

# LTC DGA DATA ANALYSIS

preliminary results

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# OUTLINES

- Objectives.
- Statistic analysis on gas ratio  
R1:Ethylene/Acetylene
- Discussion

# Objectives

- Demonstrate the approach used in the LTC data analysis.
- Discuss some issues of the collected DGA data and the methodology of statistic analysis.

# Statistics analysis of gas ratio

- Data sources (13767)

- Alliant, GPC, HSB, DUKE.

- Target models:

- AS1X(1737)
- AS2X(778)
- AS2R(14)
- V1X(1203)
- ATS1X(2815)
- ATS1R(677)
- NONE(6549)

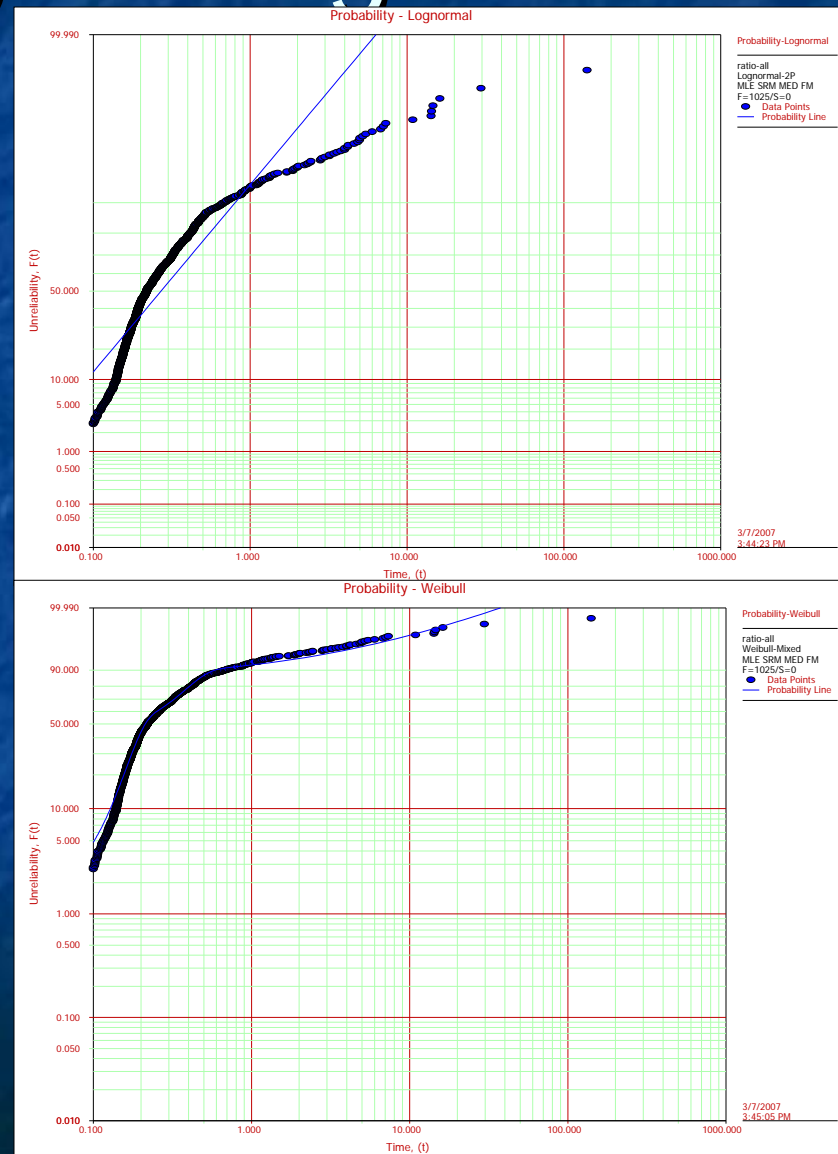
# Statistics analysis of gas ratio

- AS1X(1737)

$$R1 = \frac{C_2H_4}{C_2H_2}$$

# Statistics analysis of gas ratio

- For the aggregated data from all of sources
  - No single distribution model can fit the data well.
  - The best fit model: mixed weibull model
  - The data are not homogeneous



