The Practical Application of SF_6 and Helium For Condenser Tube and Air Inleakage Detection

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By Anthony La Porte and Richard E. Putman

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Conco Systems, Inc. is the world leader in off-line mechanical tube cleaning. Conco manufactures a complete line of exclusive tube cleaning tools and systems used to clean condensers and heat exchanger tubes in nuclear and fossil power generation stations worldwide.

The Service Division provides specialized services incorporating state-of-the-art equipment for SF_6 and helium leak detection services, as well as Eddy Current Testing, tube cleaning and plugging.

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THE PRACTICAL APPLICATION OF SF_6 AND HELIUM FOR CONDENSER TUBE AND AIR INLEAKAGE DETECTION

ABSTRACT

Many different methods are available for the detection of condenser tube and condenser air inleakage, some based on the chemical analysis of the condensate and others monitoring the quantity of air entrained in the ejected vapor. However, once detected, it is then necessary to locate the actual source of the problem so that it can be rectified with confidence and the health of the unit restored.

The nature and severity of the leak largely determine the best method to be employed in locating its source. Tracer gases such as Helium and SF_6 have become widely accepted over the past 10 years as the standard operating procedure. In addition, on-line injection of SF_6 into circulating water lines to isolate leaks in tube bundles is state-of-the-art.

The use of the tracer gas technique has eliminated much of the guess work normally experienced when using less sophisticated methods, has resulted in less down time to perform leak detection, and has especially helped to reduce the increase in heat rate which is associated with air inleakage.

This paper presents the practical application and use of tracer gases to perform leak detection, compares this method with earlier and less sophisticated techniques, and outlines the key elements, both theoretical and practical, which an engineer should consider when determining the most appropriate procedure and tracer gas to use in a given application.

BACKGROUND

Intuitive Methods of Leak Detection

Prior to 1978, condenser tube leakage inspections made use of the following techniques; shaving cream, sheets of plastic, cigarette smoke, sight and hearing. These techniques have not proven to be very reliable. Cases of Barbosol shaving cream were often consumed at both fossil and nuclear generating stations. A technician would spread the shaving cream over the tubesheet and wait until it was sucked into the leaking tube, which would then be plugged. However, non-leaking tubes would sometimes become plugged unnecessarily, because the tube(s) only *appeared* to be sucking in the cream. Further, in addition to a non-leaking tube being plugged, the prevailing standard operating procedure was to plug the surrounding tubes as well!

Saran Wrap was also used. The technician would place a piece of plastic over the tubesheet and look for the area under the plastic that was being sucked in. Here again, non-leaking tubes surrounding the "suspect" leaker were also plugged.

Another technique involved the use of cigarette smoke. Technicians would enter the waterbox, partially close the manway, then light up and proceed to hold the cigarette in front of individual tubes to see if the smoke was "inhaled" by the tube.

The "hearing" technique and the "sight" technique were also used. Individuals believed that they could find tube leaks by placing an ear up to the tubesheet in an attempt to locate the leaker, and/or determine by just looking at a tube whether or not it was a leaker. Out of the millions of tubes that have been inspected, very few tubes have been "heard" to be leaking.

Traditional Methods of Leak Detection

TECHNIQUE:
- ***Smoke***
- ***Sight and Sound***
- ***Plastic Wrap***
- ***Shaving Cream***

SHORTCOMINGS:
- ***Unreliable***
- ***Inaccurate***
- ***Not Cost Effective***

All of the above intuitive techniques have their shortcomings so far as reliability, accuracy and cost effectiveness are concerned. None of the techniques offers a means of verifying that the suspected tube is the actual leaker prior to putting the condenser back on line and then checking the chemistry. These techniques are not supported scientifically, and they all rely on the "gut feeling" of the technician.

Development of the Technology

In an effort to increase the accuracy and reliability of condenser tube leakage detection, a method was devised utilizing a Mass Spectrometer and helium as the tracer gas. The project, sponsored by EPRI, assumed that the spraying of helium into tubes while sampling the condenser off-gas would indicate leakage. The thought was that if helium was injected into the tubes while the unit turbine was under power, the gas would be drawn into the condenser through the leaking tube and thus be evacuated with the rest of the non-condensibles through the condenser air ejection system.

