Part 2 API 2000 Flow certification taskgroup work results (final)

Philip E. Myers
PEMY Consulting LLC
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Visit www.pemyconsulting.com for more information or contact phil@pemyconsulting.com

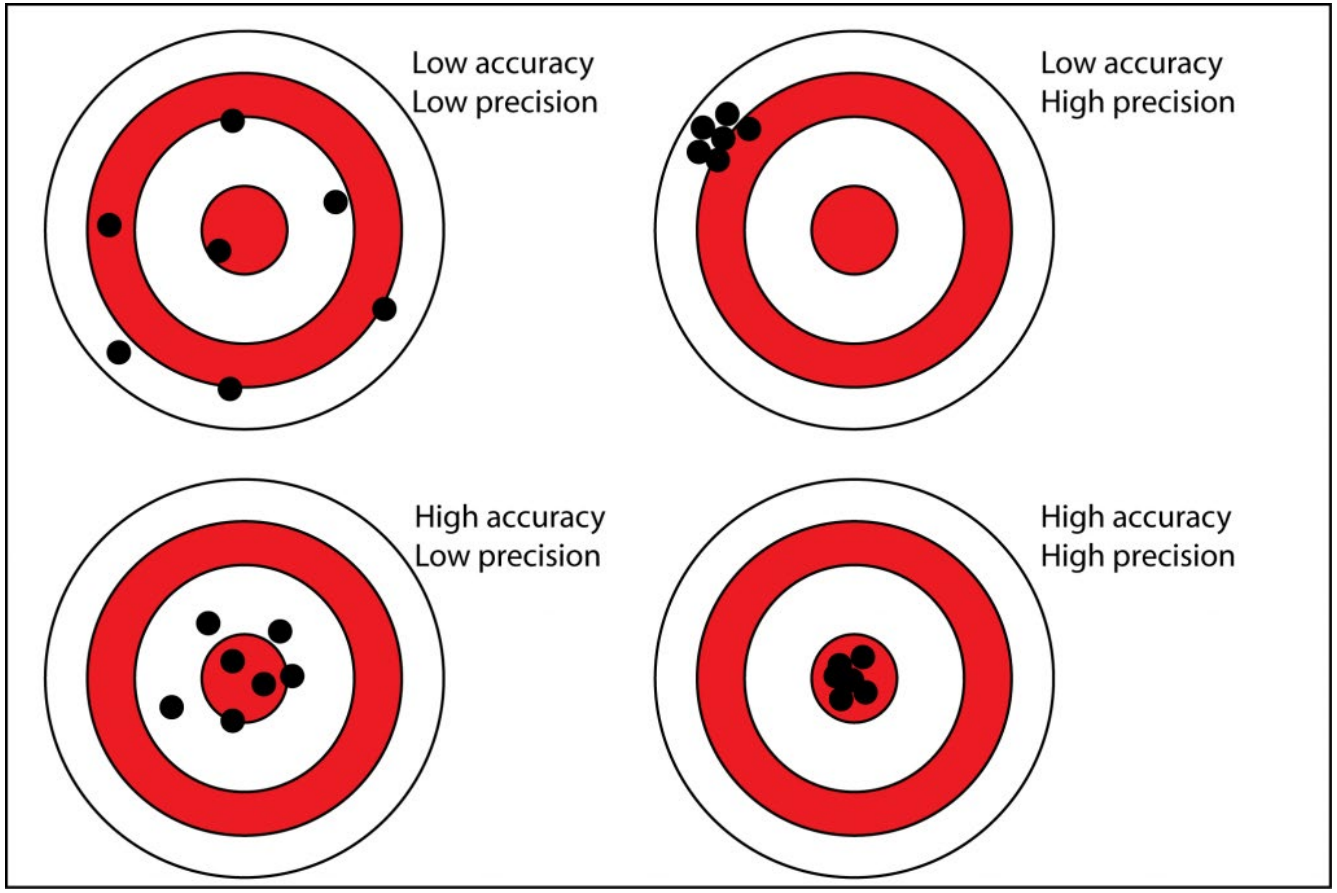
API 2000 Flow Certification Charter

- API 2000 flow certification TG formed to review manufacturer claims as to accuracy of certified flow curves.
- The TG performed informal testing. PEMY Consulting analyzed the data and found significant variances in the performance.
- This prompted the TG to seek help from ASME and possible API funding to correct this problem.
- Part 1 white paper documents the data, the issues, and the results of the testing.
- Part 2 (the second white paper) provides insights and guidance about what future steps short of doing nothing are possible to improve the flow certification process for API

The 2 white papers written about the TG work

- There are 2 white papers:
  - Part 1: Four vendors submitted complete data. After analyzing these data, we found that flow rates measured by the four vendors under identical conditions of inlet pressure and orifice diameter differ by -8.7% to 6.2% . Disparities of this magnitude cast doubt on the reliability of vendors' sizing tables.
  - Part 2: Described in this presentation
  - All data (sanitized), test results, data analyses are on github at
  - https://github.com/rbitip/Public-API-2000-Flow-Certification-Testing
  - This is a public domain site free of charge and all detailed information can be downloaded from it

Precision and Accuracy



Lab measurements are ***precise*** if:

- Replicate measurements of the same thing by the same lab are in good agreement
- Measurements of the same thing by different labs are in good agreement.

