

DGA Survival Analysis (Quick Introduction)

Dr. Jim Dukarm

Presented to IEEE C57.104 Working Group

November 1, 2011

What is DGA Survival Analysis?

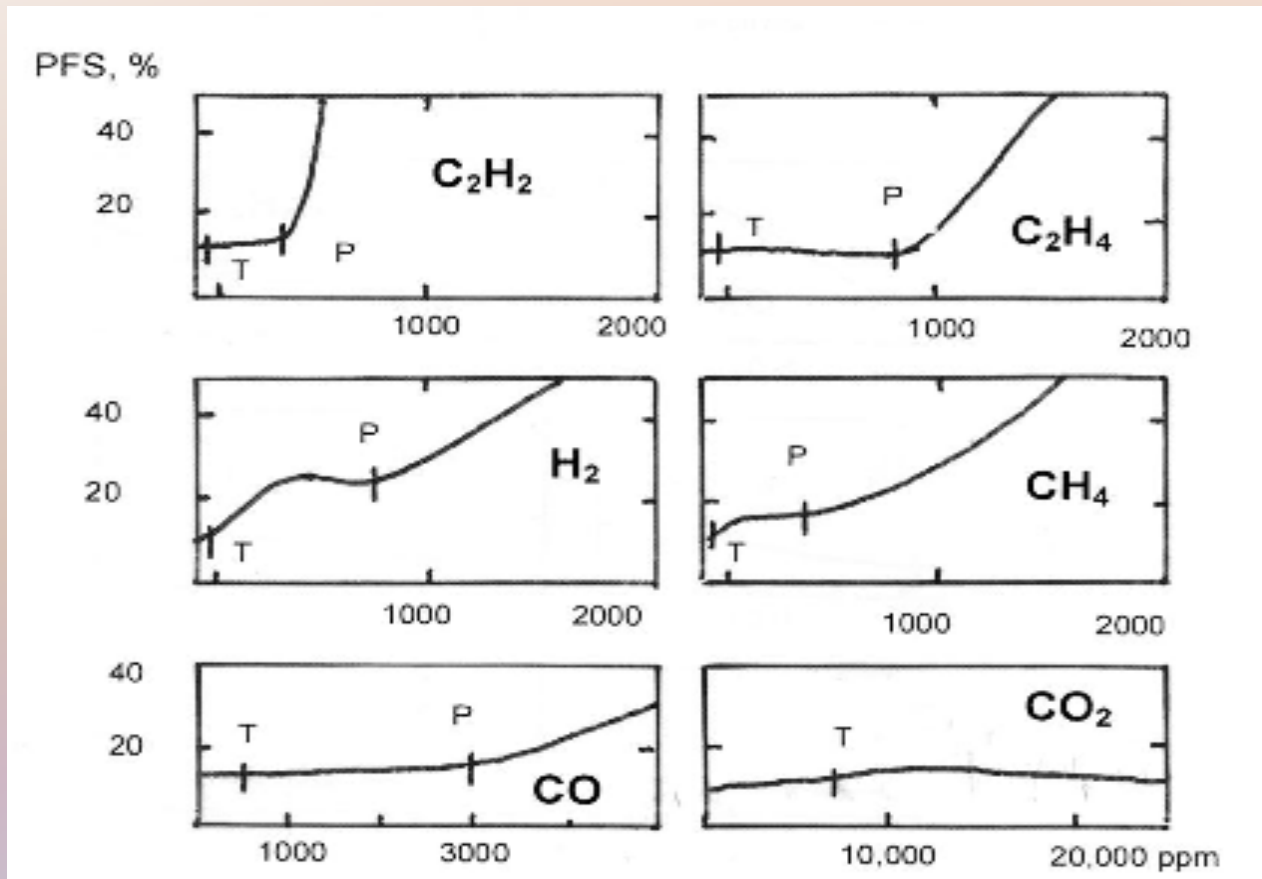
1. What it is: Use of transformer DGA data **plus** indication of which samples are failure-related to get statistical measure of "**scariness**" instead of just "unusualness".

2. Key ideas:

Failure-related sample. A DGA sample associated with a trip or gas alarm, or known to have been taken not long before a failure. (The sample must have gas increments or gas levels related to the cause of the failure or the reason why the transformer was taken out of service).

DGA Survival Curve. A chart showing expected proportion of failure-related events with gas concentration greater than x .