Because this was a new application for mass spectrometry, there were problems with the increased background helium, difficulty with isolation of the leaking tube, and sometimes leak indications were appearing where no helium had been sprayed. This led to an initial determination that tracer gas leak detection in condensers might prove to be ineffective. However, perseverance triumphed.

Development of Leak Detection Techniques Using Tracer Gases

HELIUM

- ***First Used in 1978 Project Sponsored by EPRI***
- ***Initially Applied to Condenser Tube Leak Detection***
- ***Later Extended to Air Inleakage Detection***
- ***Sometimes Unreliable for Detecting Small Leaks or the Source of Dissolved Oxygen Leakage***

Successful Application of Helium Technology

The first successful application of helium to detect *tube leakage* also used a nitrogen “kicker” to make sure that the helium traveled the full length of the tube. Helium was sprayed down the tubes for approximately 10 seconds utilizing a plenum measuring 1 foot wide, 2 feet tall and approximately 1 inch deep. Immediately after spraying the helium, an equal application of nitrogen “pushed” the helium down the tube. However, the subsequent installation of air movers in the manways on the opposite side from where the tracer gas shooting was taking place made sure that the entire length of the tube was covered by the helium and the nitrogen was no longer required. By August of 1978 the earliest helium methodology of leak detection was being performed at nuclear generating stations on a routine basis.

During that same year, the question arose as to whether the application of helium mass spectrometry could be used to locate the source of condenser *air inleakage.* Based on the theory that when a waterbox is drained, and a tube is found to be leaking, for all intents and purposes, it is an air leak. Initial problems with this method of air inleakage inspection included the increased helium background, how to pinpoint leakage (is it the packing or the flange?) and the fact that helium, being lighter than air, tends to rise. In spite of initial ambiguities in data interpretation, experience showed that as more inspections were performed by a technician the faster the learning curve was climbed, and the proper and intelligent interpretation of the data displayed on the strip chart recorder became routine.

As the proficiency of technicians grew and the “art” of tracer gas leak detection became standard practice within the utility industry, generating stations were reducing air inleakage as well as promptly locating condenser tube leaks.

By 1981 the question most asked was which waterbox had the leak in it. At most generating stations the draining of the waterbox and checking the chemistry to see if it cleared up was the routine way of determining the leaking waterbox. It was determined that by injecting helium into the circulating water while the unit had turbine power, the gas would be drawn through a leaking tube into the condenser and be evacuated with the rest of the non-condensibles. The first helium “on-line” injection took place at a nuclear generating station and proved to be successful. However, it was found that in situations where there were small leaks, leaks closer to the outlet end or leaking plugs, testing with the on-line injection of helium frequently did not give any indication of a leakage. Using helium to discover the source of dissolved oxygen leakage was also unreliable. It became clear that a tracer gas with higher sensitivity was needed since a negative indication of helium was no longer a certain indication of the absence of a leak in the waterbox.

The Introduction of Sulfur Hexafluoride (SF_6) as a Tracer Gas

It was natural in the evolution of tracer gas leak detection that a more sensitive tracer gas should be found. In 1976, Simmonds and Lovelock[(1)] had found in England that SF_6 could be used very effectively as an airborne tracer in atmospheric research. The utility industry in the U.S. was also exploring the path of plumes from smokestacks and cooling towers and the same tracer gas was used[(2)]. The fundamental property of SF_6 is that it can be detected in very low concentrations; as low as one part per 10 billion (0.1ppb), compared to the lowest detectable concentration of helium of one part per million above background. It was later found that on-line injections utilizing SF_6 also allowed leaks as small as one gallon per day to be detected.

Development of Leak Detection Techniques Using Tracer Gases

SULFUR HEXAFLUORIDE (SF_6)

- ***Initially used in England as a sensitive airborne tracer in atmospheric research***
- ***Colorless, odorless inert gas which does not react with water***
- ***Can be detected at concentrations as low as 1.00 ppb***
- ***Development of On-line Injection Technique for detecting Condenser Tube Leakage: On-line Injection allows leaks as small as one gallon per day to be detected***
- ***Air Inleakage: Using SF_6, air inleakage can often be brought down below industry standards***
- ***Use of SF_6 method to locate source of Dissolved Oxygen***

Sulfur Hexafluoride, discovered in 1900, is a colorless, tasteless and incombustible gas which is practically inert from a chemical and biological standpoint[(3)]. It does not react with water, caustic potash or strong acids and can be heated to 500 Deg.C without decomposing. One of its common uses within the utility industry is for arc suppression in high-voltage circuit breakers and the insulation of electric cables. SF_6 also has many other uses, such as in medical equipment, increasing the wet strength of kraft paper and the protection of molten magnesium in the magnesium industry.

