Proficiency testing (PT) within the routine analytical chemistry laboratory: Dissecting the FAPAS report

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ABSTRACT

To ensure that a laboratory has methodology that is competitive in the market it is essential to continuously challenge the methodology by means of unknown external examination. Proficiency testing can be used in this manner to assess how the methodology used in the laboratory performs. Apart from it being a necessity for SANAS accredited laboratories to participate in proficiency testing to maintain the accreditation status of the laboratory, the results can provide a laboratory with objective external feedback. A satisfactory z-score gives clients great confidence in the results produced by the laboratory. Few proficiency testing providers are available in South Africa that serve the food and feed industry. FAPAS covers the proficiency needs required by the FDA laboratory which include amongst other testing, testing of veterinary drug residues, melamine, mycotoxins and various pesticides in a wide range of matrices. The FAPAS report provides not only z-scores, but useful information on international trends.

INTRODUCTION

As part of the Quality Assurance Program, the FDA laboratory routinely participates in the FAPAS proficiency testing [1] scheme offered by the UK based Food and Environmental Research agency or FERA. When a |z| score is unsatisfactory or ≥2 a corrective action is raised and root cause analysis follows. The report becomes very important during the investigation as it provides an abundance of useful information that enables a participant to benchmark the performance of the laboratory against international laboratories. A recent proficiency test report for analysis of Tetracyclines in Pig kidney [2] will be discussed.

Client Request / Industry Demand → Evaluation of available methodology → Validation of Approved Method against documented policy criteria → Proficiency Testing → Satisfactory Z score ≤2 Method Implemented → QC Criteria Established and Routine Implementation

Unsatisfactory Z-score
Corrective action and investigation initiated
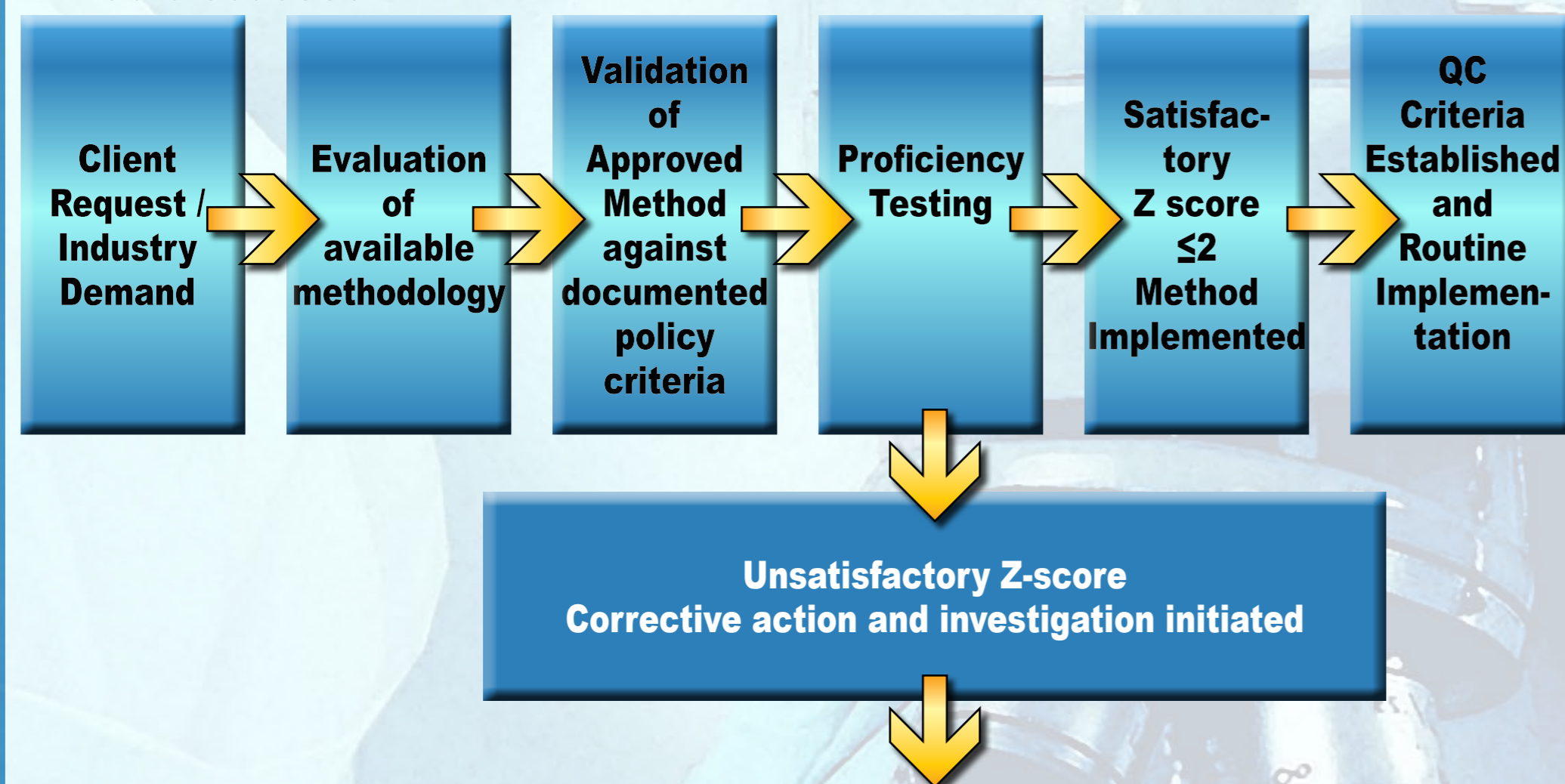
DISSECTING THE REPORT

