

# Reviewing the PM<sub>2.5</sub> DQO's

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# Purpose

The Data Quality Objectives set forth specific standards to ensure that decisions can be made with a specified level of confidence.

To develop the DQO's several assumptions had to be made about the statistical nature of the data. We are reviewing these assumptions.

Assumption	Grade	Impact
The annual average is the limiting restriction.	A Mostly true	None
Normal distribution of measurement error.	C Rarely true	Expected to be small
Normal distribution of the population about long term seasonal averages	B Appears to be more log-normal	Very small for the annual mean
50% variation about the long term seasonal averages	? the max is ~80% ??	Can be significant

Assumption	Grade	Impact
Sufficiency of 75% of 1 in 6 sampling	B+ Not quite good enough	Small, most use 1 in 3
10% meas. CV and 10% bias	A- But depends on the above.	Bias is key
Decision error rates of 5%	Up to you!	Up to you!

# Normal measurement error

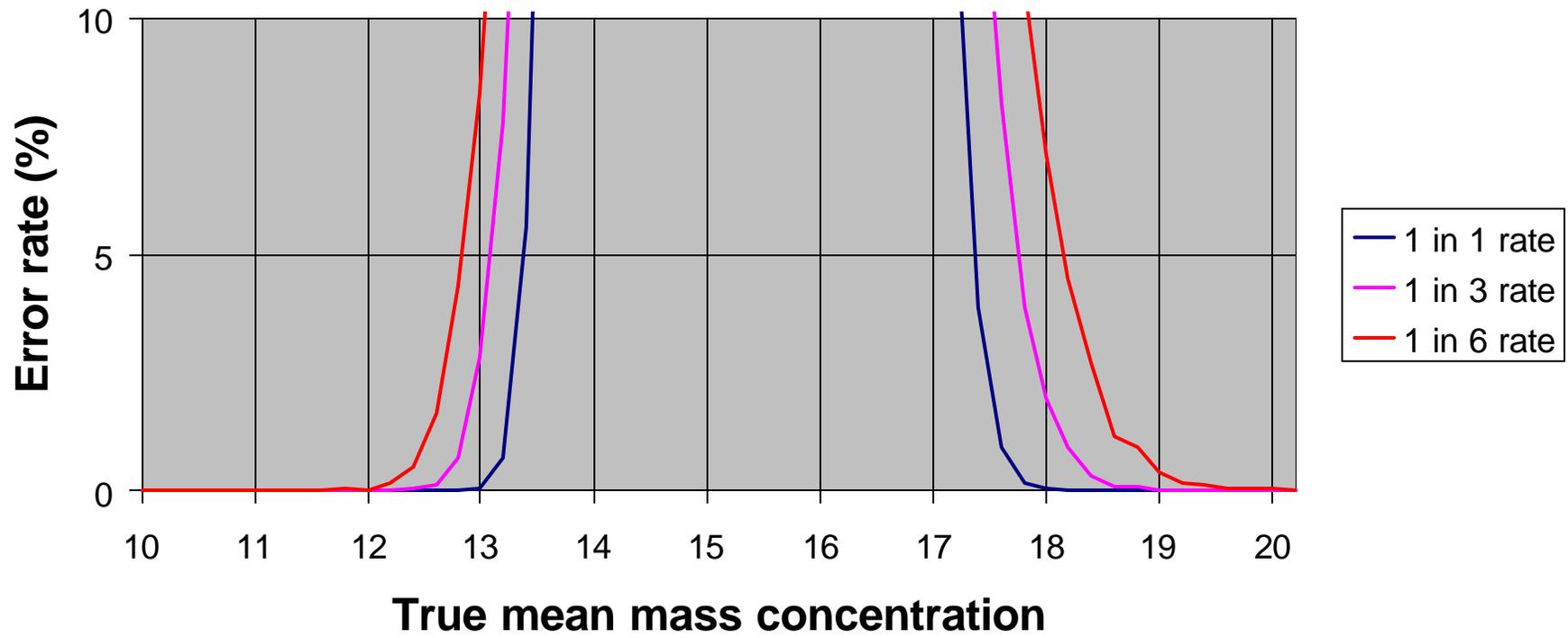
Hidden in this assumption is that it was expected that the measurement error would have a constant CV across the range of concentrations seen.

- For some sites the standard deviation rather than CV appears fairly constant.
- It is not known what factors determine the type of response.
- The impact has not been examined.