Fluorotracer™ Analyzer

The sensor technology adopted for detecting the presence of SF_6 operates on the principle of electron capture. Figure 1.0 is a general view of the SF_6 analyzer while Figure 2.0 provides a schematic flow diagram showing how the off-gas sample passes through the analyzer. Sample gas is pumped into the electron-capture cell where it passes between two electrodes and is ionized by a radioactive foil. Ionized nitrogen in the sample supports a current across the electrodes, the current level being reduced in proportion to the concentration of SF_6.

Fluorotracer™ Analyzer

Figure 1.0

Flow Schematic for SF_6 Analyzer System

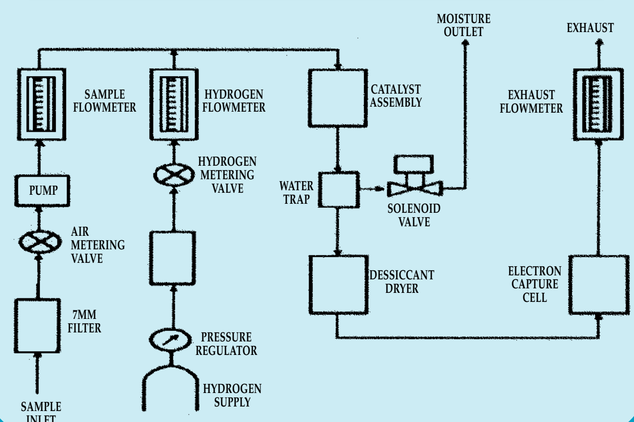

Figure 2.0

To remove any oxygen in the off-gas sample, hydrogen gas is introduced into the sample stream, which enters the catalytic reactor where a chemical reaction occurs between the oxygen and hydrogen. The water produced is removed from a water trap and the sample is finally dried in a desiccant before the sample enters the electron capture cell.

An analyzer for use with SF_6 as a tracer gas is now available for use in both fossil and nuclear generating stations. An SF_6 release mechanism which weighs approximately 8 pounds, has an extended duration of operation, and can be adjusted to release the tracer at a variable rate so as to obtain the desired SF_6 concentration as determined by current plant conditions is also available, see Figure 3.0, the SF_6-PAK.

SF_6-PAK

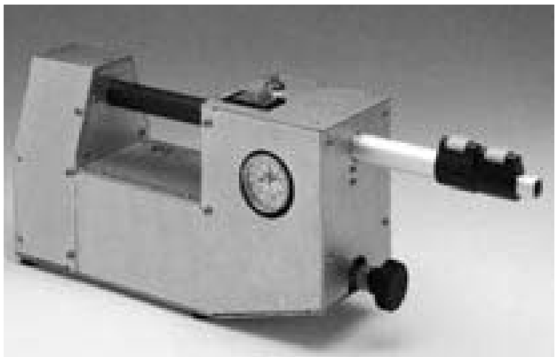

Figure 3.0

SUCCESSFUL APPLICATION OF SF_6 TECHNOLOGY

The first "on-line" injection using SF_6 was conducted at a nuclear generating station and proved to be successful[4]. Over a period of six months, on-line testing continued and it was found that if an indication was seen on the strip chart recorder it was certain that the box was leaking.

Again, the natural progression led to utilizing SF_6 for condenser air inleakage inspections as well. Before the use of helium, it was not uncommon for generating stations to run in excess of 50 CFM of air inleakage. With the introduction of helium as a tracer gas, the air inleakage at most stations was steadily brought down to much lower levels. Now, many stations are running with less than 10 CFM of air inleakage. As the rate of air inleakage falls, it is more difficult to find the leakage when using only helium. Clearly, an improved sensitivity and reliability of the tracer gas was becoming crucial and the use of SF_6 was found to overcome the difficulties encountered with helium.

How a Leak is Identified

The presence of a tube leaking cooling water is often first indicated by an increase in the conductivity of the condensate. The chemistry department should be asked to verify the source of the contamination before plans can be made to locate the problem and rectify it.

