Calibration of Surface Contamination Monitors

UKAS Accredited Organisations

2007 Comparison

Final Report

Normal expectations (ISO17025):

- Comparison participation at least annually
- Initial analysis of results within a few months of participation
- Evaluation and resolution of discrepancies (non-conformances) before next assessment visit
- Use of “type-test” data for comparison - not average performance
- Standardised reporting of instrument response
- Reporting of all raw data to allow meaningful evaluation

UKAS Accredited Organisations

DML	**– Devonport (pending)**
DRMS	**– Aldermaston**
DSTL	**– Alverstoke**
JCL	**– Dounreay**
NUKEM(H)	**– Harwell**
NUKEM(W)	**– Winfrith**
HMS SULTAN	**– Gosport (training establishment)**

Schedule

July 07	**- meeting of UKAS labs**
	- agreed comparison exercise, protocol, etc
August 07	**- first measurements**
November 07	**- last measurements**
March 08	**- draft report circulated**
May 08	**- wash-up meeting**

Reporting

All labs reported:

- **Raw data**
  - ***(background and source measurements)***
- **Snap-shot and eye-averaging where possible**
- **Instrument responses (emissions) = $(R_s - R_b)/(SER/A_s)$**
- **Uncertainties and uncertainty budgets**
- **Calibration source details**
  - ***(size, age, activity, traceability,…)***
- **Linearity measurements**
- **Measurements on same C-14 large area source**

Comparison – minimum outputs

Comparison against type-test benchmarks (where available)

Compliance based on uncertainties and ± 30% (GPG14)

Comparison/acceptability of uncertainty budgets

Source uniformity data

Comparison of snapshot and eye-averaging techniques

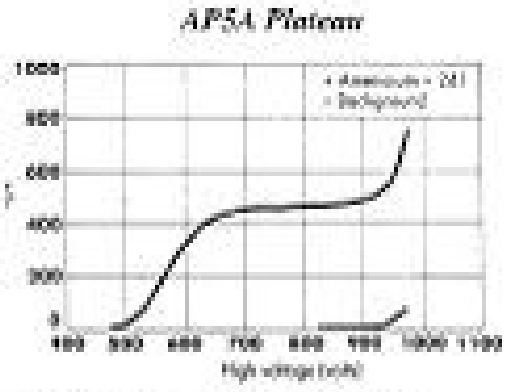
Quality of calibration sources

Instruments

Alpha Scintillation Probes

AP5 Family

This hand-held ZnS probe with 100 cm² window, high transmission hex-grill and slim, wedge-shaped profile is popular for monitoring workplaces, benches, personnel and tools. The AP5RA version has a ruggedised hex-grill. Note: the thin radiation windows are field-replaceable.



Alpha probe data (*from Thermo catalogue*)

Alpha efficiency is expressed as a percentage of the 2π flux of a certified reference source

Probe	Radiation Window Area (cm^2)	Shape	Isotope (MeV)	Efficiency (% surface emission)	Background s^{-1}
AP5AD	100	rect.	241Am (5.486)	35%	< 0.1

Instruments

BP19 Family

These slim-profile probes with light alloy diecast housings and 100 cm² radiation windows are replacements for the BP6, weighing less, and mechanically stronger, with a new design of light seal. The BP19AD has a greater low

BC400 plastic phosphor in a light alloy diecast housing are ideal for general purpose and large area monitoring for low, medium and high-energy beta. The BP19DD is a thin window version offering better ^{14}C beta efficiency. This probe can be matched with Thermo's portable survey meters, such as the Electra/Delta series, ASP-2, E-600, or RM-25. See also HP-380B.