# 75% of 1 in 6 sampling

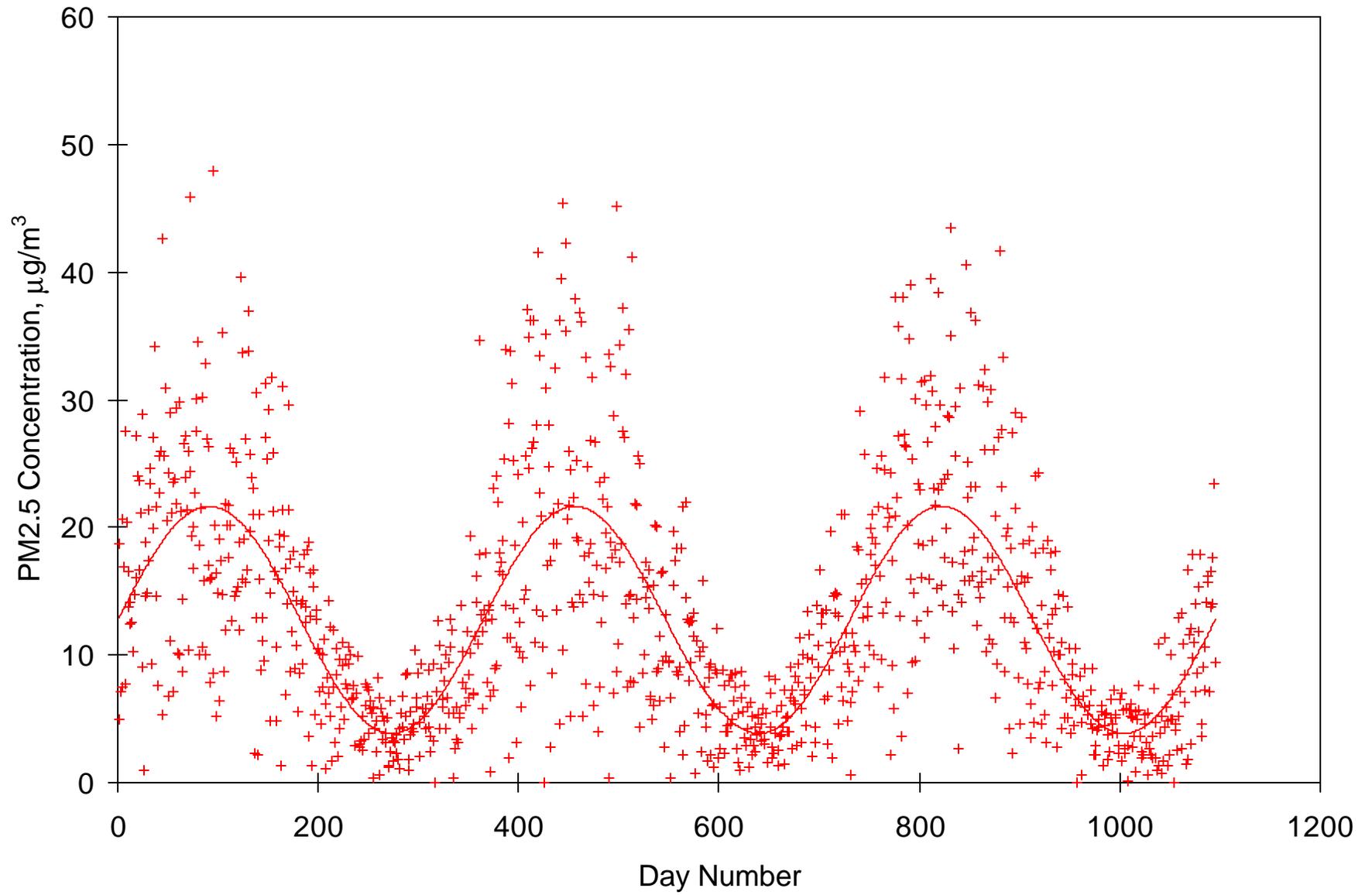
- More complete and more frequent sampling is better! (Up to the limit of the bias.)
- In the worst case scenario looked at, the 75% of 1 in 6 day sampling does not quite meet the 5% error rate.
- There is over a 3/4 of a microgram difference in the length of the “gray” range between 1 in 3 day sampling and 1 in 6 day.

