TECHNICAL EVALUATION

APPLICANT

Lakeland Electric
501 East Lemon Street
Lakeland, Florida 33801-6603

Charles Larsen Memorial Power Plant
Facility ID No. 1050003

PROJECT

Project No. 1050003-018-AC
Acknowledgment that an Air Construction Permit is not Required
Combustion Turbine Maintenance and Repair, Unit 8

COUNTY

Polk County, Florida

PERMITTING AUTHORITY

Florida Department of Environmental Protection
Division of Air Resource Management
Office of Permitting and Compliance
2600 Blair Stone Road, MS#5505
Tallahassee, Florida 32399-2400

October 18, 2012

1. BASIC FACILITY INFORMATION

The Lakeland Electric Charles Larsen Memorial Power Plant (Larsen Power Plant) facility is categorized under Standard Industrial Classification (SIC) Code No. 4911, Energy Services. The facility is located at 2002 East Highway 92 in Lakeland, Polk County. The UTM Coordinates are Zone 17, 408.9 kilometers (km) East and 3102.5 km North. This site is in an area that is in attainment (or designated as unclassifiable) for all air pollutants subject to Ambient Air Quality Standards (AAQS). The location of Polk County is shown below in Figure 1. Figure 2 shows the location of Larsen Power Plant while Figure 3 provides an aerial view.

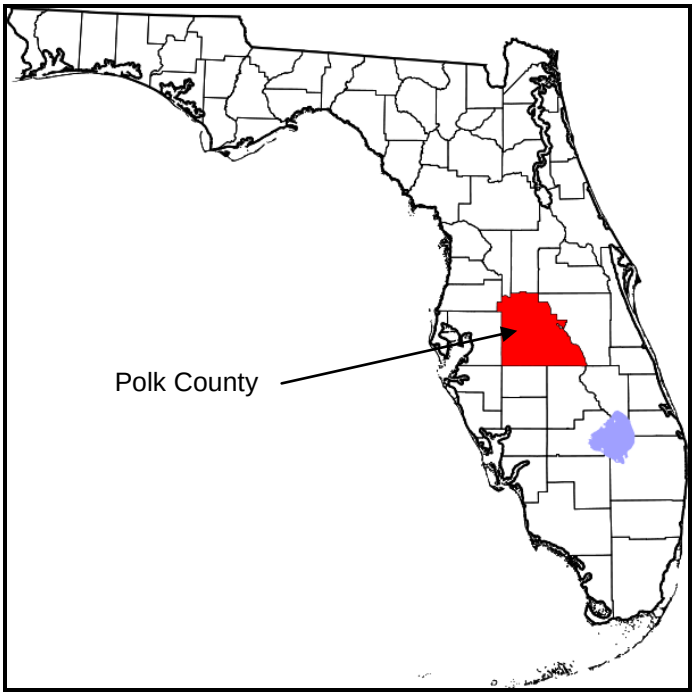

Figure 1. Polk County Florida.

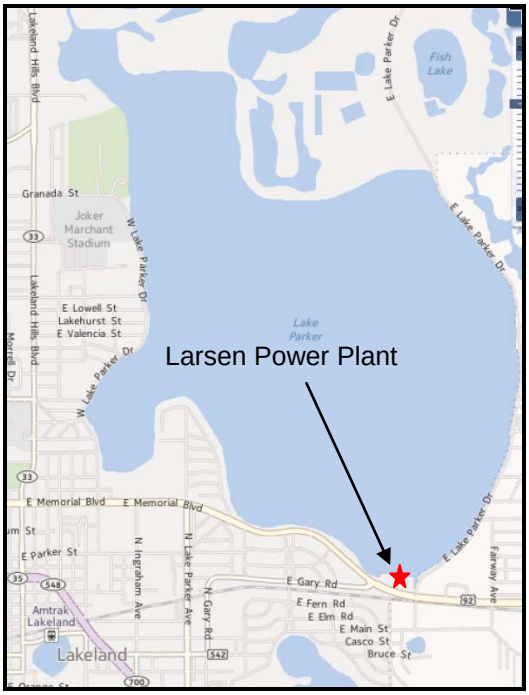

Figure 2. Location of Larsen Power Plant.

Figure 3. Aerial View of Charles Larsen Memorial Power Plant.