Lab measurements are ***accurate*** if they are both precise and are close to ***reference standards***.

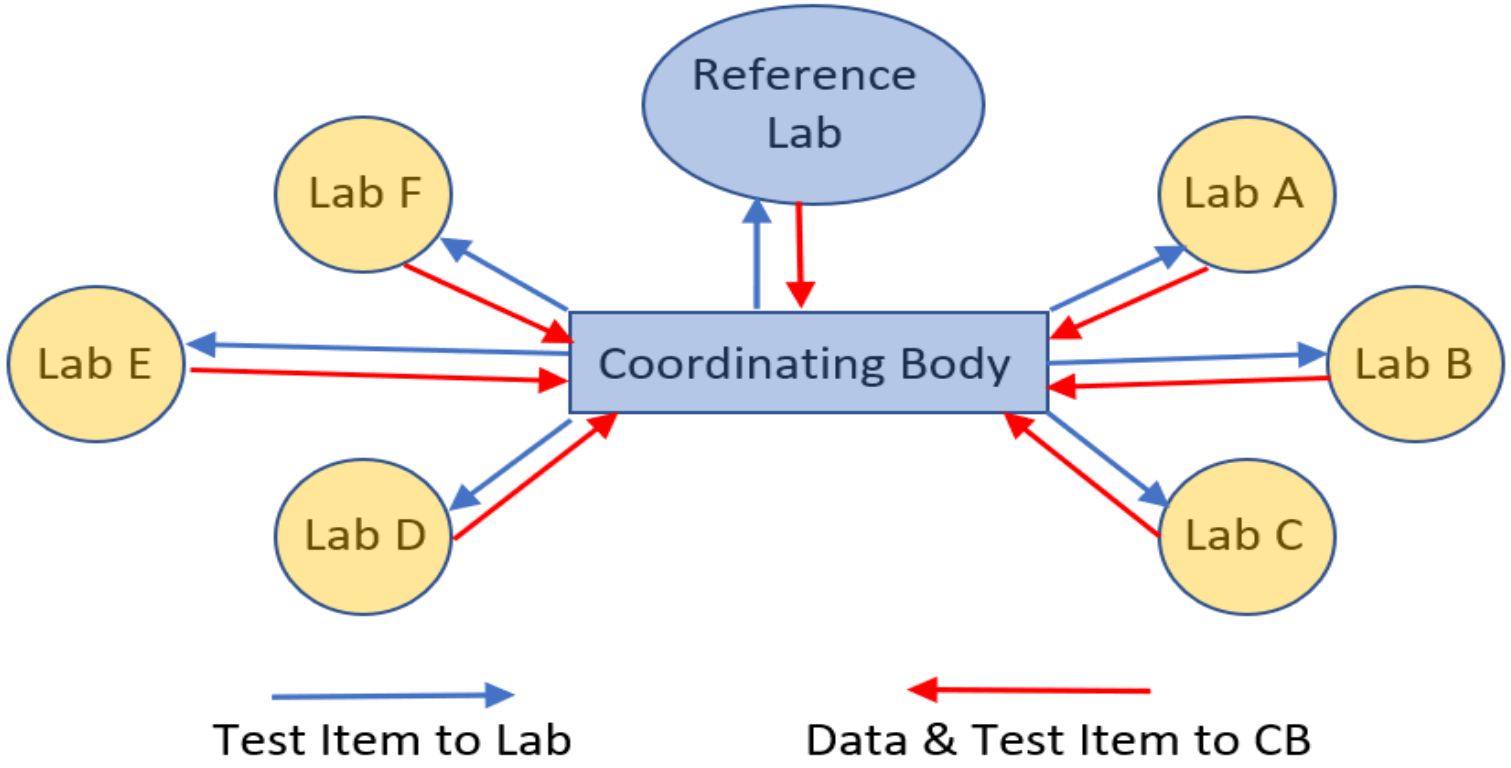
- One way to develop reference standards might be sending test specimens such as the nozzles used in this Flowrate Taskgroup study to a ***reference laboratory***.

ISO 13528:2015 Statistical methods for use in proficiency testing by interlaboratory comparison :

A coordinating body (CB) sends a test item to a reference lab for testing.

