



Life, on **INTERGEN**<sup>®</sup>



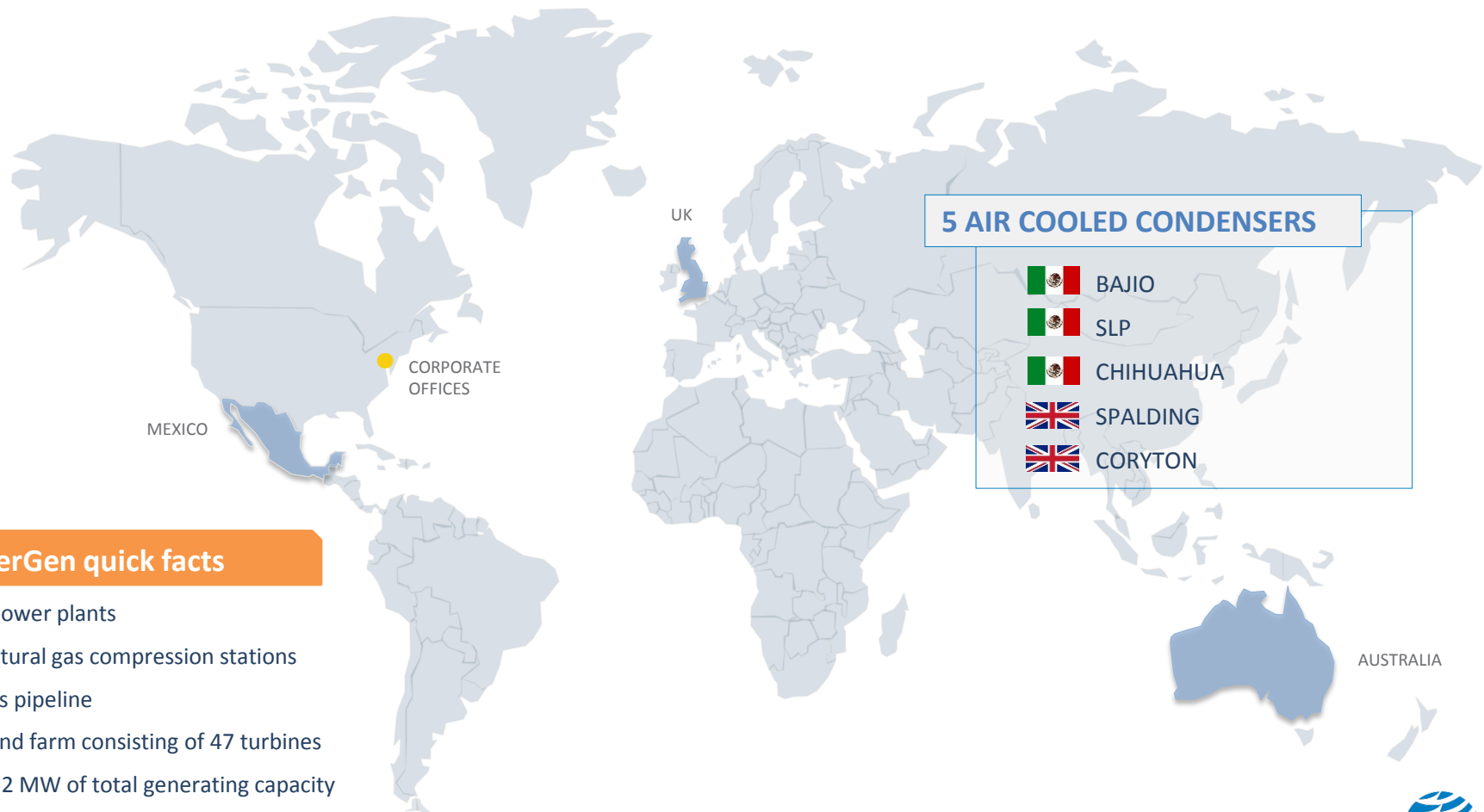
## Air In-leakage Cases / Experiences

ACC Users Group – Las Vegas, 2017



# Air In-leakage Cases / Experiences

## Company Overview



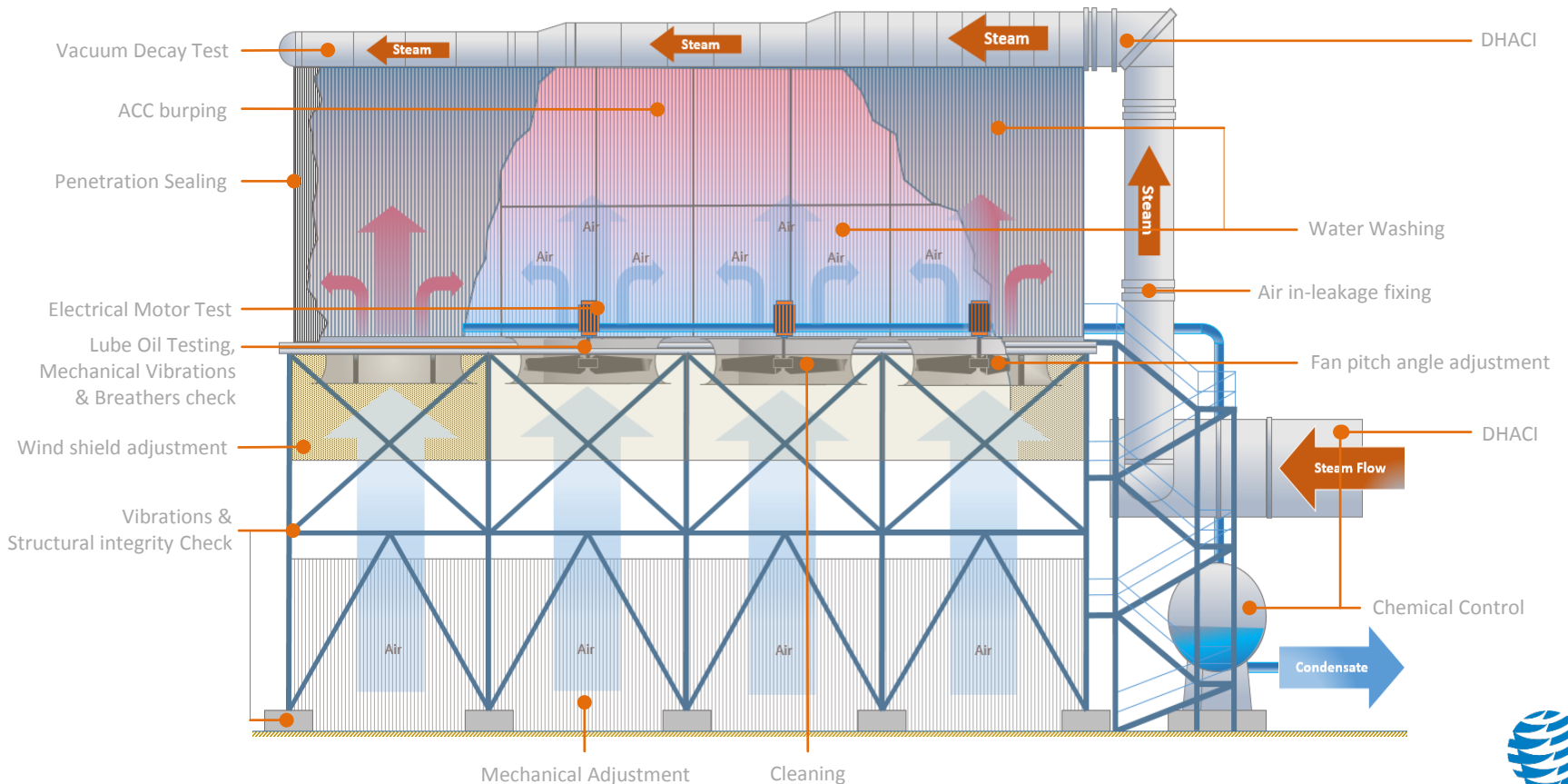
### InterGen quick facts

- 12 power plants
- 3 natural gas compression stations
- 1 gas pipeline
- 1 wind farm consisting of 47 turbines
- 7,322 MW of total generating capacity
- > 600 employees