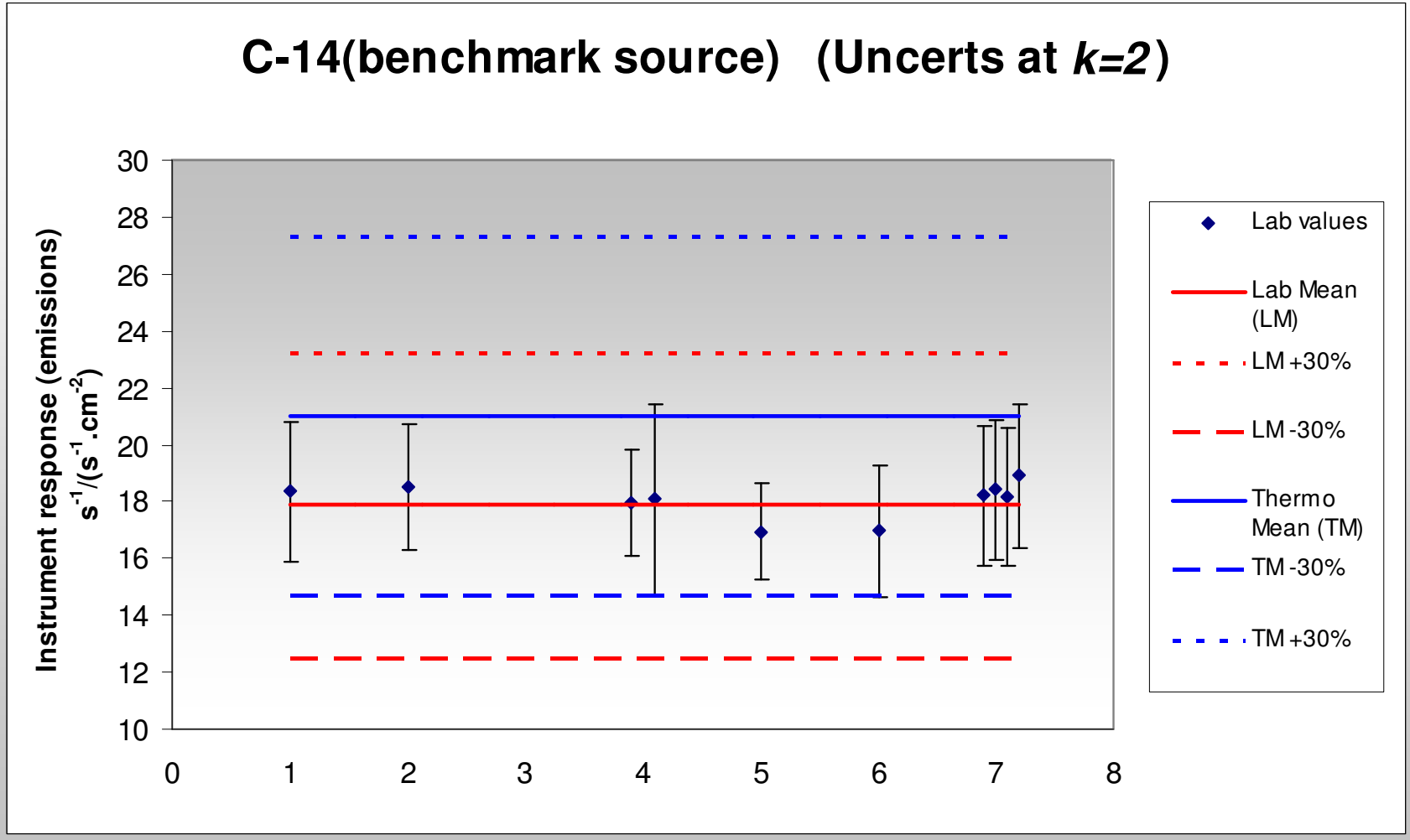
+ Slim profile, low weight

Beta probe data (*from Thermo catalogue*)