A list of the emissions units (EU) at the Larsen Power Plant is provided in Table 1 below. The facility consists of two simple cycle combustion turbine (CT) peaking units (Units 2 and 3), one combined cycle CT with simple cycle bypass (Unit 8), three stationary reciprocating internal combustion engines, fuel oil storage tanks and associated equipment.

Table 1. Summary of Emissions Units at the Larsen Power Plant.

EU No.	Brief Description
005	Simple Cycle Combustion Turbine Peaking Unit #3
006	Simple Cycle Combustion Turbine Peaking Unit #2
008	Combined or Simple Cycle Combustion Turbine #8
014	Startup Diesel Engine for Simple Cycle CT Peaking Unit #2
015	Startup Diesel Engine for Simple Cycle CT Peaking Unit #3
016	Emergency Engine for Site Lighting

Unit No. 8 is a General Electric PG 7111EA (GE 7EA) combustion turbine-electrical generator that is fired with natural gas and distillate fuel oil. Unit 8 is equipped with an unfired heat recovery steam generator (HRSG) for combined cycle operation. This unit is rated at approximately 90 megawatts (MW) while operating in simple cycle mode and approximately 120 MW when operating in combined cycle mode. The steam generated from the HRSG powers a steam turbine-electrical generator that was previously a component of a conventional fossil fuel steam generator at the Larsen Power Plant. Unit No. 8 began commercial service in July, 1992. Nitrogen oxides (NO_X) emissions are controlled by water injection for both gas and oil operation.

2. PROJECT DESCRIPTION

The project is described in a letter from Lakeland Electric dated October 1, 2012 and containing several attachments and analyses. Link to Lakeland Electric Submittal The Unit 8 maintenance and repair project will be conducted during an outage between February and June 2013. It consists of the seven items identified in Table 1. Items 1A, 2, 3, 4, and 5 involve inspection of hot path components, where metal and equipment is exposed to high temperatures. Over time this results in metal fatigue of hot path components requiring repair and replacement as-needed. Item 1B involves inspection of the high pressure components of the air compressor and subsequent repair and replacement as necessary. Item 6 involves the replacement of the existing 20-year-old computer control system, which is obsolete (GE Mark IV). The new control system will operate the unit in the same manner as the existing system.

Table 2. Description of Maintenance and Repair Items for Unit 8.

Item No. Project Title	Scope of Work	Reason	Description
1A **Gas Turbine Hot Gas Path Inspection**	The scope of work is to inspect and repair/replace combustion hardware and hot gas path components.	Borescope inspections to these components have revealed that these components need refurbishment and in some cases replacement for turbine reliability.	The fuel nozzles, combustion liners, and transitions will all be replaced. A combination of new/refurbished parts will replace the parts coming out of the machine. All of the major Hot Gas Path components will be inspected. These components include the 1st, 2nd, and 3rd stage buckets/nozzles/diaphragms/shroud blocks. The 1st stage nozzle is expected to require refurbishment. Also, some of the other components will require refurbishment as well, but extent as to which ones and quantity won't be known until the HGP section is inspected.

Item No. Project Title	Scope of Work	Reason	Description
1B **R17 Compressor Blades**	Reposition and double peen the R17 blades in the compressor section.	Borescope inspections show these blades have moved.	Reposition and double peen the R17 blades in the compressor section.
2 **HRSG Economizer Module Replacement - LLP9022**	The scope of work is to provide access through the south side wall of the HRSG at the economizer module, remove the existing economizer module assemblies (2), make repairs to the insulating barrier and inner liner in preparation for the new modules, install the new economizer modules (2), tie in drains, inlet and outlet header piping, reinstall the south wall casing, install alignment/vibration bars and supports. Afterward, HRSG will be chemically cleaned.	The existing economizer modules are original equipment that has been in service for ~20 years. By metallurgical analysis, the tubes in these modules have reached the end of their useful life expectancy. Tube failures in the Economizer modules have increased substantially and repairs are decreasingly a viable option as the material to tie into remains fatigued.	There are four Heat Exchanger sections in the U8 HRSG: The Economizer, the Evaporator, the Primary Superheater, and the Secondary Superheater. The Economizer heat exchanger is made up of two separate modules, each with an upper inlet and outlet header. The total effective heating surface of the economizer is 86,160 sq. ft. The Economizer makes up 29% of the total heating surface of the HRSG. Note that the HRSG heat transfer surfaces have been routinely monitored for tube conditions with repairs performed as necessary.
3 **Gas Turbine Exhaust Plenum and Expansion Joint Replacement**	The scope of work is to remove the existing turbine exhaust plenum and expansion joint and install the new exhaust plenum and expansion joint.	The existing exhaust plenum and expansion joint are original equipment that has been in service for ~20 years. This duct and insulation have reached the end of their useful life expectancy. Heat to the outside is over 900 degrees and repairs are not a viable option as the material remains fatigued.	The hot gases from the turbine diffuser exit into the plenum duct, which makes a 90 degree turn into the HRSG duct system. The plenum duct is insulated and has metal shielding to keep the heat in. The existing plenum will be removed and replaced with a new plenum.
4 **Gas Turbine Exhaust Diffuser Replacement**	The scope of work is to remove the existing turbine exhaust diffuser and install the new exhaust diffuser.	The existing exhaust diffuser is original equipment that has been in service for ~20 years. This diffuser has reached the end of its useful life expectancy. The diffuser has many cracks all the way around it and many repairs have been performed to the point that repairing the diffuser is no longer a viable option.	The hot gases from the turbine exit into the exhaust diffuser, which diffuses the hot gases into the plenum. The existing diffuser will be removed and replaced with a new diffuser.