Air inleakage can be inferred from an increase in the air concentration in the gases drawn off by the air ejector system. This is often associated with an increase in condenser back pressure. As a rule of thumb, air inleakage levels should be held to 1 CFM per 100 MW of generation capacity.

Finally an increase in the dissolved oxygen concentration in the condensate signifies air leaking into the suction of the condensate pumps, or a leak below the condenser hot well.

RULES FOR THE SELECTION OF HELIUM OR SF_6 AS THE PREFERRED TRACER GAS

Criteria For Selection of Test Method

AIR INLEAKAGE

- ***Total Amount of Air Inleakage***
- ***Characteristics of Specific Leakage***
- ***Test Constraints***
- ***Leak Quantification***
- ***Dissolved Oxygen Considerations***

CONDENSER TUBE LEAKAGE

- ***On-Line Injections***
- ***Tubesheet Inspection***
- ***Leak Characteristics***

SF_6 can be used whenever and wherever helium can be used, although the same is not true of helium. A number of factors go into the decision as to which tracer gas to select for a given situation.

Tracer Gas Comparison - Helium vs. SF_6

Test Situation	Condition	Preference (✔)	
		Helium	SF_6
Tube Leaks - On line Gas Injection Test	*Leakage <100 gallons per day*	*??*	✔
Tube Leaks - Testing from inside water box	*Leak >50 gal./day* *Leak <50 gal./day*	✔ *NA*	✔ ✔
Air Inleakage	*Leakage >10 CFM* *Leakage <10 CFM*	✔ *NA*	✔ ✔
Dissolved Oxygen	*Search for Dissolved Oxygen Source*	*NA*	✔
Power Considerations	*MW >20% full load* *MW<20% full load*	✔ ✔	✔ *NA*
	Unit <50 MW capacity	✔	*NA*

On-line Circulating Water Tracer Gas Injection

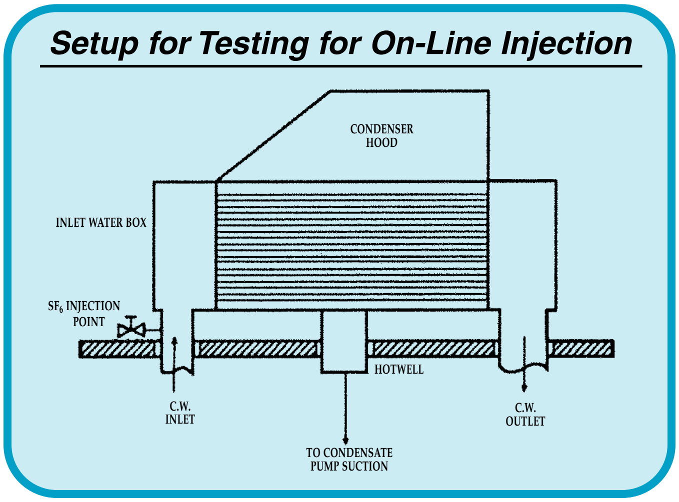

Figure 4.0

Standard procedure for on-line injection, Figure 4.0, is to use SF_6 as the tracer gas to determine which water box is leaking. Helium has only a 50/50 chance of succeeding if the leakage is less than 100 gallons per day. The alternative approach is to reduce power, drain the waterbox and look for a change in chemistry.

Systematic Hands-On Tube Sheet Inspection

The following factors should be taken into consideration:

- *Size of leak* - If the chemistry shows a leak in excess of 50 gallons per day you can utilize either SF_6 or helium. If leakage is less than 50 gallons per day, the use of SF_6 is the standard procedure.
- *Unit Turbine Power* - If the unit is running at greater than 20 percent turbine power then either tracer gas may be used. If the unit has no turbine power and the leak is so bad that the unit can not be brought up to any turbine power level, standard procedure would dictate the use of helium.

Condenser Air Inleakage

The following factors should be taken into consideration:

- *Unit Air Inleakage* - If the unit has greater than 10 CFM of air inleakage either tracer gas may be used. If the inleakage is less than 10 CFM then the use of SF_6 should be the standard procedure.
- *Dissolved Oxygen* - The search for the cause of DO leakage below the hotwell level requires the use of SF_6 as the standard procedure.
- *Unit Turbine Power* - If the unit has 20 percent or greater turbine power either tracer gas may be utilized. If the unit has no turbine power and cannot be brought up to any level of turbine power then helium should be selected.
- *Unit Size* - Inspections of units of less than 50 MW capacity should always use helium.