When an unsatisfactory |z| score is achieved a corrective action within the QC system is raised and a full investigation is undertaken to determine the cause of the problem. During this investigation, the information from the FAPAS report is used as a source of information.

The Test Material
The stability of the analytes is certainly a possibility and inappropriate storage conditions could have had a detrimental effect on the results. The time between the dispatch date and the final date for the submission of the results will supply additional stability data within the matrix.

The Levels
The analytes in the test material are usually present in the testing material below the maximum residue levels (MRL's). The detection levels indicated by the various participants indicate the suitability of the test method used and whether an appropriate technique was used by the laboratory for the combination of analyte/matrix at that particular concentration level.

Other participants
If results are poor for all participants it may indicate an underlying problem with the actual test. This scheme usually attracts a minimum of between 50 and 60 participants globally per test. Statistical analyses of the data are therefore well presented in the final report.

Assigned value
The determination of the assigned value is calculated with the amount of participants included. With a high number of participants reporting, the robust average of all the submitted results are calculated and used as the assigned value [3, 4]. This difference between the concentration level obtained by the laboratory and the assigned value can be used to calculate the uncertainty associated with the method as well as the suitability of the current methodology.

Graphic representation
The |z| score for each compound reported is represented on a bar graph. This visual representation of all the participants brings forth where a participant is in terms of other participants. Figure 1 is a bar graph from test 02228 (FDA laboratory Number 33) for Doxycycline. It is immediately apparent that a number of participants obtained a satisfactory result. Figure 2 is a bar graph for 4-Epitetracycline. It is immediately apparent from the bar graph that a number of laboratories obtained an unsatisfactory result. Valuable information can therefore be obtained regarding the technical capabilities of a particular laboratory.

