

AES Indiana uses mobile DGA solution to gain insight into aging transformers

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AES Indiana used Vaisala's Optimus™ Mobile multi-gas DGA Monitor, the OPT100 Mobile and Delta-X Research's Transformer Oil Analyst™ software with Monitor Watch™ to detect and identify faults on a suspect transformer. This was done without taking the transformer offline by using a mobile DGA online monitor and feeding its information to a cloud-based analytic software tool.

For nearly one hundred years, AES Indiana has been creating value for its customers by moving promptly, anticipating opportunities, avoiding risk and changing direction when needed to best serve its clients. The Vaisala multi-gas Dissolved Gas Analyzer (DGA) OPT100 Mobile, integrated with Delta-X Research's Transformer Oil Analyst (TOA) software with Monitor Watch, ensure AES Indiana's tradition is met.

To maintain service delivery commitments, AES Indiana has implemented Vaisala's revolutionary mobile online Dissolved Gas Analyzer (DGA) monitoring solution to stay ahead of unforeseen outages and failures. All maintenance and asset managers know that faulty transformers can cause unplanned outages leading to

catastrophic events with impact to the community, the bottom line, and of course, you and your maintenance teams. Upon learning of the Vaisala OPT100 Mobile solution, AES Indiana wanted to run a pilot, as they immediately saw how this technology could be used for responding to DGA gassing alarms/reports.

Traditionally, standard oil sampling procedures are carried out only once or twice a year. If a transformer is not "healthy" and shows signs of dysfunction based on DGA measurements, software tools, or lab consultants, the frequency of testing is then increased to almost every two weeks. What is really needed in these cases is an online DGA monitor that provides real time data that can be compared to operating conditions.

Here an online DGA monitor with capability to provide real time data for comparison to operating conditions is a traditional fix. However, not every transformer is worth the cost. A mobile online solution to gather true DGA analysis and fault determination was the fix. Vaisala developed a DGA monitor technology platform to be mounted on a trailer and deployed temporarily - no onerous maintenance or manual calibration between deployments.

Understanding this challenge, Vaisala developed its OPT100 Mobile DGA platform and leak detection solution to provide the first truly mobile online solution on the market - significantly improving the ability of substation managers to manage their assets and drastically reduce unintended labor costs and unplanned outages.

Scenario and challenge

Currently, AES Indiana owns 350 transformers, 3 fixed DGA monitors, and 15 single gas monitors. As expected, monitoring transformer performance and gas condition across the entire portfolio can be rather time consuming and extremely costly. AES Indiana has been using traditional DGA sampling from existing laboratories, but those can take days before AES Indiana has access to any data at all.

After lab sampling and further analysis from Delta-X Research's TOA software, AES Indiana identified a 50-year-old transformer showing signs of active gassing and potentially degrading health. Continuous monitoring with the OPT100 Mobile became the primary analytical tool to assess the current condition of this particular transformer.

In order to investigate the scenario described further, Vaisala provided AES Indiana with an [OPT100 Mobile](#) multi-gas DGA monitor. It measures 7 key fault gases, moisture in transformer oil and utilizes total gas pressure for air leak detection. The unit has zero-maintenance and **no** consumables, partly due to its non-dispersive infrared (NDIR) technology and patented gas extraction system. It also has

internal mechanisms to self-calibrate the NDIR measurement system as well as systems for calibrating based on the local oil condition.

AES Indiana also leveraged Transformer Oil Analyst (TOA) diagnostic software from Delta-X Research (www.deltaxresearch.com) to interpret both the lab and the monitor data. As well as supporting standards-based interpretation methods, TOA provides Reliability-based DGA interpretation that compares a transformer's performance against that of a statistically large population of transformers, including failures, to more correctly identify at-risk transformers and quantify the risk of continuing operation. With Reliability-based DGA, the Monitor Watch option of TOA correctly assesses transformer health while avoiding the spurious alarms that are common with limits-based solutions typically applied to monitor data. With TOA providing correct and consistent interpretation of both lab and monitor data, AES Indiana relies on TOA as a key decision support tool for maintaining, refurbishing and replacing critical assets while optimizing capital budgets.

AES Indiana then uses the results from TOA to prioritize problematic transformers for further

investigation. Once identified, these transformers are connected to Vaisala's OPT100 Mobile and the continuously monitored online data merges with the historical lab data kept in TOA. In this case, the results provided AES Indiana with the missing pieces of data to truly understand this problematic transformer's condition and develop a proactive maintenance plan.

