle fatigue failure of the 1st stage turbine rotating or stationary components of the 4.6 gas turbine resulting in significant damage to the hot gas path or ingestion of foreign object into compressor.

PML *$800,000* *(Loss without consideration of a deductible or business interruption)*

Maximum Foreseeable Loss (MFL)

The Maximum Foreseeable Loss (MFL) is defined as the maximum amount of physical damage and time loss expected to occur under the worst possible conditions. This is based on the failure of operating controls and safety or protective devices with no shutdown or isolation of affected equipment. The MFL assumes this equipment operates to destruction.

The MFL is calculated using a percentage of the total equipment value and is expressed as a specific total dollar amount.

MFL Scenario

The MFL scenario for this location is a catastrophic mechanical failure of the 4.6 gas turbine/generator due to an overspeed or high vibration condition resulting in significant damage to unit requiring replacement.

MFL *$3,400,000* *(Loss without consideration of a deductible or business interruption)*