GOOD PRACTICE FOR CONDENSER LEAK DETECTION PROCEDURES

Injecting tracer gas as the waterbox is being drained to determine the approximate location of the leak in the box is *not recommended.* However, once the unit is downpowered and the waterbox is drained, it is incumbent upon the technicians to systematically check the entire tubesheet from top to bottom. First, one large leak could be masking a smaller leak in a different location within the box. Secondly, the actual location of the leak, (i.e. closer to outlet end, a leaking plug, a waterbox seam) may be in a different area than observed when back filling with the tracer. Technicians should be discouraged from prejudging situations since this can give rise to false data and result in delays in locating the leak.

The Use of a Strip Chart Recorder Vs. The Detector's Readouts

The interpretation of the data provided on the strip chart recorder, Figure 5.0, is the "art" of leak detection for both condenser air inleakage and condenser tube leakage. The information available from the recorder chart tells you when you are getting close to a leak, when you passed the leak, when you hit the leak, whether the gas is traveling to another leak, whether the leak is closer to the outlet end; and also gives you a hard copy for future use. For leak isolation purposes you can determine whether a valve is leaking at the packing as opposed to the flange. During a typical air inleakage inspection it is not uncommon to spray tracer gas on literally hundreds of suspected leakage paths within the condenser vacuum boundary.

Chart Recording of a Typical Leak Response

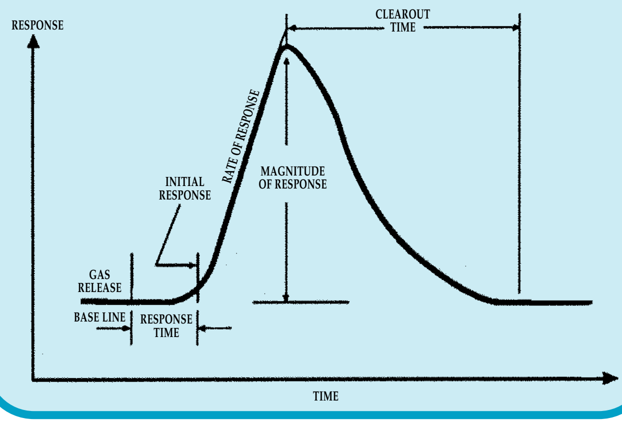

Figure 5.0

Take a Test Shot into the Condenser Before Beginning an Air Inleakage Inspection and/or a Condenser Tube Inspection

Test Preparation

- ***Check calibration of instrument and/or adjustment of standing current***
- ***Check Sample Flow through instrument***
- ***Check the sample point and exhaust system***
- ***Carry out a test shot***
- ***Establish Typical Sample Response Time using Strip Chart Recorder***

The most important reason to take a test shot *prior* to any inspection is to verify that all of the equipment is working properly and that a sample is being received from the off-gas. The worst thing that can happen to a technician performing a tracer gas inspection is to finish the inspection without finding any leakage and then discovering that he was not sensing any tracer gas. The second reason for performing a test shot is to determine the response time. Though important for both air inleakage and tube leakage inspections, it is almost impossible to find and isolate a tube leak efficiently without knowing the response time, technicians may otherwise tend to chase every indication of leakage that they see. Thus, in addition to the use of the detector, the two most important ingredients to a successful leak detection program are knowing the response time and making effective use of a strip chart recorder.

Avoid Indiscriminate Spraying of the Tracer Gas on the Tubesheet

The effective location of leaks requires a very discrete application of the tracer gas and it is important to keep track of every shot of tracer gas during the whole condenser tube leakage inspection process, otherwise the isolation of that one leaking tube can become almost impossible.

