

# A Manufacturers View on the Needs of Testing CBRNE Equipment

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# Brief Introduction to Smiths Detection

- Smiths Detection is a global organisation with major R&D and Manufacturing facilities in the UK, Germany, France and the USA.
- Our CBRNE experience covers:
  - **Chemical** – >30 years  
(hand held to fixed site)
  - **Biological** – > 10 years  
(hand held to full system suites)
  - **Radiological** – > 5 years  
(hand held to system installations)
  - **Nuclear** – > 5 years  
(hand held to system installations)
  - **Explosives** - > 30 years  
(includes imaging and trace detection)



## What Manufacturers Want

- An Appropriate and Fair System of Testing
  - Suitable for the intended application of the equipment.
  - Acceptable universally (ideally globally).
  - Representative of reality:
    - we do laboratory tests because we cannot do real world testing.
    - what is the anticipated real world scenario?
    - why is the test applied in the way it is used?

### ISSUES:

The military / industrial / airport environment has many and extreme variables. Humidity, temperature, altitude, exhaust gases etc.

The number of agents and interferences is rapidly increasing therefore requires a large test matrix which can be very expensive.

**Need to rationalise to be revealing, practical and acceptable.**

## The Key Items

- \*Probability of detection (true positives – algorithms applied)
- \*False alarm rates
- Interferents
- Usability, including cleardown rates.
- Environmental factors
- Safety (e.g. CE marking)
- Maintainability / Supportability
- Reliability
- Cost of Ownership
- Post processing requirement \*
- Time to Result

**Some are important separately but can be interlinked**

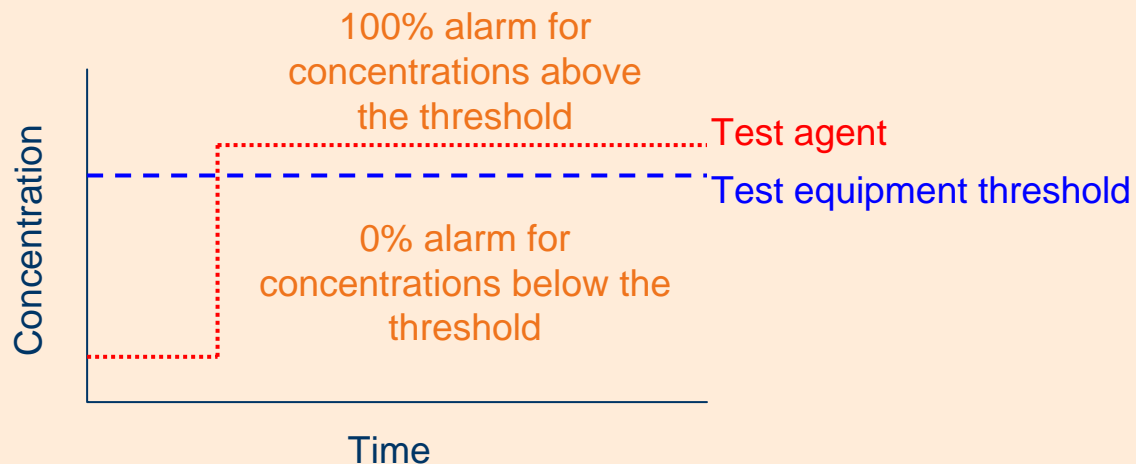
**Reproducibility is required from both the test process and the equipment under test.**

**Getting these right can be the key to success to ensure the tests and equipment used are jointly fit for purpose – this will ensure the customer can trust the results and will then spend wisely.**

## Probability of Detection ( $P_d$ )

- The  $P_d$  is a function of the test sensitivity required.
- Most equipments have a pre-set **threshold** in the supplied software.

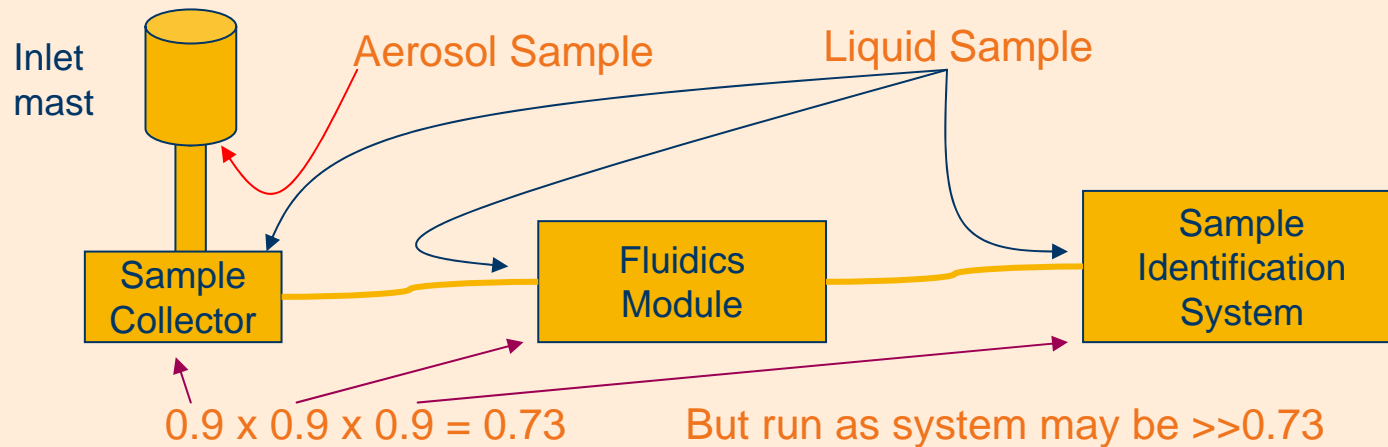
Idealised test and equipment:



**Tests should be at or near the threshold for best data value. A big issue and difficult to achieve due to multiple variances, it implies very tight controls on testing or multiple (more complex?) protocols required.**

## Control of the Test Items

- Calibration methods need to be very well defined.
- Variances across the whole test need to be understood:  
e.g. the effect of interfaces, outputs, reference technologies, **sample variance** and sampling methods applied.
  - VX – breakdown to thiols
  - Biological material - affected by storage, culturing process, life cycle etc.
- Relationship with real world dissemination needs understanding:

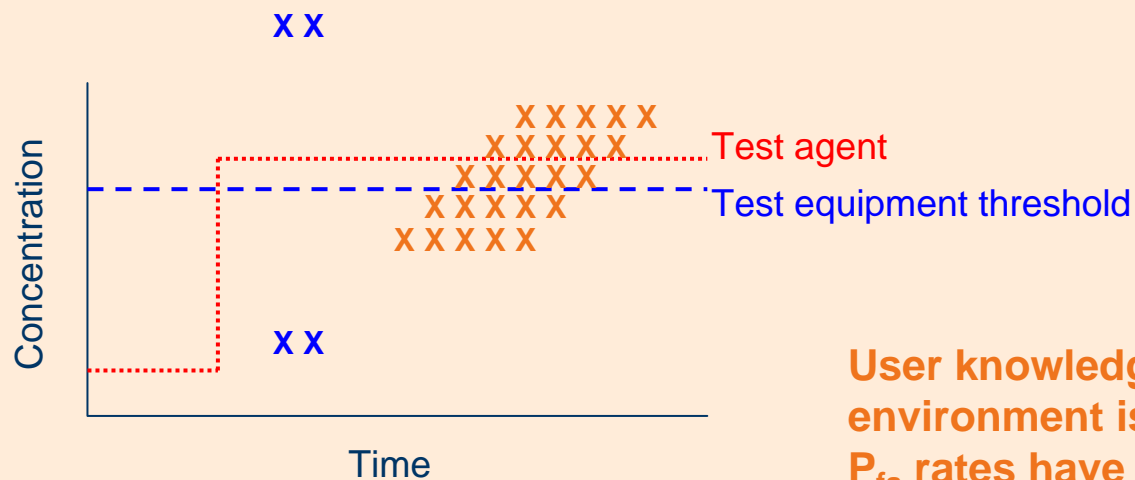


## Test Requirements

- Need to characterise responses across the threshold (not a single point).
- Understand **all** the variances in order to define the accuracy of the characterisation.
- Repeatability essential across all experiments (test equipment, test location, test time) for cost effective comparisons.
- Understand the raw data not just the indicated alarm, but also understand the alarm process.
- Ability to enable a re-analysis process based on the captured raw data.

## False Alarm Rate (Probability of False Alarm [ $P_{fa}$ ])

- From the preceding information the detection should have been characterised, now the  $P_{fa}$  needs characterising.
- Understand the relationship between threshold and  $P_{fa}$ .
- Need the sample itself and the sampling process to reflect reality, e.g. do extreme levels of diesel exhaust or smoke used in tests occur in reality.



**User knowledge of the anticipated environment is essential to ensure  $P_{fa}$  rates have a realistic test.**

## Interferents

- How the  $P_d$ , which should already have been characterised, changes with an interferent.
- Are “Black Samples” indicative of real world scenarios or are these rare extremes / overload?
- Understanding the raw data under a range of conditions allows a better understanding of overall equipment performance.
- Understand the change in  $P_d$  as a function of concentration of test agent and interferent.

## Other Items

- Usability, including cleardown rates.
- Environmental factors
- Safety (e.g. CE marking)
- Maintainability / Supportability
- Reliability
- Cost of Ownership
- Post processing requirement
- Time to Result

**The characteristic of the  $P_d$  function relates to the sensitivity variation with: environment (humidity, vibration, T °C, RH%, altitude etc.), life of the equipment, life of the consumables etc.**

## What Next?

- We need common guidance for all laboratories / test houses to follow this process leading to standardisation of methods and approaches.
- This is difficult to achieve and it is important that we need to work together to reach agreement across communities.
- Big issue items include: different equipment used, chamber / test geometries, sample release methods and equipment, reference test methods, inherent variation in reference sample material (ageing, growth, storage etc). We need to ensure variation across and between sites is minimised.

**Achieving common processes will help move technology forward, provide reassurance to end users and allow better selection by customers of appropriate products to use.**

**Thank you for your attention.**