### Error rates: 1 in 6, 1 in 3, & 1 in 1



# Population variation

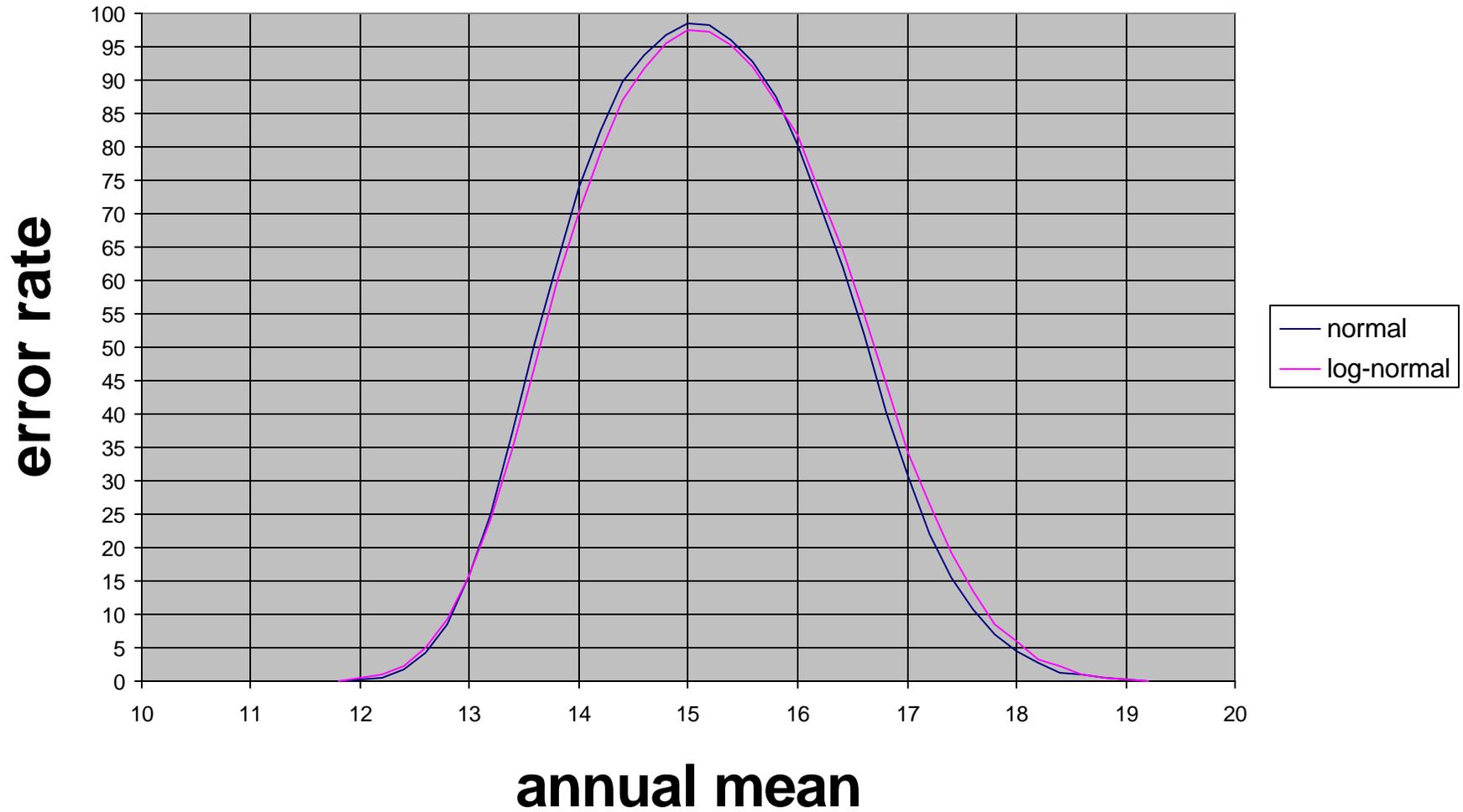
- The Model QAPP / Quality System paper assumed a normal distribution about sinusoidal long term averages with a 50% CV.
- The 5% error rate is violated for scenarios with 10% measurement CV, 10% bias, and increased population variation.
- 50% appears to be about the median amount of variation.
- Autocorrelation has not been looked at.