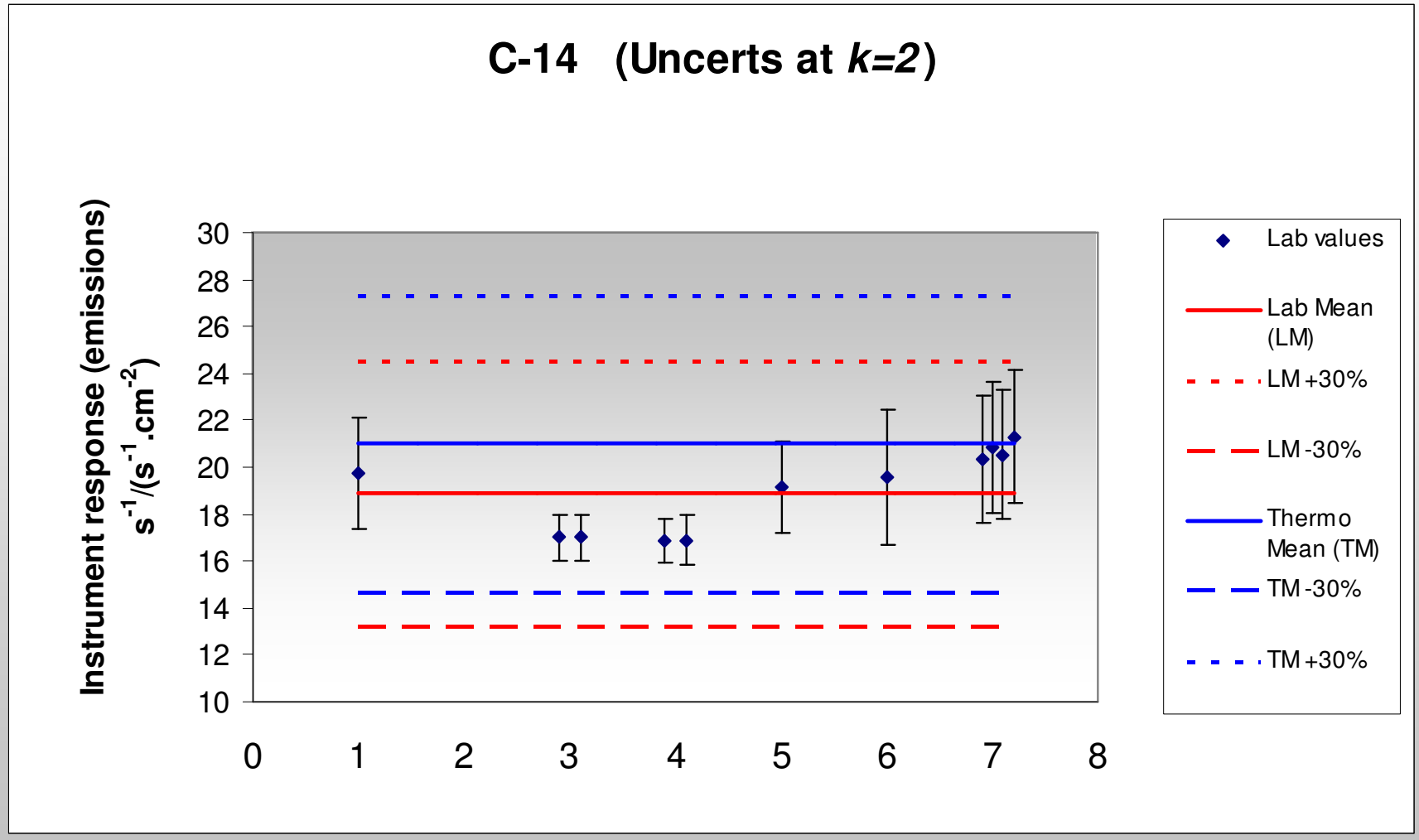
Alpha efficiency is expressed as a percentage of the 2π flux of a certified reference source

Probe	Radiation Window		Efficiency (% surface emission)				Background
	Area (cm^2)	Shape	Beta				s^{-1}
			^{14}C	^{60}Co	^{36}Cl	$^{90}Sr/^{90}Y$	
BP19DD	100	rect.	21%	34%	48%	51%	< 8