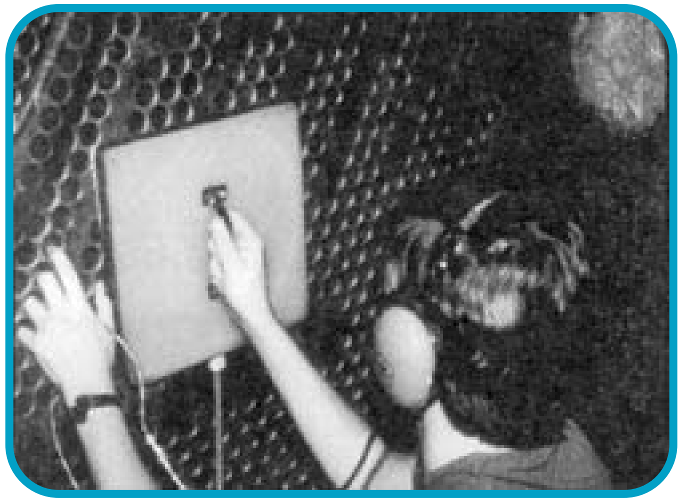

Figure 6.0

Experience here has shown that the use of a plenum placed directly on the tubesheet is mandatory. Typically a 1' x 2' x 1" plenum, Figure 6.0, is used first. If leakage is indicated, go to a 1' x 1' x 1" plenum and then to 4" x 4" x 1" plenum and subsequently to a "single tube shooter." The use of the plenum method eliminates the possibility of missing a tube or that the tracer gas does not travel across the whole surface of the tubesheet. Finally, a wand type mechanism should be utilized to spray the waterbox seams after the tubesheet inspection has been accomplished.

Note that 99.9 percent of waterbox inspections begin on the inlet side waterbox, spraying the tracer gas toward the outlet end.

Indications of Tube Leakage are Present with Every Shot of Tracer Through the Plenum

When inspecting a waterbox for tube leakage, it is important to have the strip chart recorder operating and to know the sample response time. Typically begin the inspection of a waterbox in the upper left corner of the tubesheet working toward the right hand side of the box and then dropping down a row working right to left. This alternating direction of left to right and right to left continues for the entire inspection. Normally each shot of tracer gas lasts for ten seconds. After waiting for a further two seconds, move the plenum for the next shot. Unless the technician monitoring the detector sees an indication of leakage, the man in the waterbox will continue to shoot without stopping.

There are instances where a leak is indicated with the very first shot as well as all subsequent shots. The first thing to do is to check the response time. Is it too long or right on time? If the response time is too long, you may be encountering one of the following problems: the leak is closer to the outlet end and is getting sucked back in with each subsequent shot.

Another possibility is that the gas being evacuated from the outlet waterbox is being directed by the blowers to an air leak. To eliminate this possibility, simply spray the tracer gas into the suction side of the blower and monitor the strip chart recorder for an indication. If an indication appears, redirect the blower or add elephant trunking to direct the exhaust outside.

To determine if the leak is closer to the outlet end, simply take your first ten second shot, wait before shooting again and monitor the strip chart recorder. If the recorded response time plus 15 seconds expires with no indication, repeat the same step until you duplicate the leakage indication. If the response time is right on target, obviously you have found an area of leakage and must utilize the descending size plenums to isolate the leaking tube.

Start the Inspection on the Turbine Deck When Doing an Air Inleakage Inspection

In order to isolate a leak it is important for the technician to know where he has been and what he has seen. It is recommended that all air inleakage inspections begin on the turbine deck, usually starting with the rupture disks. It is important to keep track of everything that is sprayed with the tracer gas. If a large leak is found on the manway on the west side of the turbine, Figure 7.0, an indication of this must be made on the strip chart recorder, because when on the west side of the condenser spraying a penetration into the condenser on the mezzanine level there could very well be an indication of leakage that does not, in fact, exist.

Figure 7.0

Technicians waste a lot of inspection time searching for a leak that they have already found on the turbine deck. This is another reason why the typical response time must be known.

Use an Air Blower on the Opposite End of the Waterbox Being Inspected

Setup for Testing for Condenser Tube Leaks

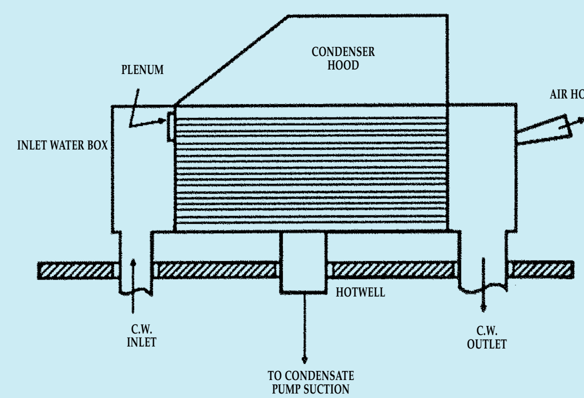

Figure 8.0

Though it is often believed that the installation of fans or blower, Figure 8.0, on the opposite side of the condenser is for personnel comfort, the main purpose is to assist in passing the tracer gas down the tubes; as well as to evacuate tracer gas from the opposite end of the waterbox so that the tracer background concentration does not rise to a point where discrete detection becomes virtually impossible.