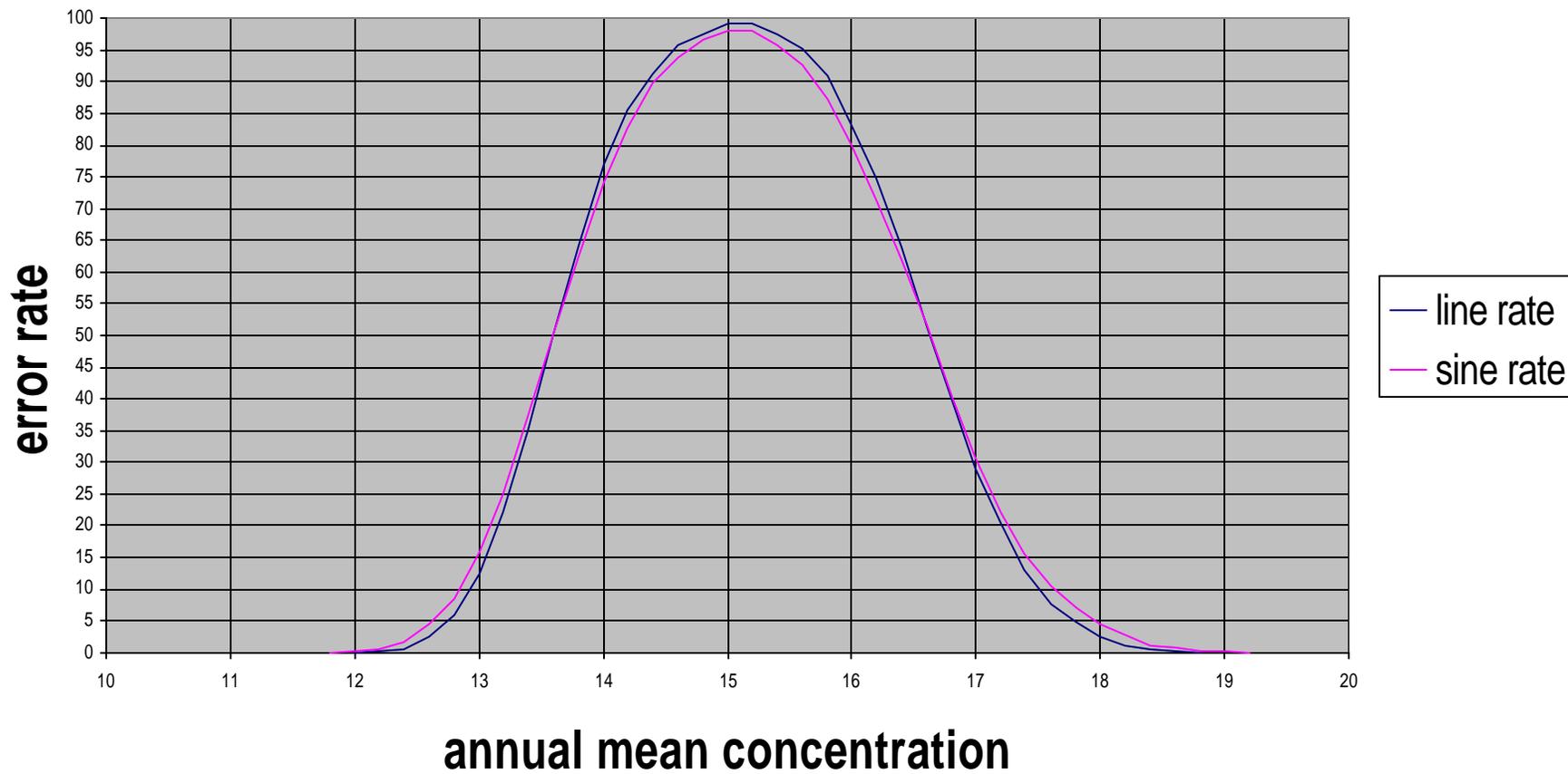
# Other population issues

- Log-normal population variance
  - little or no effect for a 50% CV,
- Straight rather than seasonally varying long term means
  - little or no effect,
- Increased population variance
  - We are seeing 30%-80% CV's,
  - These do have a significant effect.