The obstacle

AES Indiana wanted to closely monitor the gassing transformer to make informed decisions regarding its maintenance or replacement. Moreover, AES Indiana wanted to avoid unpredicted outages, but needed to do so without having to commit to a hefty investment for a DGA monitor system for the problematic transformer before knowing its true health. Therefore, AES Indiana needed factual and reliable data to properly understand this transformer's status, including the potential need to adjust power loads across other assets in their fleet.

The solution(s)

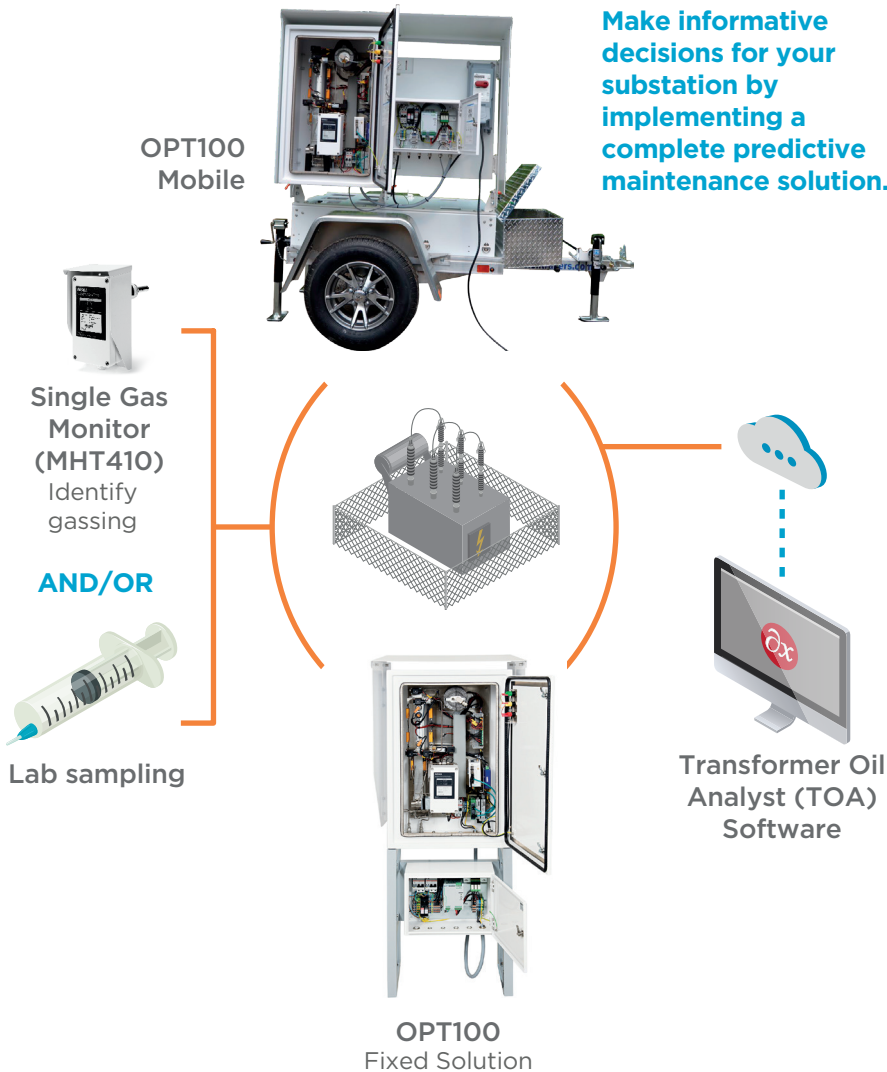
In this case, AES Indiana used a single gas monitor (e.g. MHT410) for alarming and lab sampling to qualify the transformer with the help of the TOA software. AES Indiana then connected Vaisala's Optimus™ OPT100 Mobile to the 1967 transformer (GE step-up transformer, 69-280 kVA) and started the online measuring process. Once connected to the transformer, the OPT100 Mobile began communicating with the Delta-X Research Transformer Oil Analyst (TOA) software with Monitor Watch by interfacing with a Digi modem integrated into the OPT100 Mobile platform. By combining the real-time online measurements of the key fault gases data from the OPT100 Mobile with the interpretation and analysis of the DGA data by the TOA software, AES Indiana was able to validate the health and confirm there was no active internal arcing or overheating and take the correct preventative measures on the transformer.