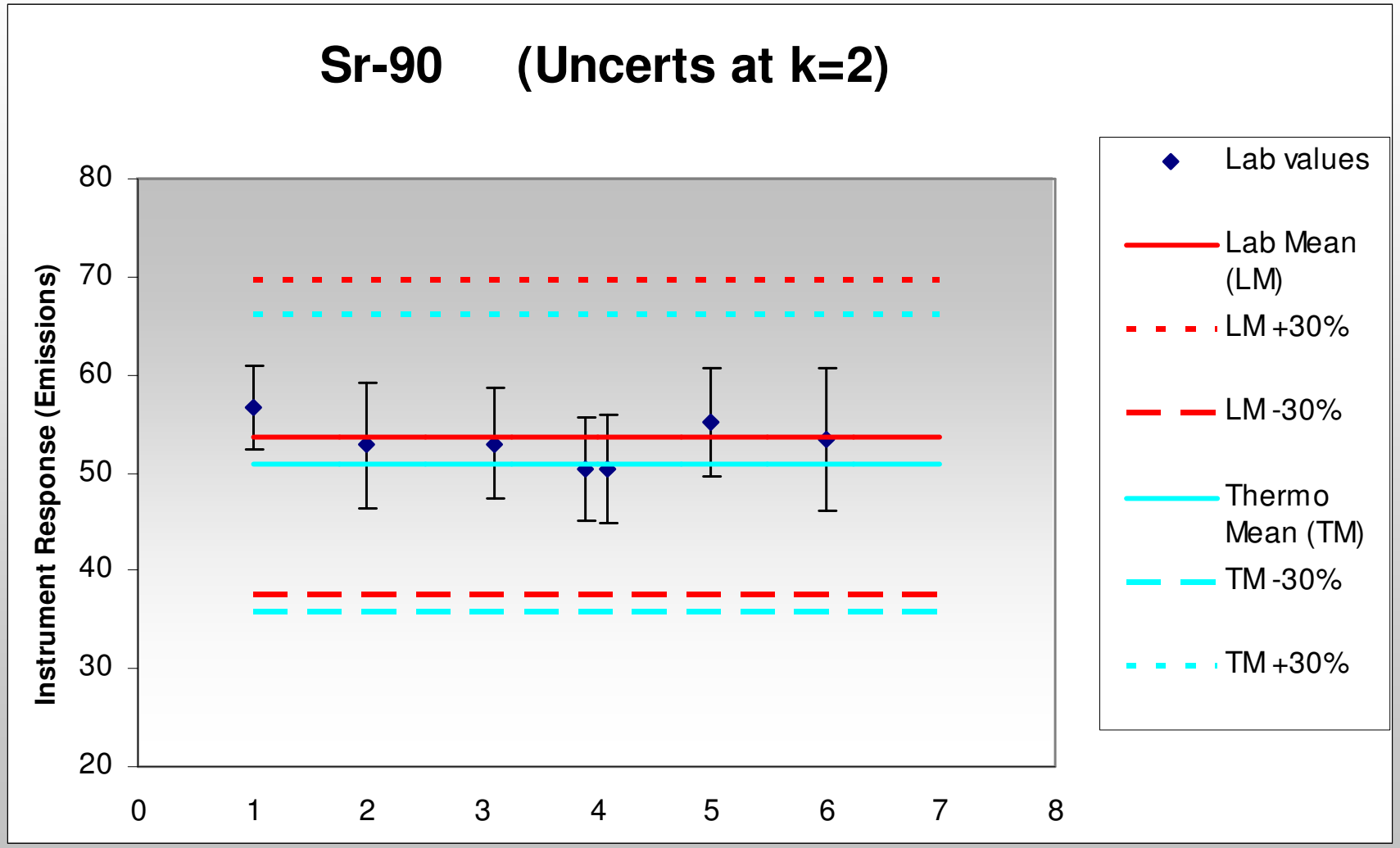
BP19 results



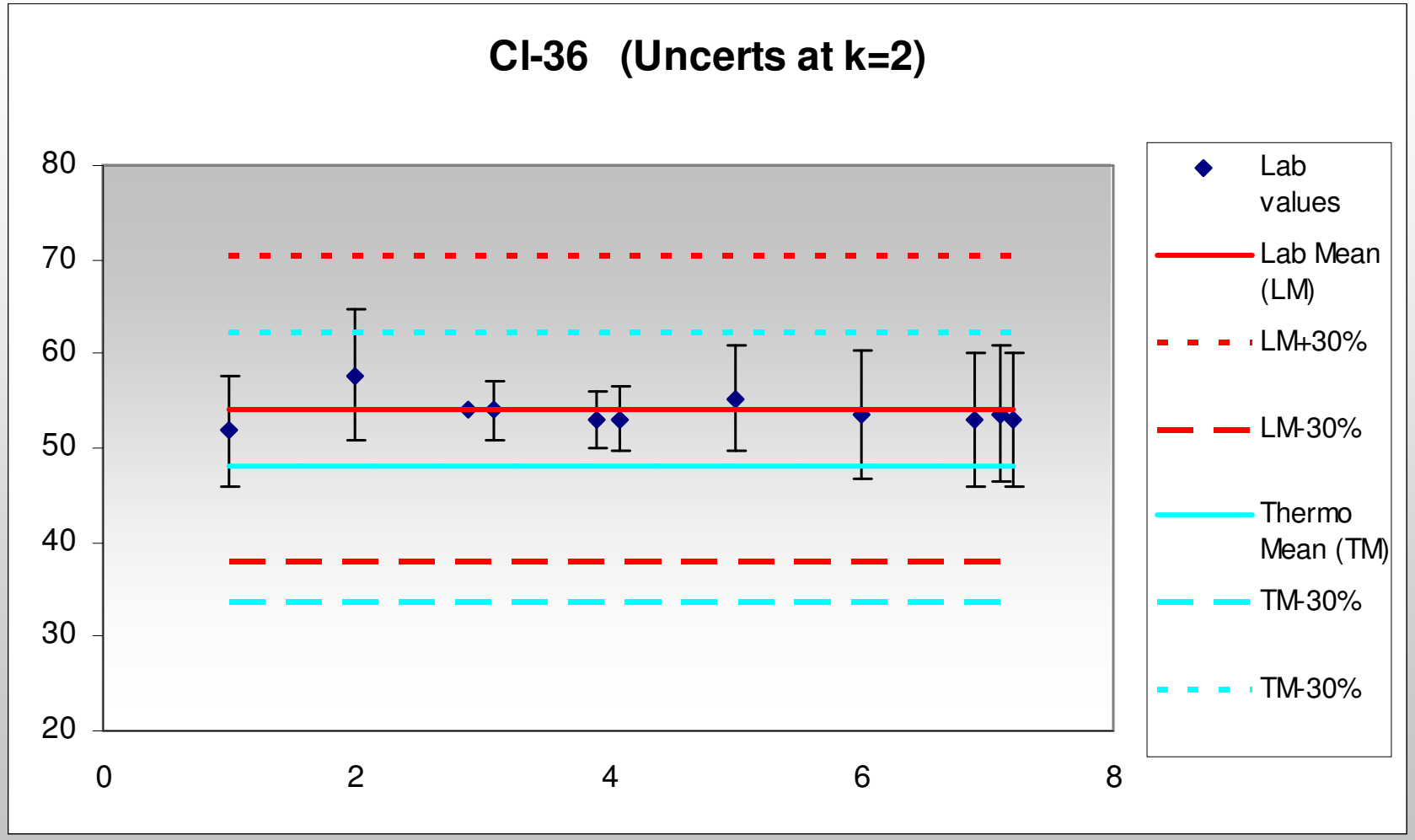
BP19 results



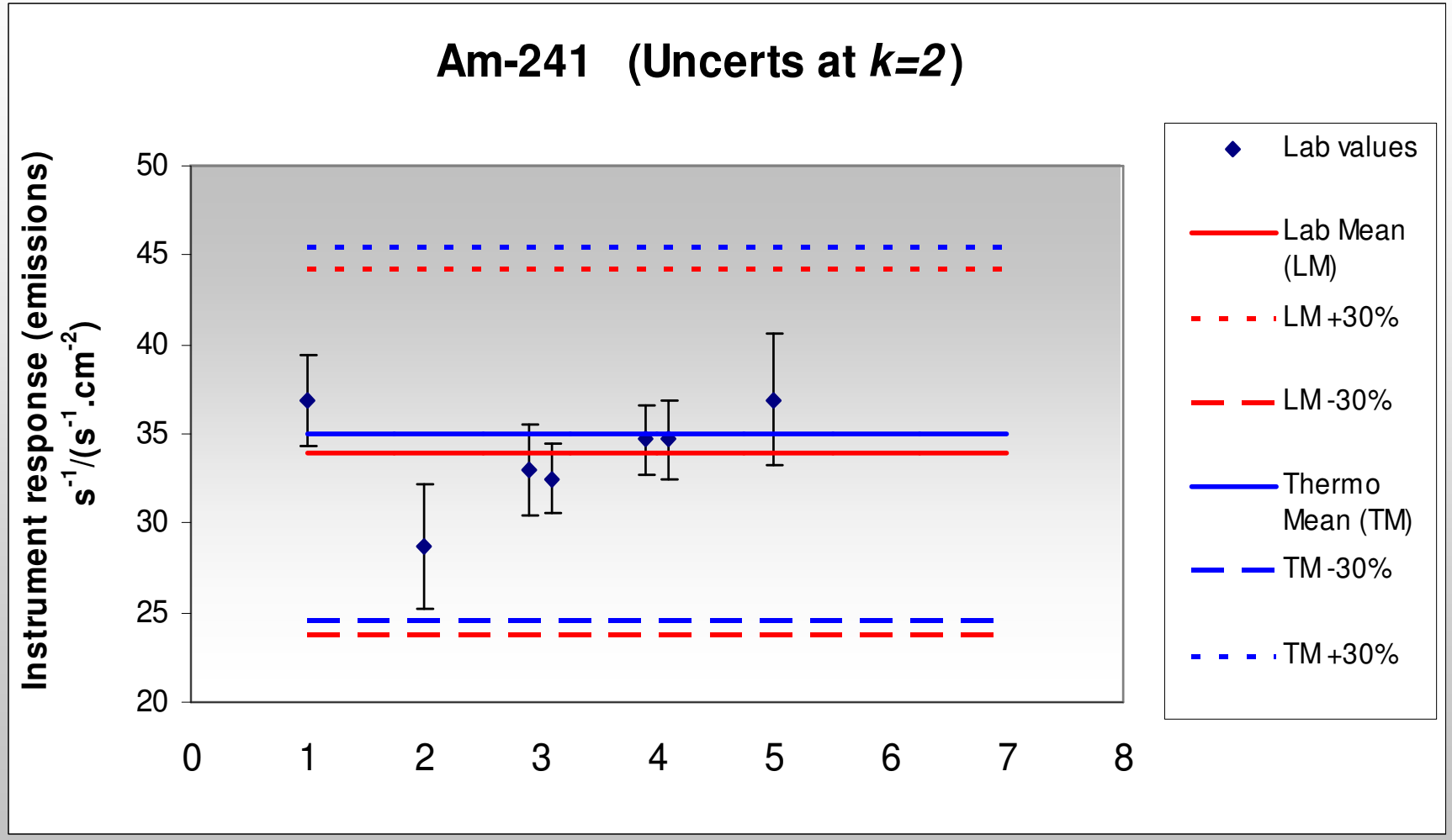
BP19 results



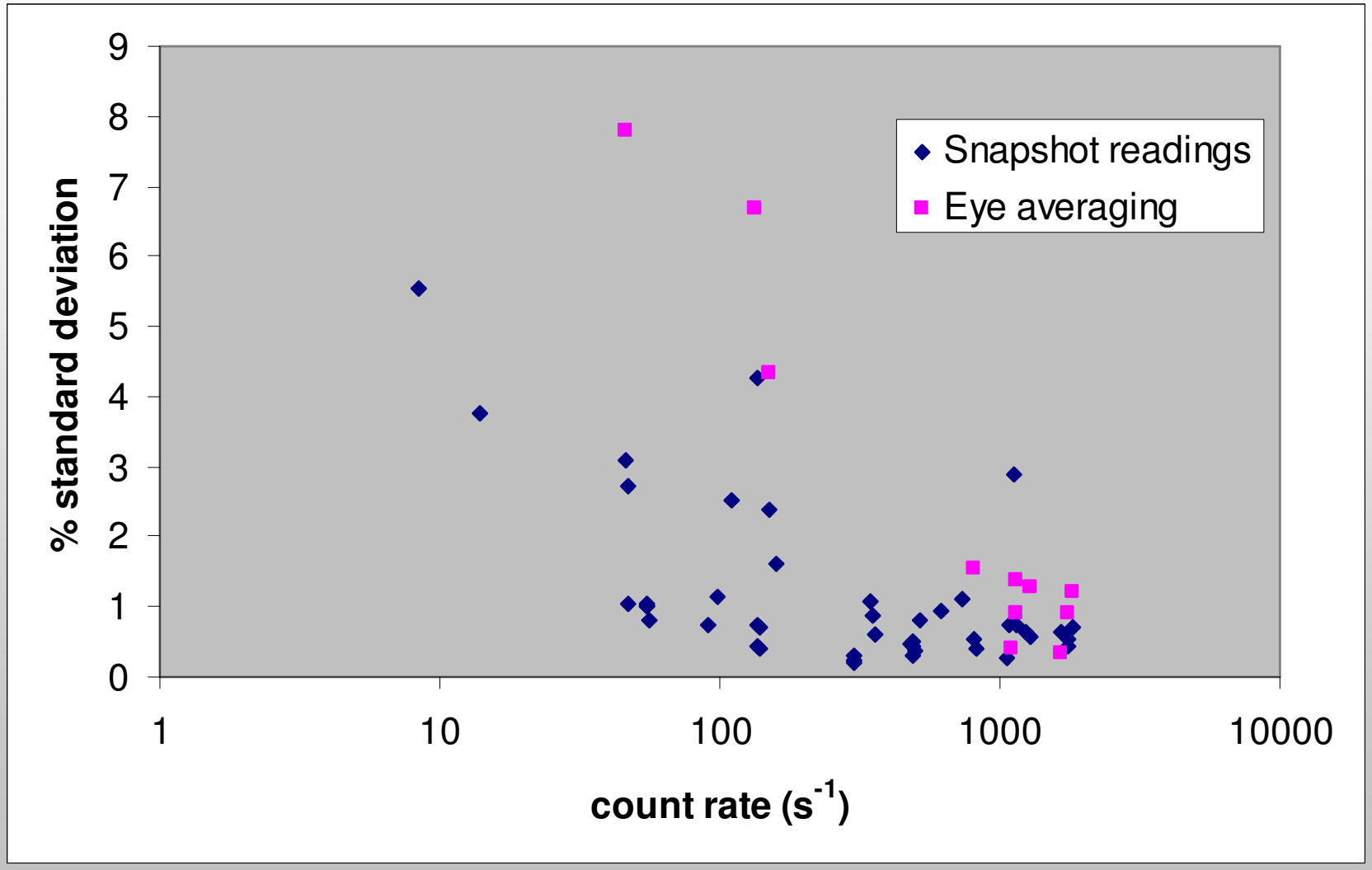
BP19 results



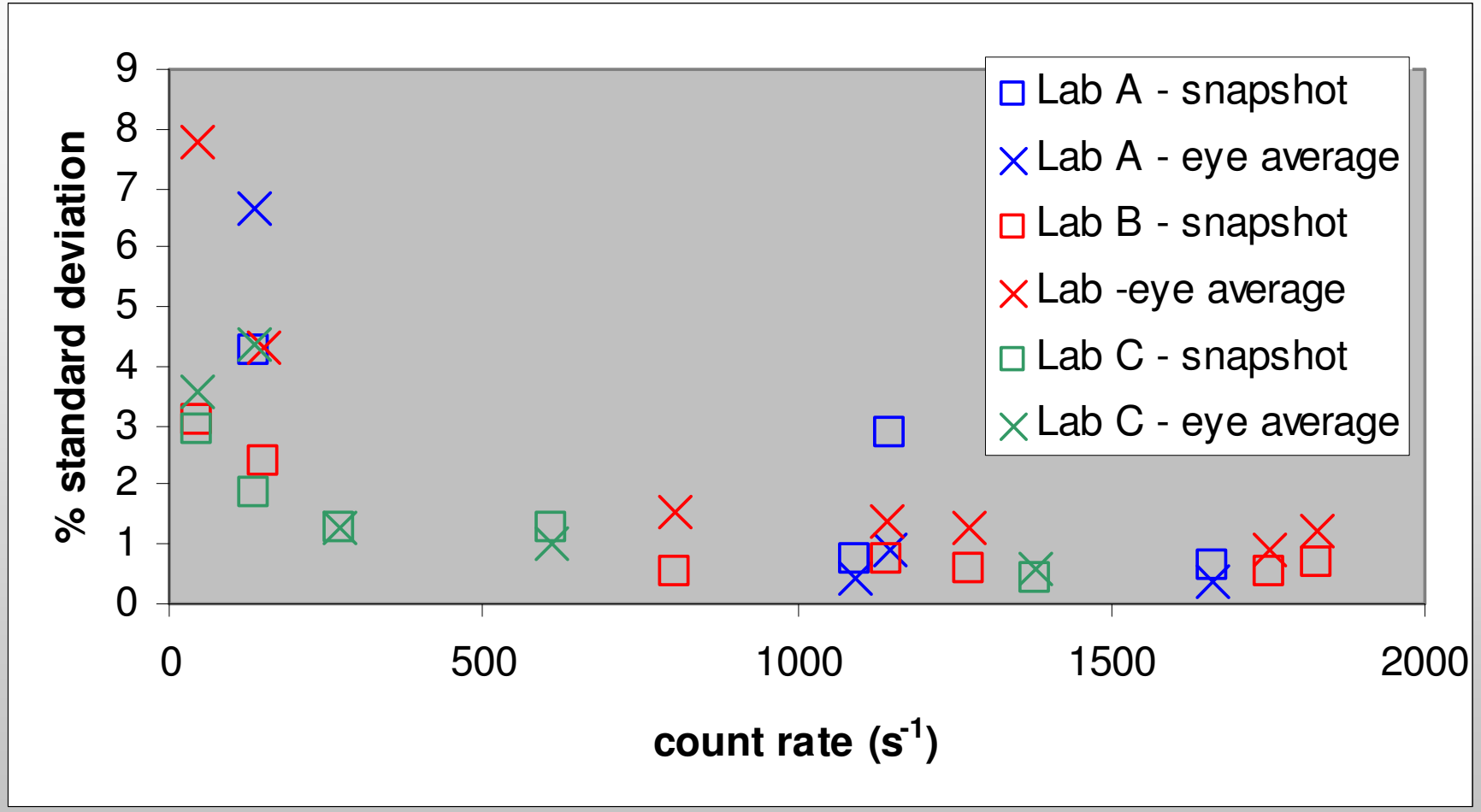
AP5 results


Am-241 (Uncerts at k=2)
Instrument response (emissions)
s-1/(s-1.cm-2)
50
45
40
35
30
25
20
0
1
2
3
4
5
6
7
8
Lab values
