THE MEARIE GROUP

The Reciprocal

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A MEARIE Publication For Insurance Members

Reduce Your Exposure to Property & Liability Claims

Transformers are a critical component in your electrical power supply system. Loss of a transformer can interrupt electrical service to your facility, causing serious loss of production. More severely, catastrophic failure of the transformer could result if gassing from an internal arcing condition leads to a rupture of the tank, and subsequent fire and/or explosion.

Large power transformers, particularly those used in specialty applications, are not off-the-shelf replaceable items. It may take many weeks, if not months, to replace the unit. It is not likely you can afford that amount of downtime at your facility. Testing and sparing of critical oil-filled transformers should be handled as part of a carefully thought-out contingency plan.

The MEARIE Group's provider of property insurance, FM Global, reveals that from 1991-2000, nearly 1,000 transformers failed at customer facilities, incurring recorded gross losses of US$492 million. More than three-quarters of these losses began with electrical arcing failures that could have been detected with dissolved-gas-in-oil analysis, a time-proven method to assess and trend the condition of your critical oil-filled transformers.

This loss amount consists primarily of accumulated property loss claims, yet what is important for LDCs to realize is in addition to property loss claims, there exists the potential for liability claims. During the discovery phase of any type of suit, counsel for the plaintiff will require proof the owner of the transformer made every scheduled service visit to inspect and test the device. And since transformers have a finite lifespan and will ultimately fail at some point in the future, it's up to the LDC to prove they followed a maintenance schedule and can show proof of this.

Science of the Hazard

Incipient faults, overheating, and internal arcing within a transformer produce various gases. Dissolved gases can be analyzed in your transformer oil by collecting a sample and sending it to a qualified laboratory facility. The results will be presented to you in a report identifying constituent gases and an evaluation of the condition of the transformer.

Increases in the amount of specific dissolved gases in transformer oil are telltale signs of internal defects. When the gassing increases, the probability of failure also rises. For example, an increase in acetylene gas is a good indication of a worsening internal arcing condition. Once this acetylene gas level rises above a specific threshold, the likelihood of catastrophic failure is imminent and the transformer should be removed from service immediately. Unfortunately, there may be no other indication of a problem with the transformer.

This is not an exact science, and the specific behavior of any given transformer cannot be precisely predicted on the basis of dissolved-gas-in-oil analysis or even other tests. With a questionable transformer, general practice is to monitor the gassing condition more closely by decreasing the interval between samples as the gas rates and amounts increase until the transformer can be removed from service and be replaced and/or repaired.

The key gases measured in dissolved-gas-in-oil analysis are listed in the following table. In addition, the symptom indicated by the particular gas is identified. Ratios of these key gases also can be used as part of the evaluation.

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Loss Experience

The table below presents FM Global loss data showing losses caused by electrical breakdown of transformers. Some of these symptoms that initiated the failure had been detected through dissolved-gas-in-oil analysis. Therefore, the loss and repair cost was greatly reduced or possibly eliminated. Losses also include fires caused by electrical ignition within the transformer, generally initiated by internal arcing.

Key Gas	Indicated Symptom
Acetylene	Internal Arcing
Carbon Monoxide	Cellulose Overheating
Ethane	General Oil Overheating
Ethylene	Severe Localized Oil Overheating
Hydrogen	Corona or Partial Discharge Activity
Methane	Overheating or Corona Activity

Benefits: Dissolved-Gas-In-Oil Analysis

- Trained and qualified personnel can obtain oil samples while the transformer is in service.
- The frequency of sampling is not restricted by operation.
- Trend analysis of a gassing transformer improves ability to monitor its condition.
- Specific information and symptoms can be analyzed through identification of key gases and their ratios.
- Close monitoring of the in-service transformer's condition allows for development of a plan for timely repair or replacement of a gassing transformer.
- Dissolved-gas-in-oil analysis complements maintenance and other testing performed during scheduled shutdowns.

Contributing Component Failures

The transformer components listed below can fail and cause the loss of the transformer. Many defective component conditions can be detected through dissolved-gas-in-oil analysis. Components that can fail:

- Bushings
- Coil blocking
- Core and clamping assembly
- De-energized tap changer assembly
- Insulating liquid
- Lead and lead-support structure
- Load tap changer assembly
- Tank, gasket, cooling equipment and accessories
- Winding

But What About...

...if the test detects a gassing transformer? What would you do?

