

# TG ADVISERS, INC.

"Turbine and Generator Experts at Your Service"

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## ***TG Advisers' February 7, 2019 Training Event***

### **1-Day Gas Turbine**

#### **Failure Modes, Troubleshooting and Condition Based Maintenance**

**\$750**

#### **Course Description**

This course provides each delegate with a detailed and applied review of the most common turbine failure modes. Our instructors will focus on risk informed repair and life extension strategies which have a significant bottom line impact. The course will also offer best practices and maintenance considerations for flexible operation which typically includes more cycling, lower minimum loads, and greater capacity ratings. All modules are supplemented with current case studies demonstrating the applied techniques. Eligible for professional certifications.

#### **Who Should Attend?**

This course is designed for plant maintenance and operations personnel, consultants, loss control engineers, and central staff responsible for aero-derivative, simple cycle and combined-cycle power plants. Ideal for those needing to complete pdh credits in 2019.

#### **Course Training Modules**

##### **MODULE 1 – Gas Turbine Design Fundamentals, Technology Enhancements and Failure Modes**

##### **Compressor:**

- *Blade design* – materials, blade root and airfoil design, coatings
- *Inlet guide vanes* – function, mechanical design, inspections

##### **Combustion:**

- *Technologies* – overview of different combustion designs and key attributes
- *Design of combustion components* – introduction, materials, coatings, and function
- *Emissions control* – enhancements to reduce emissions

##### **Hot Gas Path:**

- *Blade design* – inlet vs. aft stage blades, blade casting and internal cooling design
- *Stationary blade design* – singlet vs. doublet/triplet design, heat transfer and cooling
- *Design life and failure modes* – base loaded vs. cycling, limiting failure mode vs. location in hot gas path
- *Material upgrades* – grain structure, alloys
- *Coating systems* – oxidation protection vs. thermal barrier coatings, application processes, evaluation of remaining life
- *Cooling systems* – overview of cooling techniques, types of cooling holes

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- *Upgrade/retrofit opportunities* – overview of new offerings and benefits

## Rotor Design

- *Construction* – disc, spacers, through bolts, aero derivative vs. frame machine
- *Materials* – materials vs. location in engine

## Failure Modes

- *Creep* – overview of mechanism, detection, life of parts and which parts are limited
- *Oxidation* – overview of mechanism, coatings to protect against, repair limitations
- *Thermal mechanical fatigue* – overview of mechanism, detection, life of parts and which parts are limited
- *High cycle fatigue* – overview of mechanism and impacted components
- *Foreign and domestic object damage* – sources of material, ways to protect against

## MODULE 2 – Gas Turbine Operations, Maintenance, and Repair Technology

### Operating Parameters and Impact on Life

- *Fuel type* – impact of fuel type of intervals and part life
- *Firing temperatures* – reduction/extension in life based on actual firing temperature vs. design
- *Inlet temperatures* – impact on part life and power output
- *Inlet chilling/wet compression* – overview of power augmentation techniques, impact on maintenance intervals
- *Fast starts* – reduction of life based on starting time

### Maintenance Intervals & Repair

- *Equivalent operating hours approach (EOH)* – pluses and minuses of using an EOH vs. an hour or start based criteria for maintenance intervals
- *Condition based maintenance approaches* – which parts are applicable, how to avoid unnecessary spend
- *Borescope inspections* – how to interpret results, what to look for and frequency of inspection
- *Combustion inspections* – included items, rotatable parts
- *Hot gas path inspections* – included items, rotatable parts
- *Major inspections* – included items, scope of inspection/repair
- *Water washes, online and offline* – pros/cons of online vs. offline water washes, performance benefits
- *Inspection techniques* – NDE techniques, detectable limits, repair limits
- *Keys to successful part overhaul* – coating quality, crack repair, blade restoration