# Statistics analysis of gas ratio

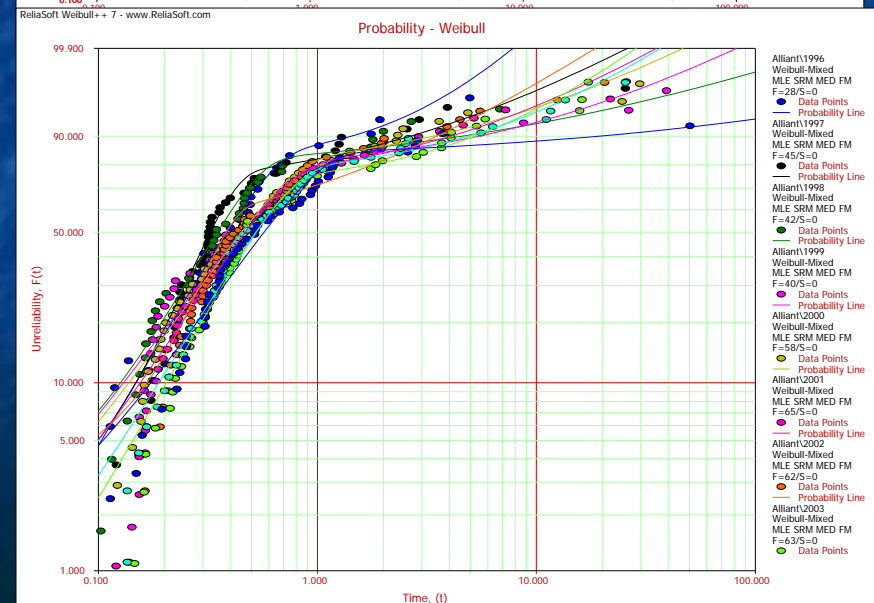
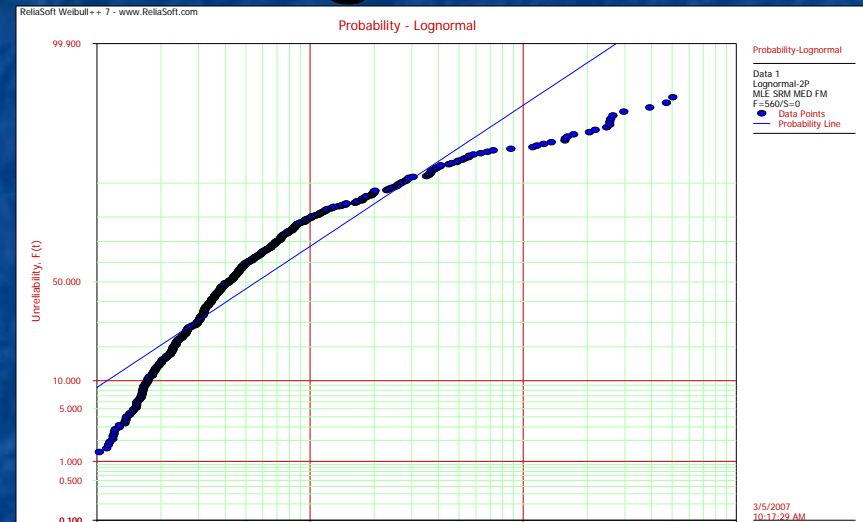
- AS1X- Alliant energy

(1) Aggregated data: from 1992 to 2006.

- No single distribution model can fit the data well.
- The best fit model: mixed weibull model
- The data are not homogeneous .

(2) Grouped data based on the sampling date (year)

- No single distribution model can fit the data well.
- The best fit model is mixed weibull model.
- The data are not homogeneous.



# Statistics analysis of gas ratio

- The data sampled on the **same model** of units from the **same utility** are **not homogeneous**.
- The source of the non-homogeneous.
  - Condition of the units: “healthy” and “non-healthy”
    - Main source
  - Different breathing systems (not available)--ignored.
  - Different labs tests (not available)--ignored.

# Statistics analysis of gas ratio

- The effect of the condition of the units on gas ratio  $R_1$ 
  - **“Healthy” LTC**
    - $R_1$  is low and remains relative constant before the unit develops some problems.
  - **“Unhealthy” LTC**
    - $R_1$  is relative bigger and its value depends on how bad the problem of the sampled unit is.