SF_6 is Sensitive to Work With

As with any work done in either a fossil or nuclear generating station, you must follow procedures. When working with pure SF_6 for on-line circulating water injection, you must make sure that all fittings are tight and that connections to the regulator and to the circulating water line are not leaking. Most importantly, when connecting the hose to the injection point you must utilize quick disconnects to ensure as little leakage as possible. The two most common causes of an increase in background can be directly attributed to carelessness when disconnecting the hose from the regulator and/or pressurizing the injection hose prior to connection to the circulating water line injection point. Both are contrary to written procedure.

Quantifying Air Inleakage

Generating stations already know what their total air inleakage is. To quantify each and every leak in our opinion is not cost effective. Due to the variables of a condenser under vacuum, the quantifying of leaks would not add any information to what the plant personnel already know.

Both SF_6 and helium detectors give readouts, one in millivolts the other in divisions. Plant personnel can determine a plan of action to repair the leaks by comparing the millivolt readout or the division readout. These, of course, are relative values and are not calibrated in engineering units such as CFM.

What should be of most concern is the exact location of the leak and the subsequent repair and retest of it. Of course, a leak detection program must have a follow-up repair program.

Performing Tube Leakage or Air Inleakage Inspections When Turbine is Not Under Power

The primary reason for not performing an inspection when the turbine is not under power is the very likely possibility of the background concentration of the tracer gas becoming so high that it eliminates any chance of isolating a leak. Both air inleakage and condenser tube leakage inspections require vapor flow to carry the tracer gas out of the condenser with the rest of the non-condensibles. If sprayed tracer gas is sucked into the condenser, it will begin to accumulate and the background concentration will rise and even saturate the detectors. We are aware that there are occasions when the station has no other choice but to attempt a tracer gas inspection with the unit shut down in their effort to bring the unit up, and have been successful in doing so. However, we recommend a minimum 20 percent turbine power to perform a tracer gas inspection.

USING TRACER GASES FOR THE INSPECTION OF OTHER SYSTEMS

In addition to condenser tube leakage and condenser air inleakage inspections, tracer gas leak detection is routinely performed on main generator hydrogen cooling systems, and stator water systems. Applications in other industries have included the testing of mine ventilation systems and the search for leaks from buried natural gas pipelines. Basically, if a system is under vacuum or can be pressurized, the use of a tracer gas is the most accurate, reliable and time effective method.

Other Applications

- ***Main Generator Hydrogen Cooling Systems***
- ***Generator Stator Water Systems***
- ***Smoke or Cooling Tower Plume Research***
- ***Testing of Mine Ventilation Systems***
- ***Search for Leaks in Buried Natural Gas Pipelines***

REFERENCES

- A. LaPorte and R.E. Putman, *The Practical Application of SF_6 and Helium for Condenser Tube and Air Inleakage Detection,* EPRI, Condenser Technology Conference, August 1996.

1. P.G. Simmonds, A.J. Lovelock and J.E. Lovelock. *Continuous and Ultrasensitive Apparatus for the Measurement of Air-borne Tracer Substances,* Journal of Chromatography, 126, 1976, pp.3-9.
2. John Tsou, private communication, 2-13-96.
3. International Physical Tables, Vol. A 11, p. 338.
4. Strauss, Sheldon, D. *Advanced Tracer Technique Enhances Leak Detection,* POWER, October 1992, pp. 112, 114, 116.

Other recommended reference material:

- EPRI Report CS-6014, Project 1689-20, September 1988. *Condenser Leak Detection Guidelines Using Sulfur Hexafluoride as a Tracer Gas.*
- EPRI Technical Brief — TB.GSZ.89.11.89. *Condenser Leak Detection by Using SF_6 as a Tracer Gas*

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