Lab Mean (LM)
LM +30%
LM -30%
Thermo Mean (TM)
TM -30%
TM +30%

Comparison of reading standard deviations



Comparison of reading standard deviations



Conclusions

- **Successful comparison**
  - ***Provided required outputs***
  - ***Completed within a reasonable timescale***

    (measurements, report, wash-up)
- **All UKAS-accredited labs have acceptable calibration and testing procedures which are comparable, consistent and traceable**

- **Manufacturers' type-test data are not reliable**
- **Need for a public database of instrument-specific calibration factors** ***(watch this space!)***

Conclusions

- **Scope for reducing overall uncertainties, especially in relation to uniformity of calibration sources**

- **Values in GPG49 are not "gospel"**

- **Eye-averaging technique should be used with caution for calibration purposes (OK for field measurements)**
  - *what is the real distribution?*
  - do all operators exercise same criteria?
  - do operators filter out outliers?

- **CONTINUE COMPARISON PROGRAMME ON AN ANNUAL BASIS**

Next Comparisons

- **SURFACE CONTAMINATION**

  Mini 900 EP15

  Measurements June/July 08

  Normal calibration certificates plus raw data worksheets

  Draft report Oct 08

- **DOSEMETERS**

  Mini 680 + MC20 **ADM300**

  bgd to 10 μGy **bgd to 100 Svh^{-1}**

  Measurements October/November 08

PASS/FAIL Statements on Reports

PROPOSAL

PASS indicates that the measured response factors comply with the type test data at the measured points. However, when the associated uncertainties are taken into consideration, some results may fall outside the 95% confidence limit.