



Conco Systems



The Practical Application of
Tracer Gas Leak Detection
for Air Cooled Condensers

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Tracer Gas Leak Detection

- Focusing On:
 - Air inleakage Impact on system
 - Limitations of air removal equipment
 - Tracer gas methods
 - Tracer gas selection criteria and operating conditions
 - Equipment used
 - ACC specific challenges



Systems for Air Removal

- Air Cooled Condensers air removal systems are designed to remove a certain amount of air in-leakage.
- As the design limitations of the air removal system are approached, the efficiency of the unit will decrease.
- In order for the efficiency of the unit to be maintained, air inleakage must be minimized



Persistent Air Inleakage Affects More than Just Performance

- Dissolved O₂ is another byproduct of excessive air in-leakage.
- Air that is allowed to enter the steam space and is unable to be removed has the potential of being entrained in the condensate.
- When air is allowed to be passed through the feed water system to the boiler, corrosive conditions will exist throughout the entire path of the system.
- If the dissolved O₂ levels remain high for a long period, the affected component's life will decrease



Leak Detection is Needed When

- Routine inspection to understand where potential failures will occur and to maintain an efficient operating ACC
- Before and after outage so components in need of repair are corrected
- Emergency Inspections because of a catastrophic failure
- Air inleakage has exceeded the air removal systems' capabilities and unit efficiency is declining



Old Leak Detection Methods

- Technique
 - Smoke
 - Sight and sound
 - Plastic wrap
 - Shaving cream
- Shortcomings
 - Unreliable
 - Inaccurate
 - Unrepeatable



The Tracer Gas Methods

Helium, A Primary Tracer Gas

- Advantages of Helium
 - Quick & reliable, non-toxic, non-hazardous
 - Detection range is 1 part per 10 million above background (~5ppm) suitable for most leaks.

SF₆ for High Sensitivity Applications

- Advantages of SF₆
 - Inert, odorless, incombustible
 - Non-reactive to H₂O allowing used below water line
 - Detection range is 1 part per billion with no background (optimal for very small leaks)



Helium Mass Spectrometer



Helium Mass Spectrometer and Components



Fluorotracer™ Analyzer



Fluorotracer™ Analyzer and Components



Criteria for Selection of Tracer Gas Method

Choosing the Appropriate Tracer Gas

Consider Your Air inleakage

- Total amount of air inleakage
- Characteristics of specific leakage
- Leak quantification
- Dissolved oxygen considerations
- Leak location



Required Unit Operating Conditions

- Minimum 15% turbine power
- Steam Flow:
 - Crucial to successful leak detection
 - Clears tracer out of condenser
 - Response time is quicker
 - Analyzer recovery time is quicker
 - Without Steam flow: Tracer gas background will continue to rise, making isolation of leak virtually impossible



Testing Equipment Utilized



- Mass Spectrometer or Fluorotracer Analyzer
- Helium or SF₆ Gas
- Spray Probe
- Polyethylene tubing



Test Shots & Calibration

- To establish an identified response time of helium detection, several test shots are conducted and timed with a stop watch.
- All areas tested are noted on strip chart recorder





What The Strip Chart Recorder Will Tell You

- When you are getting close to a leak
- When you passed a leak
- When you hit the leak
- Whether the tracer gas is traveling to another leak
- Whether a tube leak is closer to the outlet end
- Whether it's the valve or packing



