

# Dissolved Gas Analysis

by: Jay Smith



Is this what your transformer core may soon look like?  
Could this have been avoided or predicted?  
Would "Dissolved Gas Analysis" give you advanced warning?  
Is your DGA analyzer telling you ALL that they should?

From the picture above, yes your soon "look a like" transformer condition could have been possibly avoided and predicted with proper "Dissolved Gas Analysis" (DGA). Maybe with a reputable analyzer this "end result" may not have happened. Not to take anything away from your analyzer but, possibly you need to look more into you DGA.

DGA, in reality means dissolved combustible gas in oil analysis. One may ask combustible gas in oil? What causes them? And what can we look for with gas analysis?

First we have to see what components make up what we call a transformer. The major components consist of the tank, the core, and superstructure, the conductors, the bushings, the cellulosic insulation, and the insulating oil. At this point, with the combustible gas in oil tests our interests are only the last two items because they are the "Achilles heel" of the transformer, and they are subject to decomposition from various forms of stress. As we continue to build our case of predicting causes and what gaseous can have in transformers we need to look at nine of the main gases we can produce in transformer oils. Hydrogen (H<sub>2</sub>), Nitrogen (N<sub>2</sub>), Carbon Monoxide (CO), Oxygen (O<sub>2</sub>), Methane (CH<sub>4</sub>), Carbon Dioxide (CO<sub>2</sub>), Ethane (C<sub>2</sub>H<sub>6</sub>), Ethylene (C<sub>2</sub>H<sub>4</sub>) and Acetylene (C<sub>2</sub>H<sub>2</sub>). The gases underlined are the combustible gases we look at to predict, and know the course of transformer failure through DGA in their presence in percentage, or parts per millions of concentration. Below are a few charts to represent and show some of the concentration of combustible gases. These evaluations come about because of certain types of transformer failure that will show up in DGA tests.

The picture at the beginning of this article is not a failure that caused downtime or a damaging explosion. But in reality, through good DGA monitoring this was diagnosed and appropriate steps were taken to prepare for removing the above transformer for service.

Case scenario:

Early tests using DGA testing did prevent this transformer from failing at a very inevitable time. The industrial facility was unable to shut down due to the fact that all production would have to stop. The client did monitor the DGA and fortunately a new transformer was ordered and arrived before inevitable complete failure occurred.

Upon removal of the transformer visual inspection of the core, showed that arcing had occurred from the primary winding to ground. Even deeper inspection showed that the insulating spaces were completely burned on the primary winding. DGA again saved expensive down time!

This article was compliments of Jay Smith.

Jay Smith came to Lewellyn Technology, Inc. 5 years ago with more than 31 years of experience in electrical and mechanical maintenance with Peabody Coal Company. Jay is a Federally Certified Master Electrician in Low, Medium, and High Voltage through MSHA. Jay holds an associate's degree in electrical technology and has a strong knowledge in electrical theory and math. Jay has maintained the world's largest coal excavating draglines and shovels.