Item No. Project Title	Scope of Work	Reason	Description
5 **HRSG Inlet Damper and Expansion Joint Replacement**	The scope of work is to cut out and remove the existing HRSG Inlet Damper and expansion joint and install the new HRSG Inlet Damper and expansion joint.	The existing HRSG Inlet Damper is the original equipment that has been in service for ~20 years. This damper has reached the end of its useful life expectancy. The louvers and insulation have fallen down, heat to the outside is over 900 degrees, and repairs are not a viable option as the material remains fatigued.	The HRSG Inlet Damper is constructed of motor operated louvers that close off the hot gases from entering the HRSG and diverts the gases out the bypass stack. The existing HRSG Inlet Damper assembly will be removed and replaced with a new HRSG Inlet Damper assembly, including a new expansion joint.
6 **CT, ST, and BOP Control System Upgrade**	The scope of work entails removal and replacement of existing GE Mark-IV control system and Foxboro I/A control system.	The control systems are obsolete and repair parts are in short supply. Increasingly, age-related failures can occur that negatively affecting Unit reliability.	Obsolete control systems will be replaced with new state-of-art systems. Spare parts will be readily available. There will be no change in the algorithms for the NOx control system. Tuning will be performed as necessary to match the existing system with the original control system.

According to the applicant's submittal cited above, there will be no increase in capacity or emissions as a result of the maintenance and repair project. In its transmittal letter, Lakeland Electric concludes:

> *"that it (the project) meets regulatory guidance for routine maintenance repair and replacement (RMRR). As a result, this maintenance project is not a modification as defined in the Department's rules and not subject to any regulatory action".*

After discussion with Lakeland Electric it was agreed that the Department would review the project and provide the City with a written acknowledgment based on the information submitted and the Department's application of its own rules.

3. AIR POLLUTION REGULATIONS

3.1. Department Regulations

Projects at stationary sources with the potential to emit air pollution are subject to the applicable environmental laws specified in Section 403 of the Florida Statutes (F.S.). The statutes authorize the Department of Environmental Protection (Department) to establish regulations regarding air quality as part of the Florida Administrative Code (F.A.C.), which includes the following applicable chapters:

Table 3. Applicable Air-Related Rules from the Florida Administrative Code.

Chapter	Description
62-4	Permits
62-17	Power Plant Siting
62-204	Air Pollution Control – General Provisions
62-210	Stationary Sources of Air Pollution – General Requirements
62-212	Stationary Sources – Preconstruction Review
62-213	Operation Permits for Major Sources (Title V) of Air Pollution
62-296	Stationary Sources – Emission Standards
62-297	Stationary Sources – Emissions Monitoring

The key regulations applicable to this review are Chapters 62-4 and 62-210, F.A.C. According to Rule 62-4.020(Definitions), F.A.C.:

> *(11) "Permit" is the legal authorization to engage in or conduct any construction, operation, modification, or expansion or any installation, structure, equipment, facility, or appurtenances thereto, operation, or activity which will reasonably be expected to be a source of pollution.*
>
> *(4) "Construction permit" is the legal authorization granted by the Department to construct, expand, modify, or make alterations to any installation and to temporarily operate and test such new or modified installations.*

According to Rule 62-210.300(Permits Required)(1), F.A.C.:

