MISTRAS
Asset Protection Solutions

Case Study 02-5-2002

Bus Bar Fault

Generator Step Up (GSU) Transformer, 25/500 kV, 784 MVA, FOA, Westinghouse, three phase, two pumps groups, shell form.

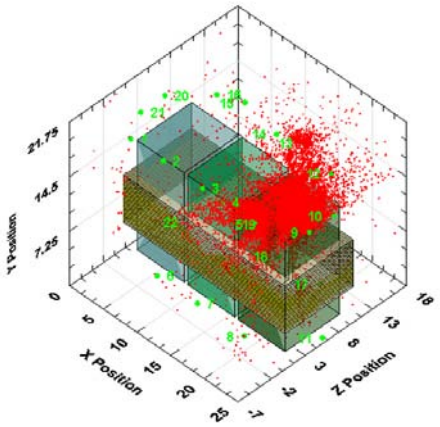
This unit started gassing the last month of 2001 after being in service for more than 20 years. Dissolved Gas Analysis (DGA) indicated the existence of overheating by all seven methods applied. The gas generation rate increased periodically, therefore, the decision was made to test this unit using Acoustic Emission (AE) with the objective of locating the gassing source(s) inside the transformer.

GSU Transformer

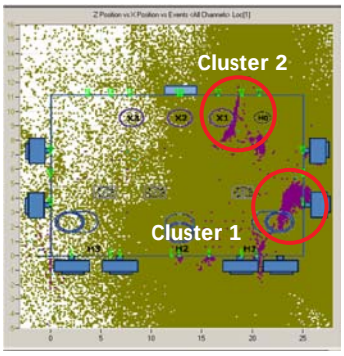
The transformer owner had two options: remove the transformer from operation and ship it to a manufacturer's facility for internal inspection or perform an internal inspection on site.

This transformer was tested continuously for 68 hours, while instrumented with 22 AE sensors. Many events were obtained over the course of the test with the event/time ratio changing dramatically. Post-test analysis indicated the existence of two clusters of events: Cluster 1 located close to H1 High Voltage Bushing and Cluster 2 located below the X1 Low Voltage Bushing. Most of the events and the highest peak amplitude were obtained in these clusters.

Analysis indicated that the number of events recorded was strongly related to pump operation. One pump group was running all the time and the second group was operating when it reached a pre-set temperature value. It is believed that these events were triggered by a high temperature value in the faulted area that reached its critical value just before the operation of pump group #2 was ordered. As soon as pump group #2 started running, all of this activity was significantly reduced. This may be due to a drop in temperature in the fault area. This behavior, along with the DGA results, reinforced the belief that a thermal problem existed.

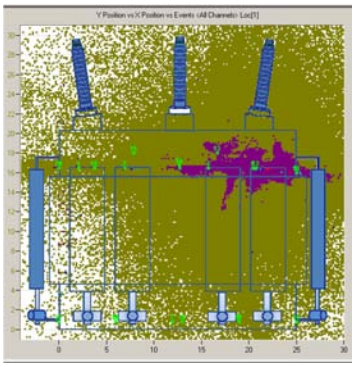


Three-dimensional plot showing the location of two sources



Location of the two sources in a two-dimensional plot (Top View)

The acoustic emission test indicated that the strongest acoustic activity was being detected on the upper part of the transformer. Therefore, an internal inspection was justified as the problem seemed to be located on the upper part of the core/connections area.



This unit remained in operation with DGA values being monitored periodically. Twelve weeks after the AE test was completed, an internal inspection was performed. Internal inspection revealed carbon build-up, due to severe overheating on one of the copper bus bars of the X1 Low Voltage bushing. This bar was also completely cracked with all of the current being carried by the other two bars (approximately 6000 A). This fault was detected in the area where Cluster 2 was located.

The transformer was repaired on-site one week after copper bus bars were replaced. The customer estimated savings of 2 million dollars considering the time the plant would have been off-line.

Overheated bus bar with carbon build-up

Find out more about testing transformers with Acoustic Emission; call (609) 716-4162 today!

195 Clarksville Road, Princeton Junction, NJ 08550 USA
Phone: (609) 716-4000 • Fax: (609) 716-0706
Email: sales.services@mistrasgroup.com • www.mistrasgroup.com/substations