Typical Leak Response

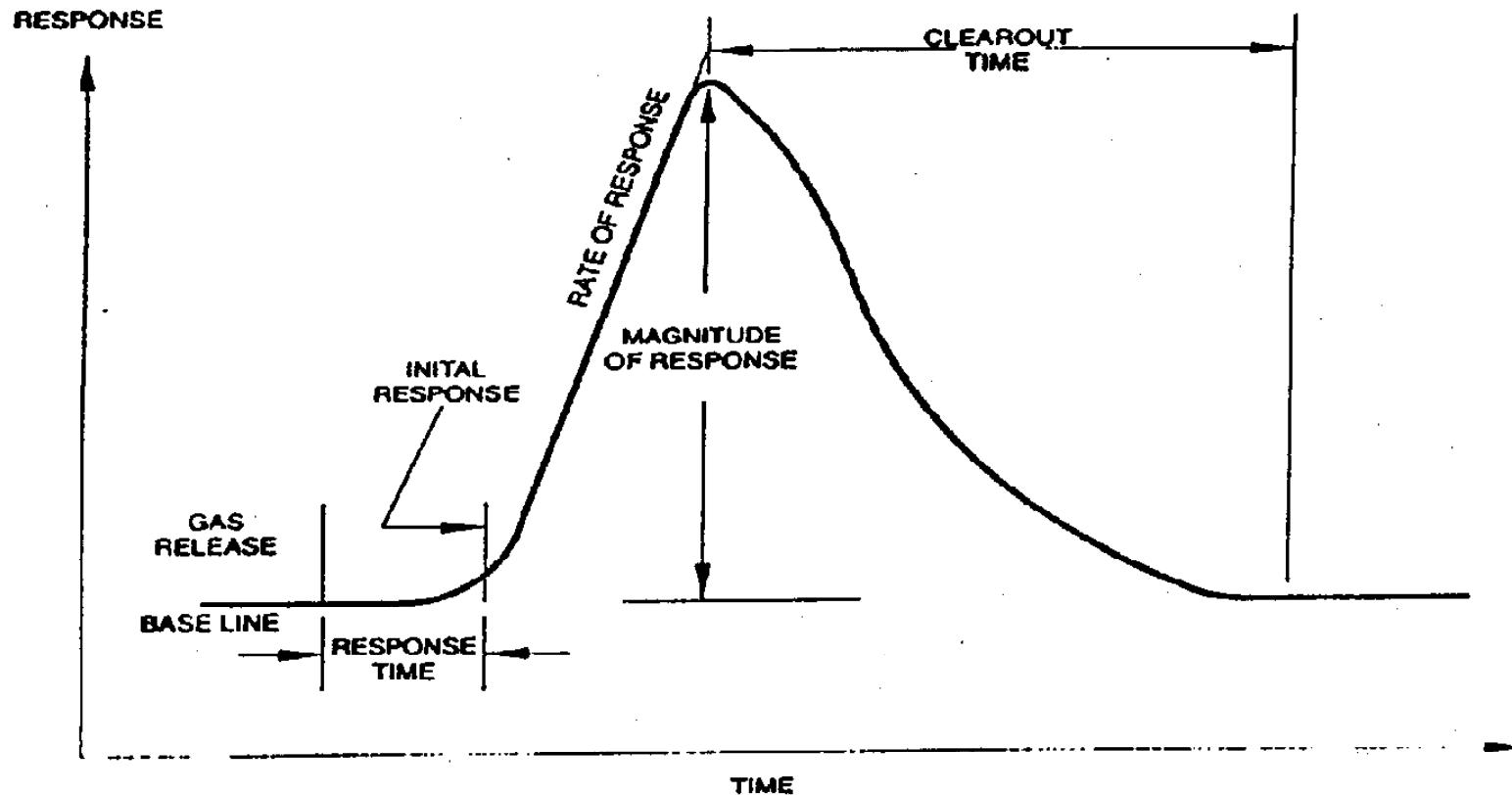
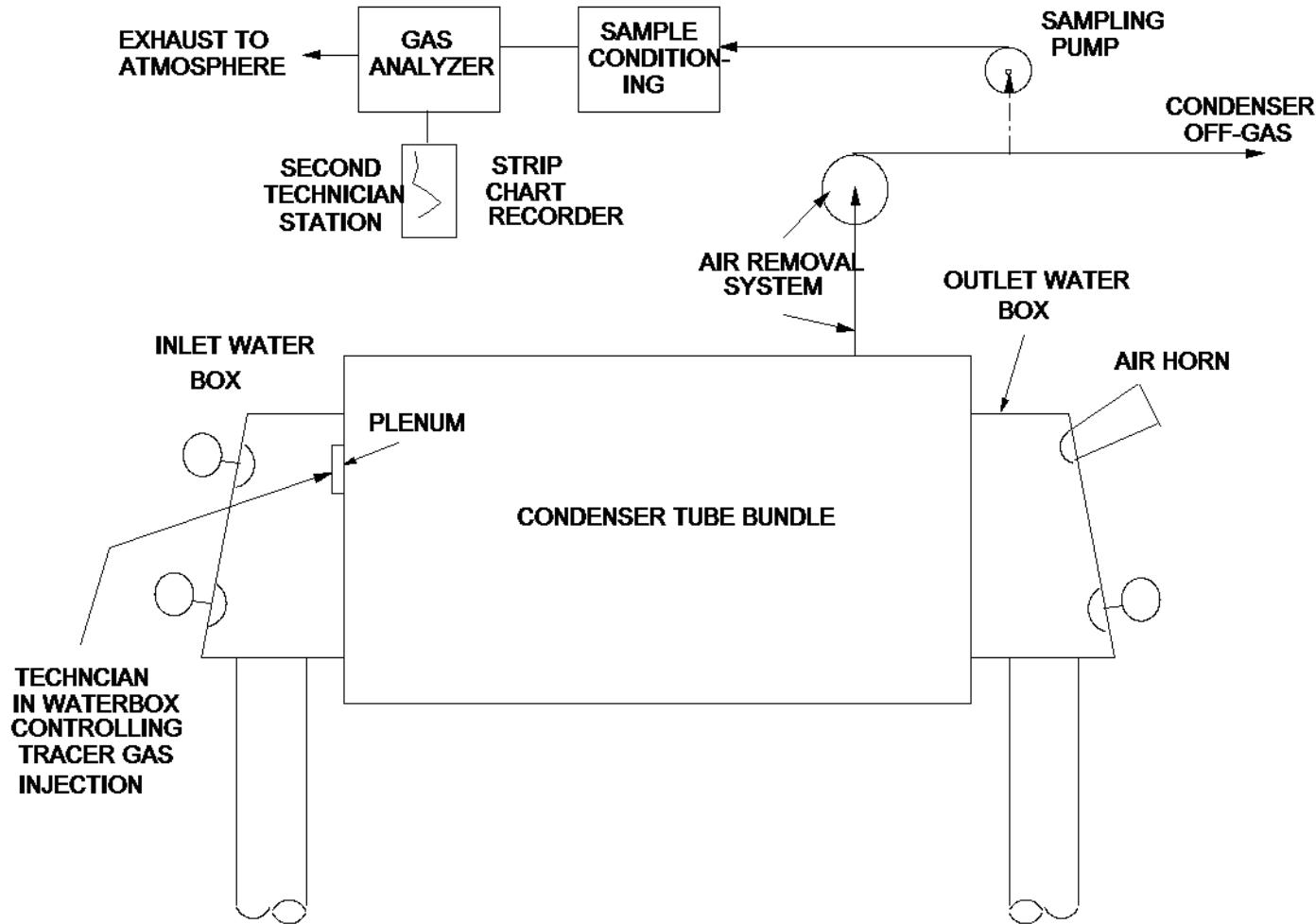