> *(a) Unless exempt from permitting pursuant to paragraph 62-210.300(3)(a) or (b), F.A.C., or Rule 62-4.040, F.A.C., an air construction permit shall be obtained by the owner or operator of any proposed new, reconstructed, or modified facility or emissions unit, or any new pollution control equipment prior to the beginning of construction, reconstruction pursuant to 40 CFR 60.15 or 63.2, or* ***modification*** *of the facility or emissions unit or addition of the air pollution control equipment;*

According to Rule 62-210.200(Definitions), F.A.C., Modification means:

> *Any* ***physical change in, change in the method of operation of****, or addition to a facility which would result in an increase in the actual emissions of any air pollutant subject to regulation under the Act, including any not previously emitted, from any emissions unit or facility.*
>
> *(a) A physical change or change in the method of operation* ***shall not include****:*
>
> *1.* ***Routine maintenance, repair, or replacement*** *of component parts of an emissions unit;*

The Department will refer back to these definitions and requirements in conducting its analysis.

3.2. Federal Regulations

The U.S. Environmental Protection Agency (EPA) establishes air quality regulations in 40 CFR 60 that identify New Source Performance Standards (NSPS) for a variety of industrial activities. EPA also establishes the minimum emission guidelines and compliance schedules for existing facilities of certain industries in 40 CFR 60. 40 CFR 61 generally specifies National Emission Standards for Hazardous Air Pollutants (NESHAP). 40 CFR 63 generally specifies NESHAP provisions based on the Maximum Achievable Control Technology (MACT) for given source categories.

Federal regulations adopted by reference are given in Rule 62-204.800, F.A.C. State regulations approved by EPA are given in 40 CFR 52, Subpart K – Florida; also known as the State Implementation Plan (SIP) for Florida. Link to 40 CFR 52, Subpart K

3.3. Facility Regulatory Categories

- The facility is not a major source of hazardous air pollutants (HAP).
- The facility operates units subject to the acid rain provisions of the Clean Air Act.
- The facility is a Title V major source of air pollution in accordance with Chapter 213, F.A.C.
- The facility is a major stationary source in accordance with Rule 62-212.400, F.A.C. for the Prevention of Significant Deterioration (PSD) of Air Quality.
- The facility is subject to applicable NSPS in Title 40, Part 60 of the Code of Federal Regulations.
- The facility is subject to applicable NESHAP in Title 40, Part 63 of the Code of Federal Regulations.

4. AIR CONSTRUCTION PERMIT APPLICABILITY REVIEW

4.1. Applicant's Analysis

As part of its submittal, Lakeland Electric provided an evaluation prepared by Mr. Ken Kosky, P.E. of Golder Associates. It includes a rule review and a "Five Factor Evaluation" for determining whether a project on a steam electrical generating unit constitutes *"Routine maintenance, repair, or replacement" (RMRR).*

According to the evaluation:

> *"Lakeland Electric has performed similar repair and replacement of gas turbine components. For example, the gas turbine associated with Unit 8 is a GE Frame 7EA that has a recommended maintenance cycle. Several maintenance cycles for the gas turbine have occurred over the past 20 years. This maintenance is conducted according to the recommended GE maintenance schedules."*

The Five Factor Evaluation is based on EPA Guidance specific to a project proposed by Detroit Edison called "Dense Pack". The EPA Guidance was issued in 2000. Link to Detroit Edison Determination The procedure reviews the ***nature, extent, purpose, frequency and cost*** of a project at a steam electric generating unit when determining whether it constitutes RMRR. The applicant's Five Factor Evaluation with regard to RMRR is contained in Appendix A.

Based upon consultant's assessment and his side-by-side comparison of the project features with the Five Factor criteria, it was concluded that the Lakeland Electric Larsen Unit 8 Maintenance and Repair project "meets the requirements of RMRR".

4.2. Department's Review

The Department does not necessarily accept all guidance developed by EPA, particularly when applied to the Department's rules, which are ultimately interpreted by the Department. The Department has found that the particular EPA Detroit Edison Guidance and the Five Factor approach is a useful tool for applicants for organizing and submitting projects that are candidates for designation as RMRR.