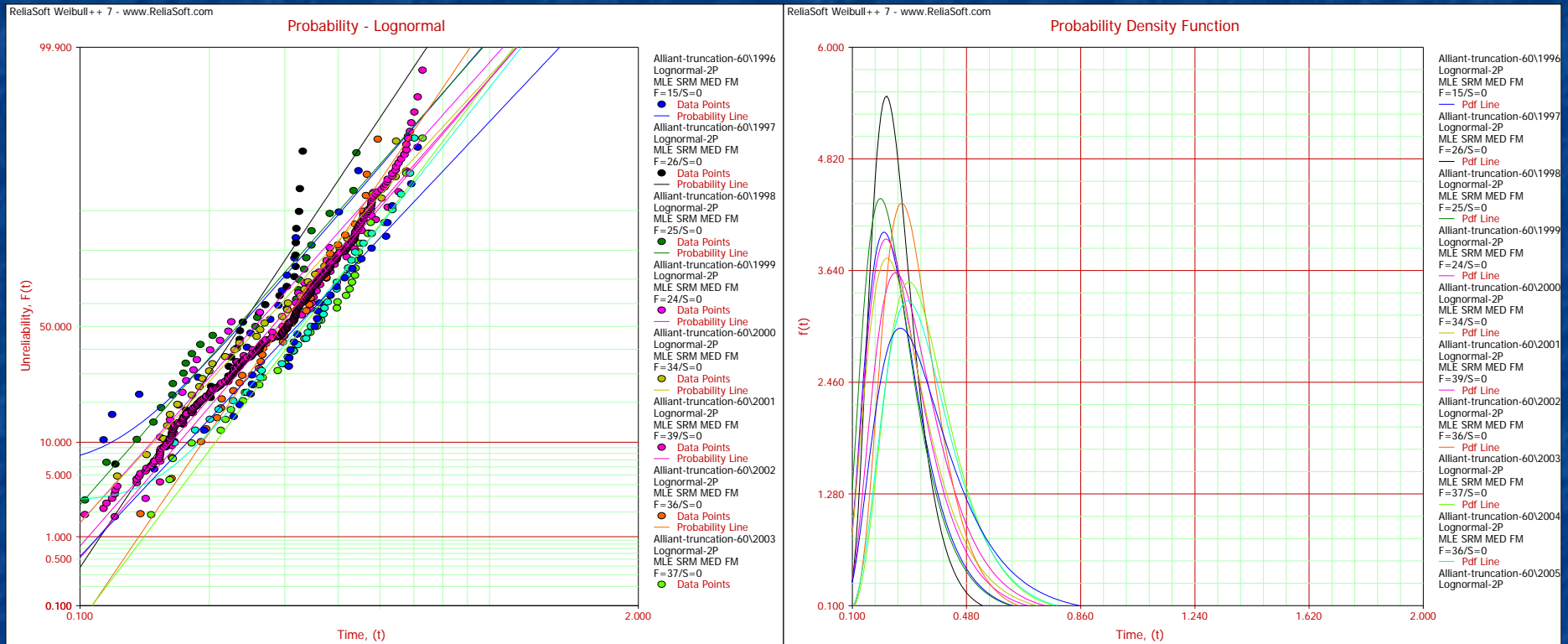
# Statistics analysis of gas ratio

- Differentiate the data of the healthy unit from unhealthy unit.
  - **Assumption:**
    - (1) The ratio from unhealthy units have higher value.
    - (2) The ratio from healthy units have lower value.
    - (3) The statistic distribution of the ratio of the healthy units from single source should follow same distribution over the time.
  - **The approach:**
    - (1) Divide the data from a single company into different groups based on the sampling date (year).
    - (2) Truncate the data in each group until the following two criteria (differentiation criteria) are met:
      - (a) the truncated data can be modeled well by a single distribution.
      - (b) the truncated data in all the groups follow the same distribution.
    - (3) Repeat the above procedure for the data from other companies.
    - (4) Aggregated the truncated data from different companies into a single pool.

# Statistics analysis of gas ratio

- Statistics analysis results of the truncated Alliant data for each group.
  - When the data truncated at 80 and 70 percentile, only criteria (a) is met.
  - Both criteria are met when the truncation is at 60 percentile value.
  - The data truncated at 60 percentile in each group can be considered from same population statistically which represents the "healthy" units. Therefore these truncated data can be aggregated into the same pool of "healthy" units.