A gassing transformer can be a very serious matter. Depending on the amount and type of constituent gases, a transformer failure may be imminent. The right decision may be to remove the transformer from service. A decision is based on the type and quantity of key gases and the rate of generation of these gases. The operating history and design of the particular transformer also is important. Unfortunately, this is not an exact science. If acetylene gas is being significantly generated, however, this is a serious matter that requires immediate attention.

Taking a sample from an energized transformer. How do you do this safely?

A trained and qualified individual should take the sample from a properly installed sampling valve. When retrieved correctly, this is a very safe process and no harm is caused to the transformer.

…if we take this sample once, just to determine there are no problems with this transformer? Is this acceptable?

One of the benefits of dissolved-gas-in-oil analysis is trend data. This is especially helpful with a transformer that is gassing and should be closely monitored.

Although a single sample provides you with the makeup of the key gases at that point in time, we recommend periodic analysis based on widely accepted industry practices. An FM Global engineer can provide you with specific details regarding frequency of analysis based on the application of your critical oil-filled transformers.

HAZARD OR RISK?

Arcing and thermal decomposition of oil are significant causes of transformer loss. These conditions can lead to a transformer oil fire and catastrophic damage.

What YOU Can Do in Your Facility Now:

- Identify critical oil-filled transformers.
- Check their condition and see if they are operating within nameplate specifications and are clean, cool and dry. Make adjustments as appropriate.
- Establish a dissolved-gas-in-oil analysis plan for your critical oil-filled transformers.
- Determine the age of your critical oil-filled transformers.

Soon:

- Perform dissolved-gas-in-oil analysis on the critical oil-filled transformers in your facility.
- Implement a contingency plan to acquire a replacement transformer or to install a spare. An alternative is to ensure access to a qualified service shop with proper repair materials.
- Implement a planned replacement and/or rewind program for your critical oil-filled transformers that are determined to be near "end of life."

Recommended Analysis Schedule:

- Power and Distribution Type Transformer: Annually
- Industrial Rectifier Duty Transformer: Every 3-6 months
- Arc Furnace Duty Transformer: Every three months

FM Global:

FM Global is one of the world's largest commercial and industrial property insurance and risk management organizations specializing in property protection.

More than one out of every three Fortune 1000 companies, as well as leading international corporations, benefit from FM Global's superior financial strength, policy coverage, risk management skills and extensive expertise in loss prevention engineering and research.

Clients rely on FM Global:

1. To better understand the nature and causes of their risks
2. For sound loss prevention solutions that safeguard their properties against the threat of loss
3. For consistent cost-effective insurance and risk financing solutions worldwide
4. To minimize business disruption and its financial impact if a loss occurs.

The **MEARIE Group** is pleased to have formed a long-term strategic alliance with FM Global. Together, we provide the resources, expertise and best practices to deliver exceptional results.

Who is Driving Your Company Vehicles?

Do you know which of your drivers is a potential accident waiting to happen? Do all of your drivers have a current valid license? Have any of your drivers been convicted for Driving Under the Influence and had their license suspended? Every day your workers are on the roads using your company vehicles as part of their job, but should they be? Unless your drivers have been charged while driving your company vehicles on the job, most likely you have no idea about their driving records, yet you still let them drive your company vehicles.

As part of your Company Fleet Safety Program you should consider performing driving record checks (MVR), at the time of hiring for all individuals whose job may involve driving a company vehicle. There should be clearly defined standards for hiring based on the results of the MVR search. These standards should establish the minimum acceptable driving record your company will accept.

MVRs should be obtained on an annual basis for all individuals who may be driving company vehicles, with your aim to achieve at least 70% of all drivers with a "Clear" record. Clear is defined as having no moving violations in the past three years, no major violations in the past five years and no multiple major violations. If an individual is found to have an unsatisfactory record corrective action needs to take place. Based on the predetermined Company Standards as outlined in you Company Fleet Safety Program, corrective action for the individual may range from receiving a written warning to the individual being restricted from driving your company vehicle. Each individual must be judged based your outlined Company standards.

A good Fleet Safety Program that outlines acceptable standards, corrective action and MVR checking protocols, can help reduce employee injuries, vehicle down time, accident claims and continue to protect your Company's reputation and assets. If you would like help in either establishing or reviewing your Company Fleet Safety Program please contact Gary Durie, Risk Analyst at (905) 265-5355 or by email gdurie@mearie.ca.

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