The Department further investigated the routine nature of the project by consulting readily accessible General Electric publications. In particular, the Department consulted GE publication GER-3808C, *"Uprate Options for the MS7001 Heavy Duty Gas Turbine"* (December 2006). Link to GER-3808C

The Lakeland Electric project is clearly not one of the uprate options described by GE in its publication. According to GE, all heavy duty gas turbines undergo periodic combustion inspections (including hot gas path inspections) due to material creep, thermal barrier coating erosion and wear. Refer to Table 4 below.

Table 4. Maintenance Intervals for Typical MS7001, MS9001, and for Extendor Components.

Maintenance Action	Maintenance Interval, Hours				
	7B	9B	7EA	9E	Extendor
Combustion Liner Inspection	3,000	3,000	8,000	8,000	24,000
Transition Piece Inspection					
Thin Wall	3,000	3,000	–	–	–
Thick Wall	8,000	8,000	8,000	8,000	–
Nimonic	–	–	12,000	12,000	24,000
Hot Gas Path Inspection	24,000	24,000	24,000	24,000	24,000
Major Inspection	48,000	48,000	48,000	48,000	48,000

Hot path gas inspections (and repairs) are indicated at intervals of 24,000 hours of operation for 7EA units such as Unit 8. Major inspections (and repairs) are indicated at 48,000 hours of operation. According to information retrieved from the EPA Air Markets Program Data (AMPD) webpage, Unit 8 has operated roughly 40,000 hours. This equates to roughly 4.5 years of continuous operation during the 20 years that it has been in service. Link to EPA AMPD

A hot path gas inspection and even a major inspection with repairs would appear to be routine and even warranted. It is noted that starts and shutdowns as well as operation on oil and "high temperature peaking" operation can accelerate the hours indicated for the inspection intervals.

According the EPA AMPD, Unit 8 is still capable of achieving it maximum heat input rates. These rates are in base mode 1,750 million British thermal units per hour (MMBtu/hr) at 25 ºF when firing natural gas and 1,149 MMBtu/hr when firing No. 2 distillate fuel oil. In peaking mode the rates are 1,161 MMBtu/hr at 25 ºF when firing natural gas and 1,149 MMBtu/hr when firing fuel oil.

The Department reviewed operation of Unit 8 during January 2010, 2011 and 2012, the coldest months when such units are capable of operating at their maximum rates (due to demand and high density of ambient air available to the compressor). In all of these months, the turbine had heat input rates of 1,050 MMBtu/hr or greater, which is a clear indication that it can still approach its maximum firing rate. Thus the action proposed by the applicant is not to recoup significant lost capability.

Construction of Unit 8 was authorized by the Department under permits AC53-190437 and Permit PSD-FL-166 issued on July 26, 1991.

With respect to the key regulations cited above as the basis for this review, the Department notes:

- The applicant obtained a permit (specifically a construction permit) as defined in Rule 62-4.020, F.A.C. to construct Unit 8. The construction permit was AC53-190437/PSD-FL-166 issued July 26 1991.
- The applicant has a permit to operate the facility (specifically a Title V air operation permit) that includes Unit 8. The most recent Title V permit 1050003-017-AV (renewal of current Title V permit 1050003-014-AV) was issued on October 1, 2012 and will be effective from January 1, 2013 through December 31, 2017.
- The work is RMRR and is not a physical change or change in method of operation
- The project is not a modification as defined in Rule 62-210.200(Definitions), F.A.C.

Additionally, the project does not involve the addition or modification of air pollution control equipment and does not constitute reconstruction of a NSPS or NESHAP source as defined in 40 CFR § 60.15 and 40 CFR 63, Subpart A. Link to 40 CFR 60.15 Link to 40 CFR 63, Subpart A

5. CONCLUSION

The acknowledges that the proposed project constitutes RMRR. The Department concurs that Lakeland Electric can proceed with the project and is not required to obtain a permit to conduct the described project. David Read is the project engineer responsible for reviewing the application. Additional details of this analysis may be obtained by contacting the project engineer at the Department's Office of Permitting and Compliance at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, by phone at 805-717-9075 or by email at david.read@dep.state.fl.us .