# Statistics analysis of gas ratio R1



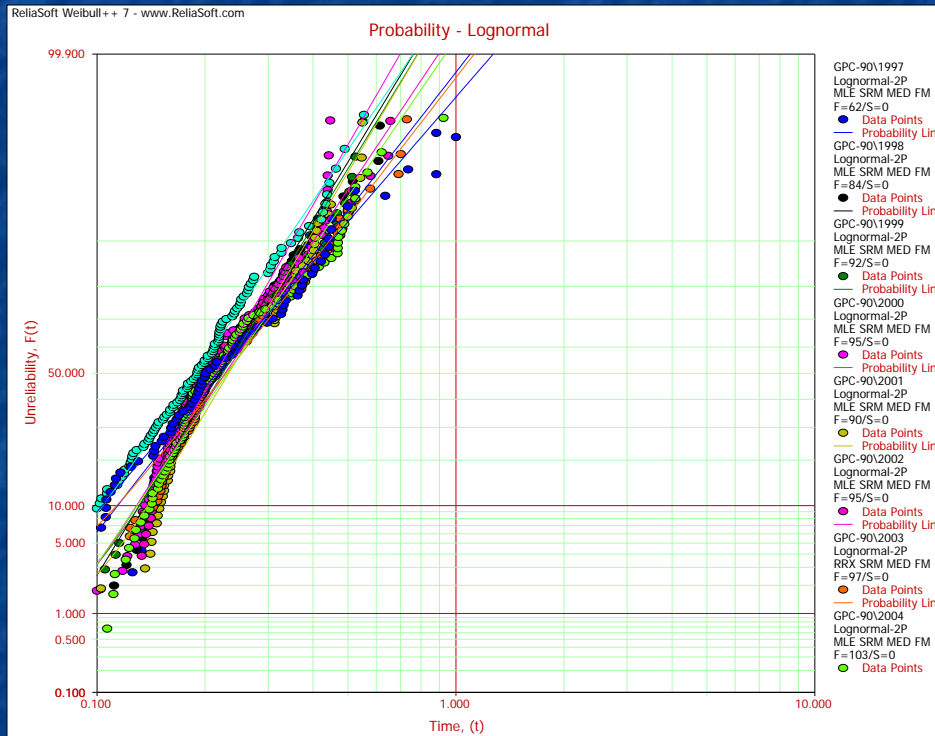
Cumulative probability for the truncated data(60%) sampled in 1996-2005

Probability density function for the truncated data(60%) sampled in 1996-2005

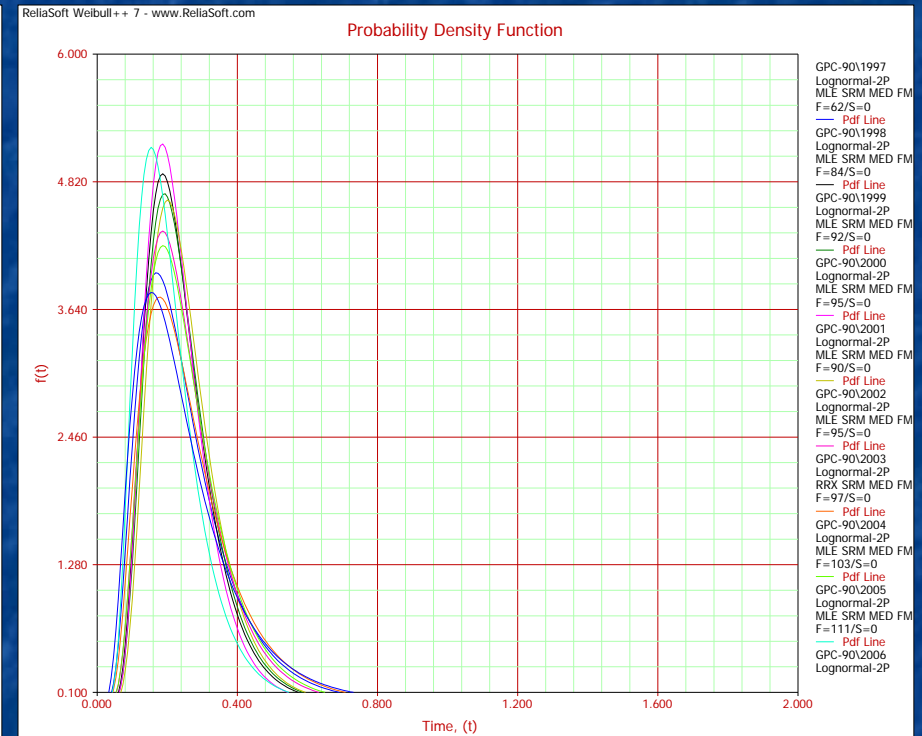
# Statistics analysis of gas ratio

- Repeat the above procedure to the data from GPC (1025 data point) .
  - the non-homogeneous phenomenon is also found.
  - Both differentiation criteria are met when the truncation occurs at 90 percentile for each group. Therefore the truncated data from each group can be aggregated in to the pool for the “healthy” units .