# Air In-leakage Cases / Experiences

## General Maintenance Experiences

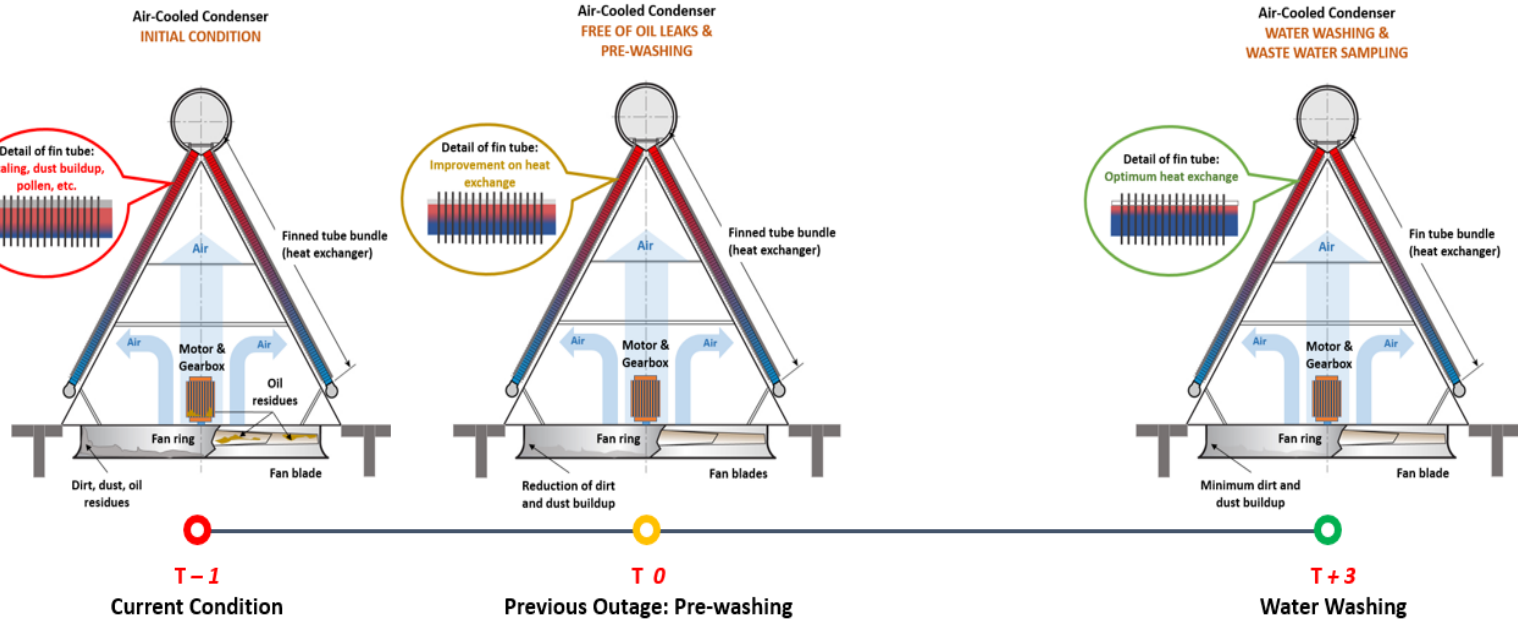
Although the Air Cooled Condensers (ACCs) are not complex equipment, their components require periodic maintenance in order to ensure their performance and contribution to the combined cycle efficiency.



# Air In-leakage Cases / Experiences

## General Maintenance Experiences

### WATER WASHING



Oil residuals on surfaces  
 Dust accumulation in fin tubes  
 Waste water sample, high in:  
 - Total solids & Total suspended solids  
 - Oily residues  
 - Biological Oxygen Demand (BOD<sub>5</sub>), etc.