Chart Recording of a Typical Leak Response



Tracer Detected at Off Gas





Off-Gas Sampling Unit





Spray Tracer, Evaluate Results

Technician sprays appropriate tracer gas as suspect location



Second technician evaluates results on the analyzer



Test Shots

- Prior to beginning of inspection
- Three second shot into vacuum space
- Time the shot from the “on” or “off”
- Response time is crucial
- Shot will verify that equipment is working and the off-gas sample is good



ACC Units Present Unique Challenges to Leak Detection

While the basic set up of the equipment is the same for ACC units as for traditional steam surface condensers...

- The shooting of the tracer can get tricky because your suspect leak locations are elevated at heights 50'-75'
- ACC units have a large volume of stairs and individual “streets” to navigate and shoot gas
- Dealing with a contractor that has ACC experience can save you hours to days



ACC Specific Procedures

- As the tracer gas is shot, The fans are shut down and restarted as technicians go from fan room to fan room
- Extensions to the shooting probe, ladders and/or scaffolding are used to reach areas that give a response and are high in the bundle
- The use of a thermal gun can sometimes speed the process of identifying the exact location of the leak.



Freeze Induced Leakage

- Higher levels of leakage on ACC tubing on units that experience freezing has been observed.
- These can be clearly seen on units where the freezing winds generally come from the same direction (NW) most of the winter.
- These units have leaks on the same ‘streets’ and the same bundles from year to year. There can also be freezing up the tube bundle where support braces cross over the tube.