APPENDIX A

APPLICANT'S FIVE FACTOR EVALUATION WITH REGARD TO RMRR

Table 2. Lakeland Electric *RMRR Five-Factor Test for Larsen Unit 8* Unit 8 Gas Turbine and HRSG Maintenance Project September 26, 2012		
Criteria Based on EPA May 23, 2000 Guidance		Unit 8 – Gas and HRSG Turbine Maintenance
Nature		
1. Whether major components of the facility are being modified or replaced.		1. The components being repaired and replaced are the major components of the unit where maintenance is normally required.
2. Whether the unit is of considerable size, function, or importance to the operation of the facility.		2. Unit 8 is one of the several generating units at Lakeland Electric's three power plant sites (Larsen, McIntosh, and Winston). The maintenance activities being conducted are scheduled during a normal outage.
3. Whether the source itself has characterized the change as non-routine.		3. All the proposed activities are characterized as routine maintenance, repair, and replacement due to normal wear of component parts of the gas turbine and HRSG. For example, the majority of the repairs are for component parts in the hot gas path [gas turbine (turbine section), expansion joint, inlet damper, and economizer].
4. Whether the change could be performed during full functioning of the facility or while it was in full working order.		4. The repair and replacement of component parts will be performed during an outage of about 16 weeks (Feb-June 2013) with other generating units available to provide electric power during a lower demand period. Scheduled outages for maintenance are routine for electric utilities.
5. Whether the materials, equipment and resources necessary to carry out the planned activity are already on site.		5. The replacement parts will be manufactured offsite and be purchased for onsite installation.

Table 2. Lakeland Electric *RMRR Five-Factor Test for Larsen Unit 8* Unit 8 Gas Turbine and HRSG Maintenance Project September 26, 2012	
Criteria Based on EPA May 23, 2000 Guidance	**Unit 8 – Gas and HRSG Turbine Maintenance**
Extent 1. Whether an entire emissions unit will be replaced. 2. Whether the change will take significant time to perform. 3. Whether the collection of activities, taken as a whole, constitutes a non-routine effort, notwithstanding that individual elements could be routine. 4. Whether the change requires the addition of parts to existing equipment.	1. Only those component parts requiring repair and replacement are affected. 2. The maintenance will occur within a relatively short amount of time and will be scheduled. The repairs and replacement will take approximately 16 weeks. 3. The amount of repairs as a whole deals with component parts requiring repair and replacement. Standard maintenance cycles for gas turbines and HRSGs typically require inspection and replacement of the items being repaired. For example, standard maintenance cycle for the GE Frame 7EA is based on hours of operation, fuel used and/or number of starts. Unit 8 has been in operation for approximately 20 years with similar maintenance activities performed, such as a hot gas path repair in 2007. 4. The replacement components/parts will be like-kind component parts that are connected to the existing equipment in the same manner as they are connected now. No additional parts will be added.
Purpose 1. Whether the purpose of the effort is to extend the useful life of the units; similarly, whether the source proposes to replace a unit at the end of its useful life. 2. Whether the modification will keep the unit operating in its present condition, or whether it will allow enhanced operation (e.g., will it permit increased capacity, operating rate, utilization, or fuel adaptability).	1. Unit 8 has been operating approximately 20 years and has at least another 10 years of useful life. The repairs and replacements of components are routine in nature and do not extend the useful life of the unit. 2. Unit 8 will operate in a similar manner as in the past; no increase in electric generating capacity, operating rate, or utilization will occur. Unit 8 will utilize the same fuels (primarily natural gas) with no change in air emissions as a result of the repairs.
Frequency 1. Whether the change is performed frequently in a typical unit's life.	1. The repairs and replacements are similar to those that have occurred in the past. Repairs and replacements to Unit 8's gas turbine have occurred in the past. Most recently, inspection in the spring of 2007 resulted in work to the second stage nozzle. The repairs and replacements being performed are the most effective and cost-effective.

Table 2. Lakeland Electric *RMRR Five-Factor Test for Larsen Unit 8* Unit 8 Gas Turbine and HRSG Maintenance Project September 26, 2012	
Criteria Based on EPA May 23, 2000 Guidance	Unit 8 – Gas and HRSG Turbine Maintenance
Cost	
1. Whether the change will be costly, both in absolute terms and relative to the cost of replacing the unit.	1. Cost is estimated at $9.4 million for the entire project: The cost of a similar new combined cycle unit is estimated at $96 million. The entire project is 9.8 percent of the total replacement cost of a comparable new unit.
2. Whether a significant amount of the cost of the change is included in the source's capital expenses, or whether the change can be paid for out of the operating budget (i.e., whether the costs are reasonably reflective of the costs originally projected during the source's or unit's design phase as necessary to maintain the day-to-day operation of the source).	2. The costs of the repairs and replacements are part the planned budget for Unit 8 and common for the repairs and maintenance being implemented and the age of the unit.