Duval's Ideas - FRE & PFS

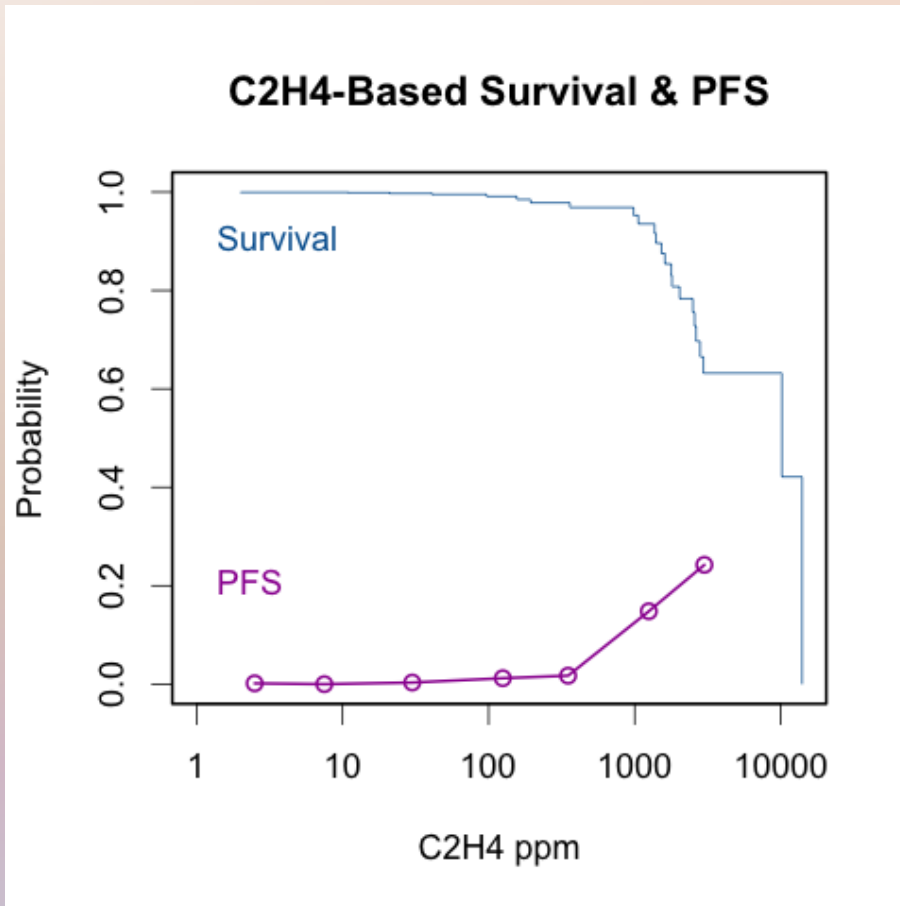


Source: Duval 2008

Duval calculated **PFS**=Probability of failure-related event based on gas ppm.

DGA survival analysis does the arithmetic differently to use the data more efficiently and extract more information.

Survival Curve Example

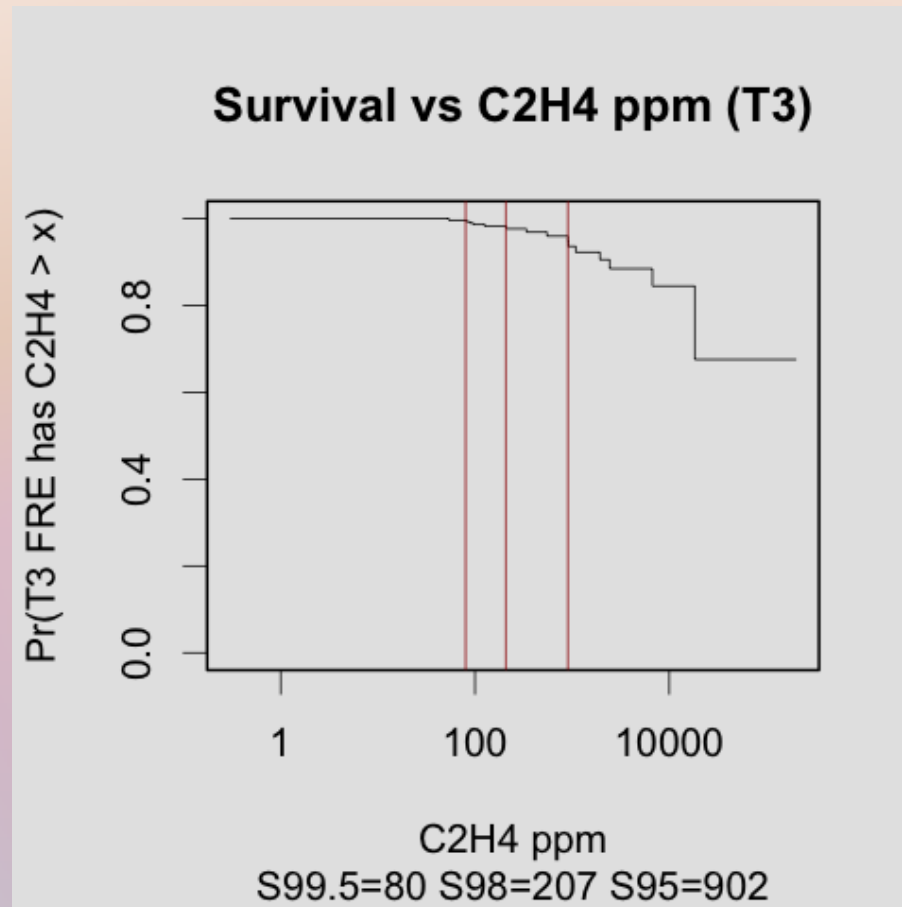


Survival analysis

calculates the expected proportion of FREs with gas concentration $> x$.

This ethylene survival curve (top) was estimated by the Kaplan-Meier method, which is used extensively in **medical research**.

Survival-Based DGA Limits



It is possible to define DGA limits in terms of "probability of survival," not just unusualness. The red lines indicate the ppm where survival probability is 99.5%, 98%, and 95%.