Motor-gear boxes free of oil leakages  
 Fan blades free of oil spills and dust  
 Pre-wash of fin tubes (reduction of dust buildup)  
 Waste water sample, moderate in:  
 - Total solids  
 - Biological Oxygen Demand (BOD<sub>5</sub>)

Motor-gear boxes free of oil leakages  
 Fan blades free of oil spills and dust  
 Pre-wash of fin tubes (minimal of dust buildup)  
 Waste water sample:  
 - In compliance with local regulations  
 - I.e. MX-NOM-001-SECRE / MX-NOM-002-SECRE



# Air In-leakage Cases / Experiences

## General Maintenance Experiences

ENGINEERING RESOURCES



### Air Cooled Condenser

Scott Woodruff | Oscar Hernández | Stuart Clements | Juan Delgado | Abdúl García

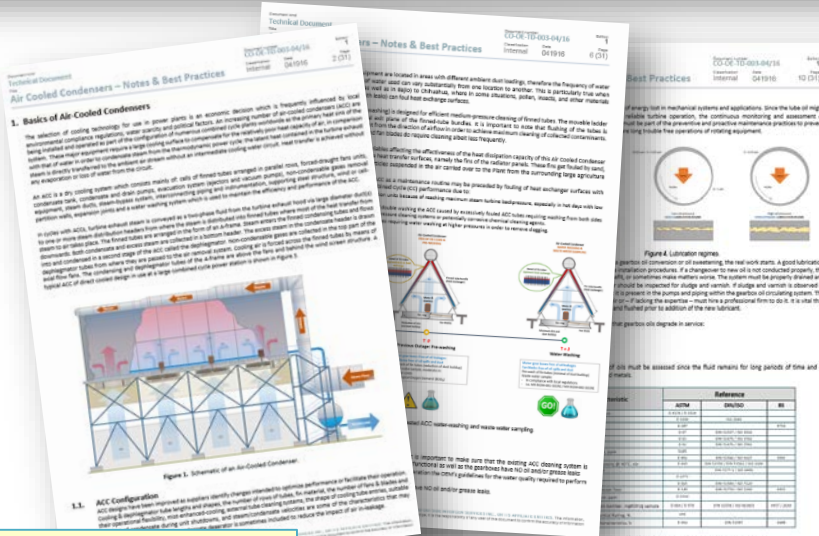
Dedicated i-Share Site for ACCs

Click to: Main Corporate Engineering Site

#### Air Cooled Condenser (ACC)

An ACC is a dry cooling system which consists mainly of: cells of finned tubes arranged in parallel rows, forced-draught fans units, condensate tank, condensate and drain pumps, evacuation system (ejectors and condensable gases removal equipment, steam ducts, steam-bypass system, interconnecting piping and instrumentation), supporting steel structure, wind or cell-partition walls, expansion joints and a water washing to maintain the efficiency and performance of the ACC.

In cycles with ACCs, turbine exhaust steam is conveyed as a two-phase fluid from the turbine exhaust hood via large diameter duct(s) to one or more steam distribution headers from where the steam is distributed where most of the heat transfer from steam to air takes place. The finned tubes are arranged in the form of an A-frame. Steam enters the finned condensing tubes and flows downwards. Both condensate and exit collected in a bottom header. The excess steam in the condensate header is drawn into and condensed in a second stage of the ACC called the desuperheater. Non-condensable gases are collected in the top part of tubes from where they are passed to the air removal system. Cooling air is forced across the finned tubes by means of axial flow fans. The condensing and desuperheater tubes of the A-frame are above the fans i screen structure. A typical ACC of direct cooled design in use at a large combined cycle power station is shown in the following picture.



Technical Document  
Air Cooled Condensers - Notes & Best Practices  
1. Basics of Air-Cooled Condensers  
The selection of cooling technology for use in power plants is an economic decision which is frequently influenced by local environmental compliance regulations, water quantity and quality factors. An increasing number of air-cooled condensers (ACCs) are being installed and operated as part of the configuration of combined cycle power plants worldwide as a cost-effective heat sink alternative. This major expansion is driven by a single overriding factor: the need to reduce the water consumption of the turbine exhaust steam as directly transferred to condensate steam from the thermodynamic power cycle. The steam heat transfer to air is achieved without the loss of water to the environment as is the case with conventional cooling water systems. Heat transfer is achieved without the loss of water to the environment as is the case with conventional cooling water systems.