Methodology
The FAPAS report allows a participant to get an indication of methodology, sample masses, extraction procedures, sample work up and clean-up and determination methods used by the global market. This information can give an indication on trends worth investigating. These parameters are indicated in detail for any laboratory to benchmark its current methodology.
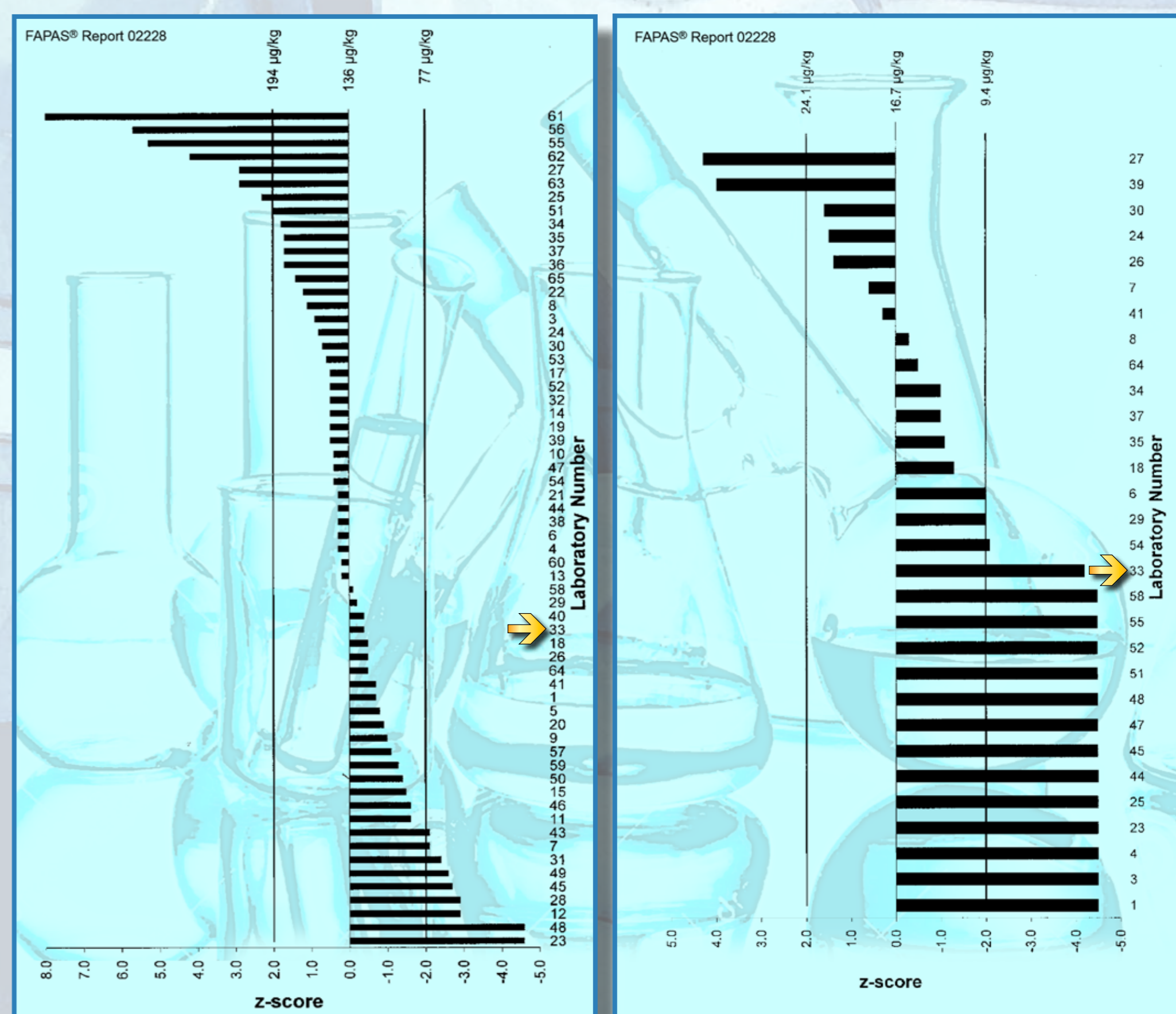

Figure 1. |Z| scores for Doxycycline   Figure 2. |Z| scores for 4- Epitetracycline

CONCLUSION

Participation in proficiency testing is a useful tool in determining if methodology used by a particular laboratory is fit for purpose and if accuracy of results can be guaranteed to the client. The details within the report can be used to benchmark the performance of a laboratory both in terms of its technical capabilities and method suitability. The report can be used as a source of information for the follow-up of an unsatisfactory result. The references sited in the report provide up to date statistical evaluation of data and can direct the laboratory towards sound statistical evaluation tools. [5].

REFERENCES

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5. Thompson, M., 2000, Recent trends in inter-laboratory precision at ppb and sub-ppb concentrations in relation to fitness for purpose criteria in proficiency testing, Analyst, **125**, 385-386