External Hogger Issues?

- Many ACC units have the Hogger and Air Ejectors outside and it may be for this reason we have seen problems with the isolation of the Hogger valve
- Hogger valves may not get properly closed, causing air inleakage to overwhelm the air removal system
- This phenomenon is seen predominantly on ACC units as opposed to steam surface condensers



Vertical Rupture Disc Issues?

- Depending on the design, units with vertical rupture discs tend to leak more often than the traditional discs that lay flat.
- This may have to do with the difficulty of installation because the vertical discs are often very high up at the apex of the tube bundles while the 'flat' discs are often on the exhaust piping.





Dephlegmator Leaks

- Cracking on piping at apex
- Tube failures at many locations



Creative Leak Repairs



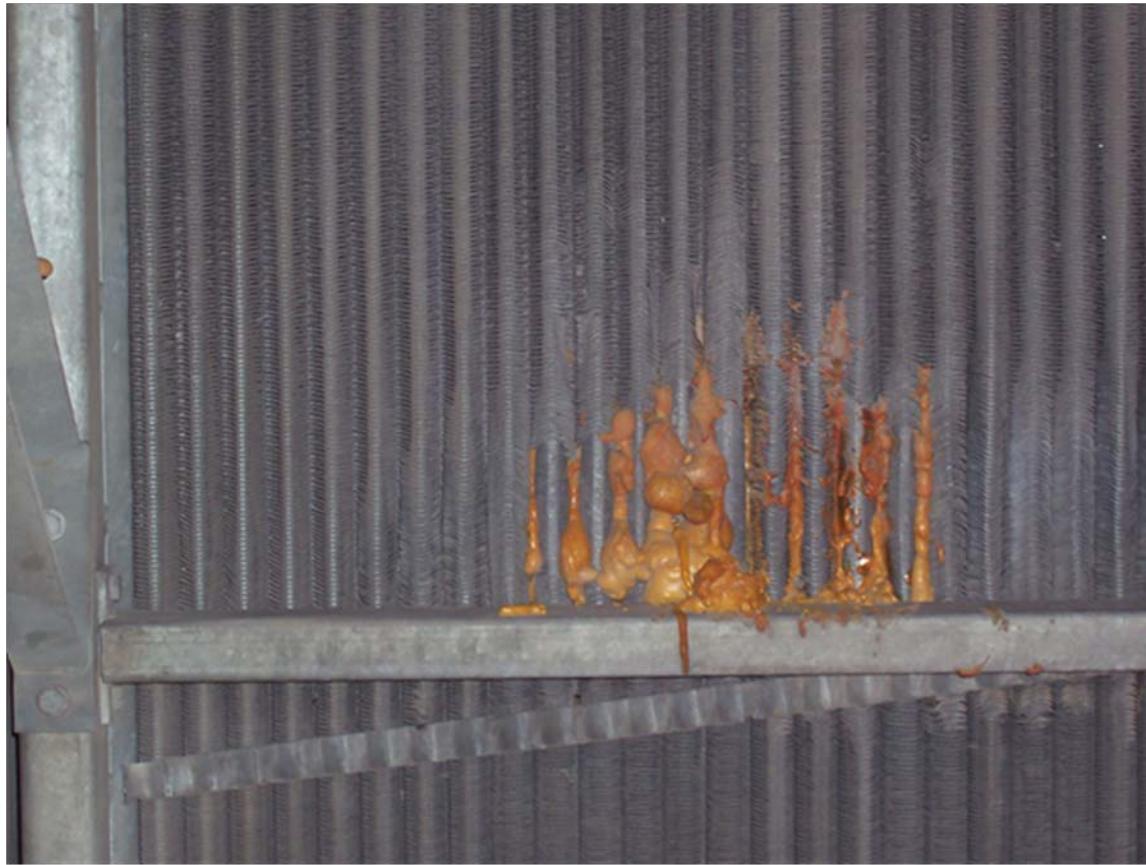


Spray Foam





And More Foam





High Altitude Leaks





Technique

- Tracer Gas Leak Detection
 - More an art than science
 - Requires patience
 - Requires qualified and experienced technicians with ACC specific leak detection
 - Is a process of logical elimination
 - A very cost effective method to maintain efficiency



Questions?