Figure 3. Schematic of an Air-Cooled Condenser

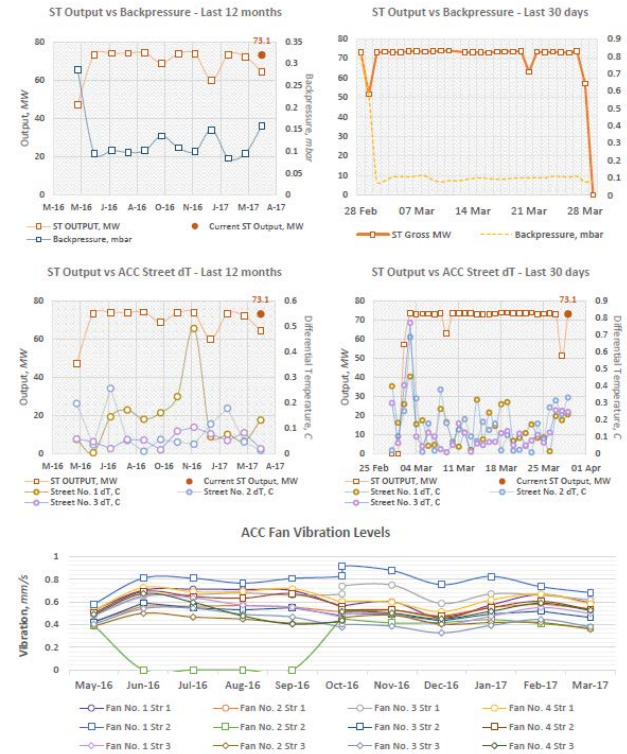
1.1. ACC Configuration  
ACC design has been reviewed and updated to optimize performance in facilitate their operation. ACC design has been reviewed and updated to optimize performance in facilitate their operation. ACC design has been reviewed and updated to optimize performance in facilitate their operation.

White Papers & Technical Bulletins



San Luis de La Paz  
InterGen Daily Report  
Monitoring Diagnostic

#### Air Cooled Condenser Performance



E-Performance Reports (PI/EtaPro)

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# Air In-leakage Cases / Experiences

## Air In-leakages

A common issue in Plants with an ACC – this condition will adversely affect plant efficiency, reliability & availability.

### Key indicators of air in-leakage:

- Increase of backpressure
- Increase of direct measurement of air in-leakage
- Increase of non-condensable gases
- Increase of plant heat rate
- Increase of corrosion rates
- Increased chemical dosage (oxygen scavengers, amines, etc.)
- Increase of chemical parameters, such as:
  - Dissolved oxygen
  - Cationic conductivity
  - Carbon dioxide
  - Iron
  - Silica
  - Sodium
  - Total Organic Carbon
- Condensate temperatures decrease (more fans into service)
- Decrease of the hotwell temperature
- Loss of vacuum in the ACC
- Loss of heat transfer
- Failed decay test

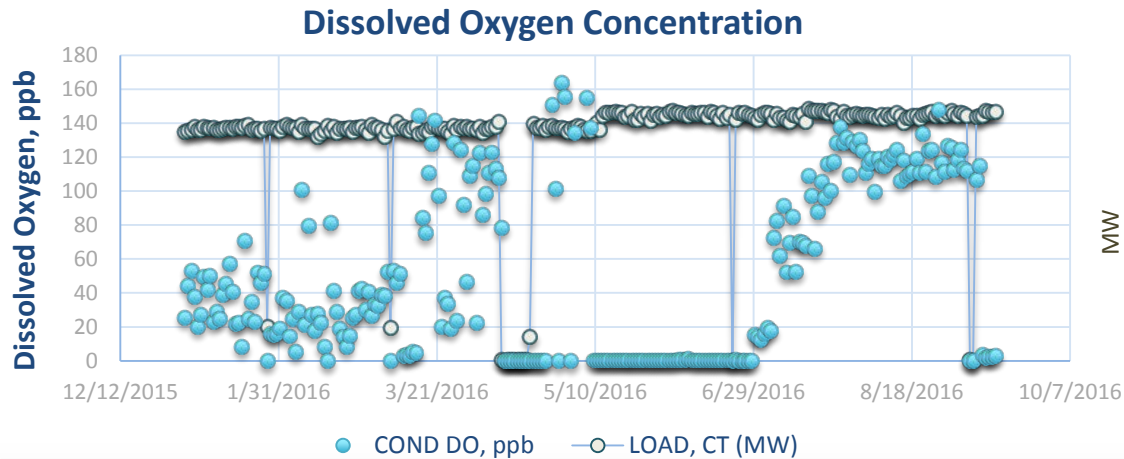
### The primary sources of air in-leakage are:

- Missing hardware (commissioning)
- Air-removal suction components
- Rupture disks
- Penetrations
- Welds
- Flanges, joints and coupling devices
- Turbine shaft seals
- Turbine instrumentation lines and test probe penetrations
- Turbine/condenser expansion joint
- Condenser instrumentation, sight glasses, etc.
- Condensate pump seals
- Drains that pass through the condenser
- Vacuum pumps
- Manways
- Atmospheric relief valves or vacuum breakers
- Low-pressure feedwater heaters, associated piping, bolt holes, valves and instruments

# Air In-leakage Cases / Experiences

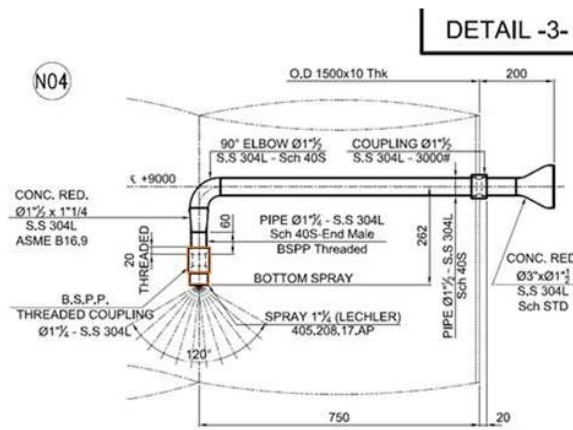
## San Luis de La Paz, Mexico

COD: 2015 | 205 MW | Combined cycle natural gas-fired



### Success Story:

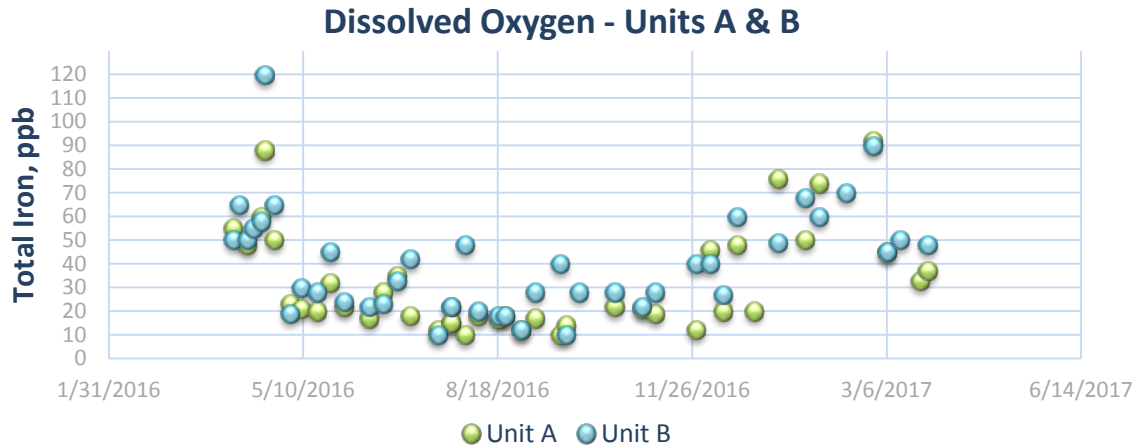
- Accurate On-Line Instrumentation
- Analysis tools available (PI/EtaPro)
- Continuous chemistry monitoring
- Teamwork commitment
- Air in-leakage identified and fixed
  - Spray nozzle missing
- Lesson learned and shared
- O&M practices improved



# Air In-leakage Cases / Experiences

## Coryton, UK

COD: 2002 | 800 MW | Combined cycle natural gas-fired



### Success Story:

- Accurate On-Line Instrumentation
- Analysis tools available (PI/EtaPro)
- Continuous chemistry monitoring
- Teamwork commitment
- Air in-leakage identified and fixed
  - Potentially, a steam turbine gland seal out of position
- Lesson learned and shared
- O&M practices improved





# Air In-leakage Cases / Experiences

Thanks!