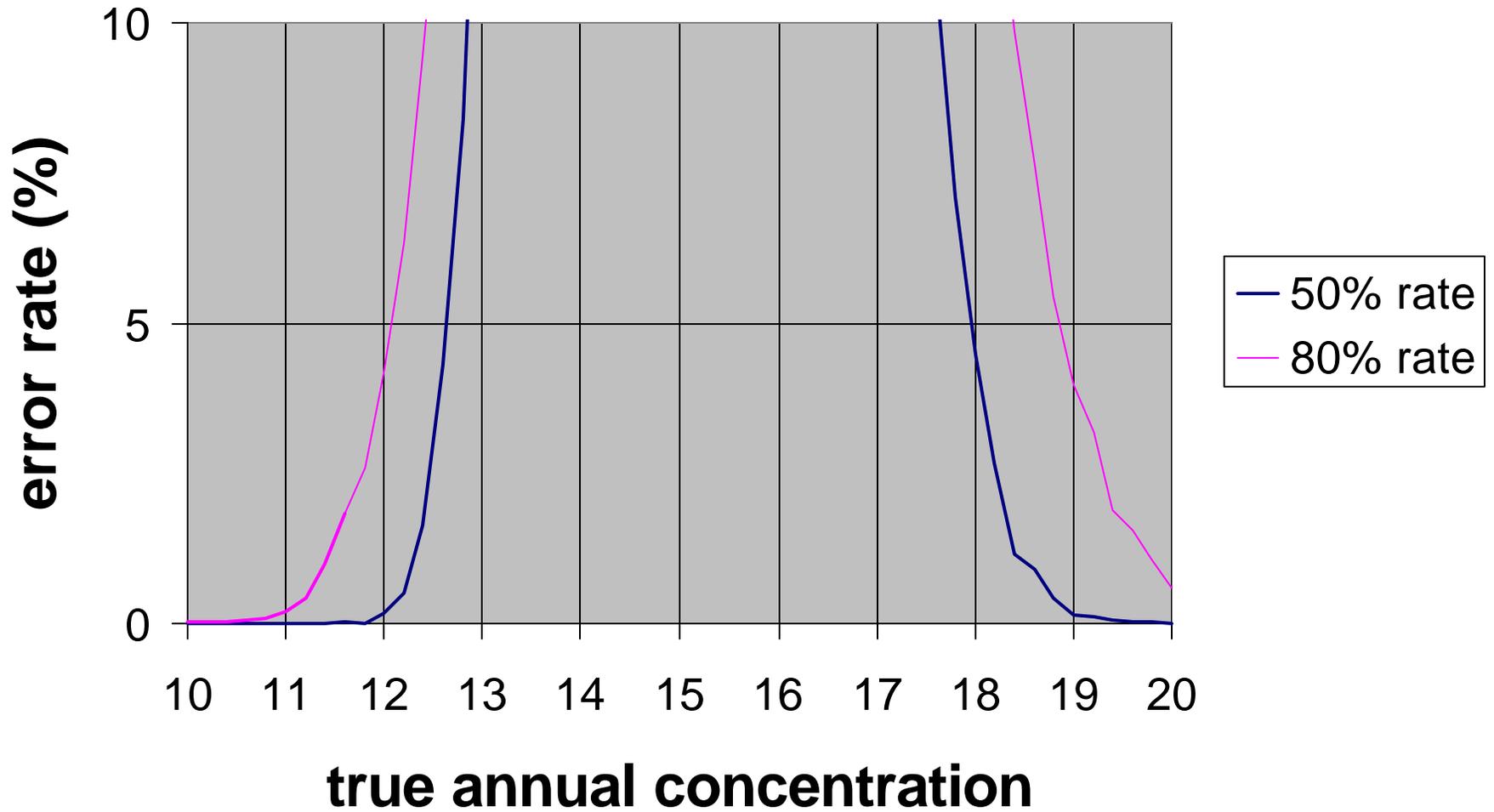
# 1 in 6 sampling: normal vs log-normal



## 1 in 6 sampling: sine wave vs. line



## 50% vs 80% population CV



## Maximum of +/-10% bias and 10% measurement CV

- This is mostly true (Shelly's presentation).
- The error rates are more influenced by the bias, and these seem well within the +/-10% level.
- The impact depends on the other assumptions, particularly on the population variation.

# Conclusions and outstanding issues

- The annual mean standard is robust w.r.t. the nature of the population variation and mean structure.
- The impact of the assumption of a 50% CV about a long term mean pattern needs to be examined.
- The impact of the non-normality of the measurement error needs to be assessed.
- Spatial and temporal correlation have not been explored.