# Statistics analysis of gas ratio R1

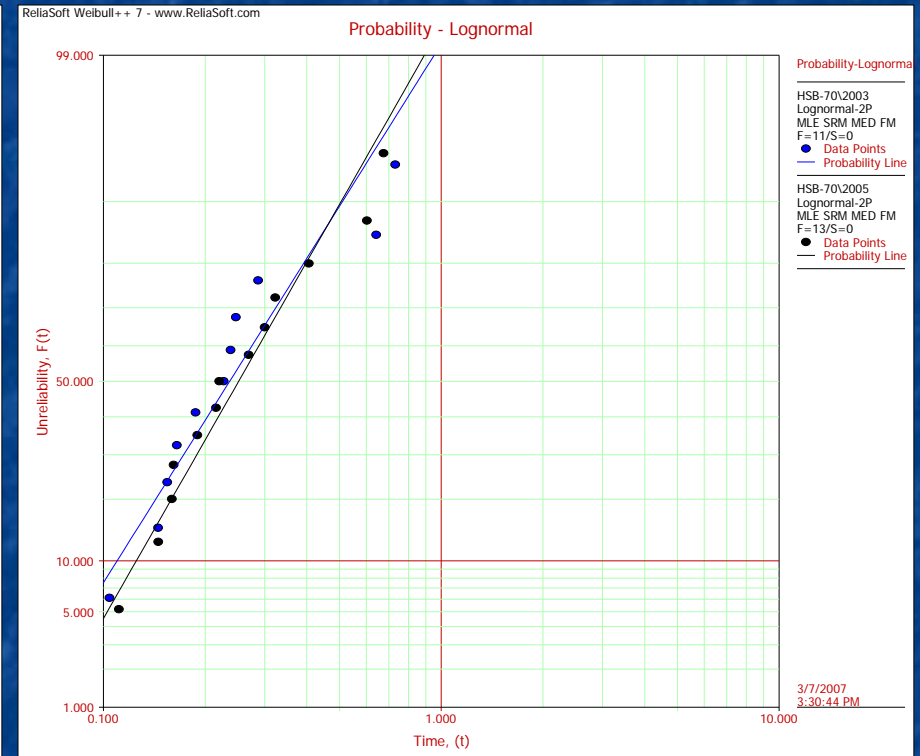
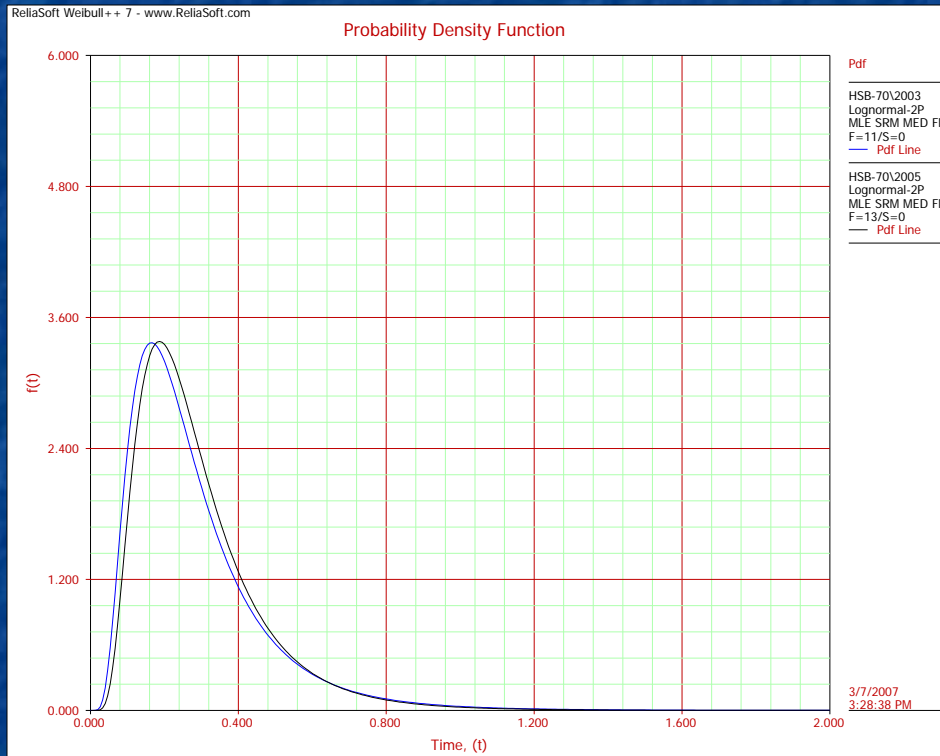


Cumulative probability for the truncated data(90%) sampled in 1997-2006(GPC)



Probability density function for the truncated data(90%) sampled in 1997-2006(GPC)

# Statistics analysis of gas ratio R1



Cumulative probability for the truncated data(80%) sampled in 2003 and 2005(HSB)

Probability density function for the truncated data(80%) sampled in 2003 and 2006(HSB)

# Statistics analysis of gas ratio R1

The distribution model fitting of the aggregated truncated data from Alliant, GPC and HSB ---lognormal distribution