Once the maintenance plan was completed and verified, the OPT100 Mobile and TOA software were implemented on another transformer. The mobility of the OPT100 Mobile was crucial to the value of this project, allowing AES Indiana to immediately deploy this online monitor to another problematic transformer needing analysis, allowing for maximum return on investment in the equipment. This was only possible because of the OPT100 Mobile design and functionality.

The power of Vaisala and Delta-X Research: Value and Benefits

In this case AES Indiana used the Vaisala OPT100 Mobile to gather data combined with the analytical power of Delta-X Research TOA software. This was especially beneficial as the TOA software could gain additional insight into the transformer by comparing the historical DGA data from previous sampling efforts on this transformer to real-time data provided by the Vaisala OPT100 monitor.

Make informative decisions for your substation by implementing a complete predictive maintenance solution.



The Vaisala OPT100 Mobile:

- Provides mobile online data for real time analysis of DGA events, lowering maintenance costs and enabling better transformer replacement planning.
- Provides reliable key fault gas measurements and leak detection and requires no consumables or regular maintenance.
- Offers a road-legal DGA platform that can be driven out and deployed in under 2 hours.
- Uses a browser-based user interface for easy data access and monitor configuration.
- Can amortize cost of the DGA monitor over multiple assets.

Delta-X Research's TOA software with Monitor Watch:

- Stores and manages lab and online monitor test data – so can easily view and compare recent and historical data for a given transformer, regardless of source.
- Interprets insulating fluid test data including dissolved gas analysis (DGA), oil quality, moisture in oil, furans, particle counts and particle statistics, and metals, trace elements and PCBs in oil.
- Applies state-of-the-art analytics, including advanced interpretation with Reliability-based DGA, using innovative statistical analysis of a large set of transformer reliability data, including failure events.
- Provides analysis criteria based on industry standards from IEEE, IEC, and CIGRE. Users can also create or modify analysis norms and criteria.
- Evaluates the noise level in monitor data output to detect early signs of problems.

“The deciding factor for the OPT100 Mobile over the rest is rather than having to worry about helium tanks and hot plates, the OPT100 Mobile has zero maintenance and no consumables... A mobile comes in handy especially when we have to prioritize one transformer over the other: we have the ability to quickly respond to red flags.”

AES Indiana Reliability Engineer

In closing

Whether your company is using lab-based monitoring or a single gas monitor like the Vaisala MHT410, the OPT100 Mobile allows you to quickly triage any transformer in your fleet. With a deployment time of 2 hours and built-in cellular communications, your team can have accurate readings **almost** immediately.

Once the OPT100 Mobile monitoring system is in place and providing data to the TOA software via Monitor Watch, end users can:

- Track and trend the monitor data quickly and easily.
- Compare and integrate online DGA monitor data with traditional lab sample data to provide a cohesive history of transformer DGA tests, giving a complete “diagnosis” of the transformer at hand.
- Identify anomalies and overlooked gassing events from traditional sampling practices.

Once an initial assessment of the health of the transformer is complete, the OPT100 Mobile can either remain for ongoing monitoring or it can be moved to another gassing transformer identified through lab sample interpretation.



OPT100 Mobile Solution used with TOA Software

About Delta-X Research

Since 1992, Delta-X Research has invested in the research and development of advanced analytics for assessing the health of high-voltage equipment. Generation, transmission and distribution utilities around the world, as well as leading industrial operations, rely on Delta-X Research to provide key decision support tools for managing their critical assets.

With over half of the largest utilities in the USA as TOA subscribers, you join a large community whose combined experience over two decades has been applied to create the most effective and recognized diagnostic tool for assessing and tracking the condition of high-voltage electrical apparatus. With TOA, you are in good company.



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About Vaisala

For over 80 years, Vaisala has been a global leader in high performance measurement instrumentation designed for the most demanding environmental and industrial applications in the world. Innovation and quality are the cornerstones of Vaisala’s success. In order to maintain this high level of quality, every sensor is designed and manufactured in our own cleanrooms at our factory and R&D center in Helsinki, Finland.

Vaisala, known globally for lightning detection systems and renewable energy solutions, has also led in the Power Industry with best-in-class moisture in oil and dew point measurement instruments. Our proven technologies have become the standard for many of the world’s largest electric utilities, systems integrators and OEM’s.

Vaisala has continued to apply this expertise and experience with industry leading solutions for measuring dissolved gases in transformers including a single-gas/moisture in oil solution, the MHT410, and a multi-gas analyzer, the OPT100.

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