The CB sends the item (or a replica) to each participating lab (PL) for subsequent testing. PL must run each test at least twice to allow CB to compute PL's precision.

CB evaluates the returned test/retest data and issues a performance report to each PL.



Two methods

$$Z_{pt} = \frac{\left(X_{pt} - X_{ref}\right)}{\sqrt{\sigma_{pt}^2 + \sigma_{ref}^2}} \quad \text{and} \quad D_{pt}^{\%} = 100 \cdot \frac{\left(X_{pt} - X_{ref}\right)}{X_{ref}}$$

where

X_{pt} = measurement report of participating lab

X_{ref} = measurement report of reference lab

σ_{pt} = test-retest standard devition of participating lab

σ_{ref} = test-retest standard devition of reference lab

Report Type 1: Z-score report

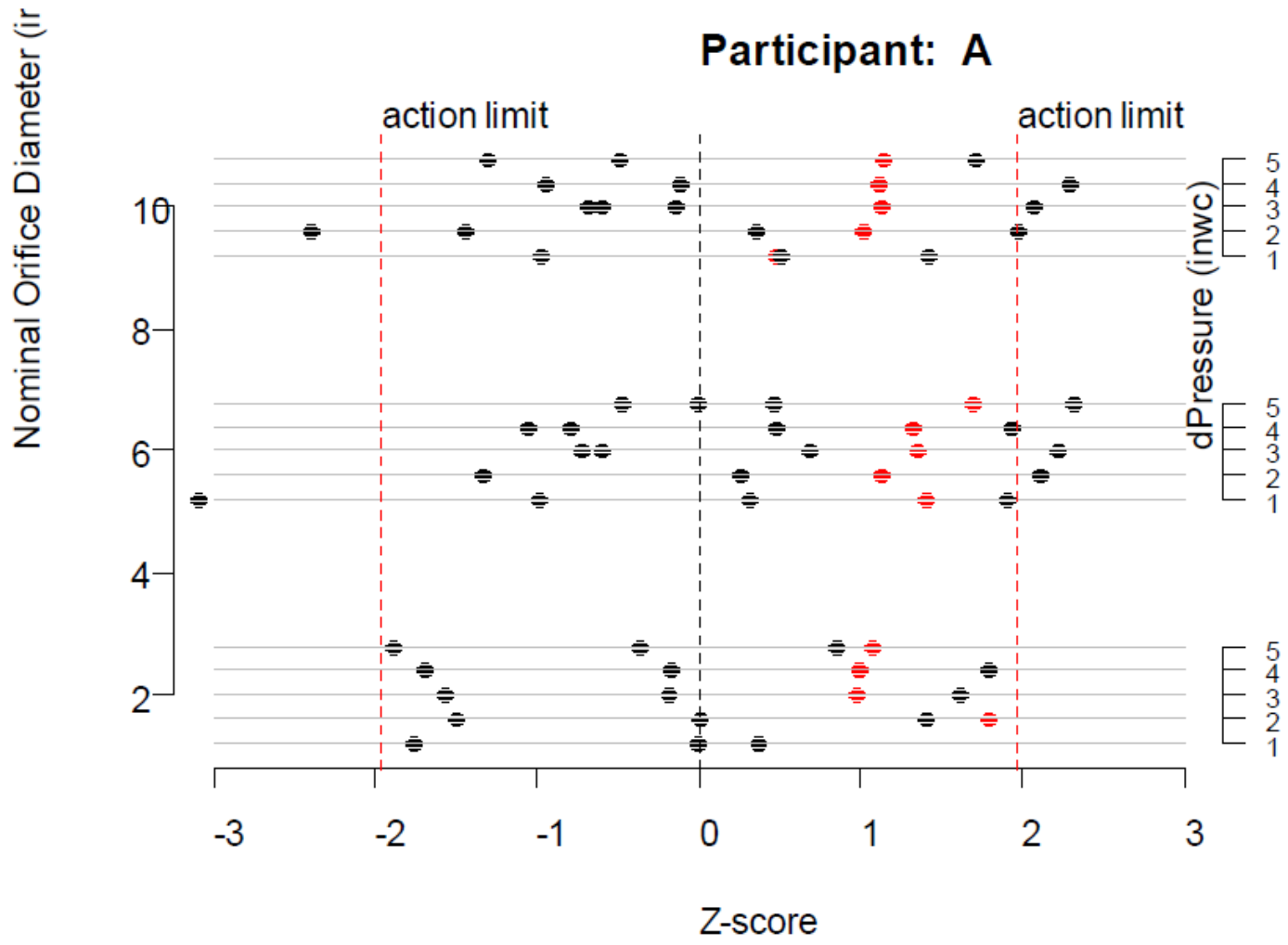


Figure 1 Z-value Report

Report Type 2: Percent Deviation Report

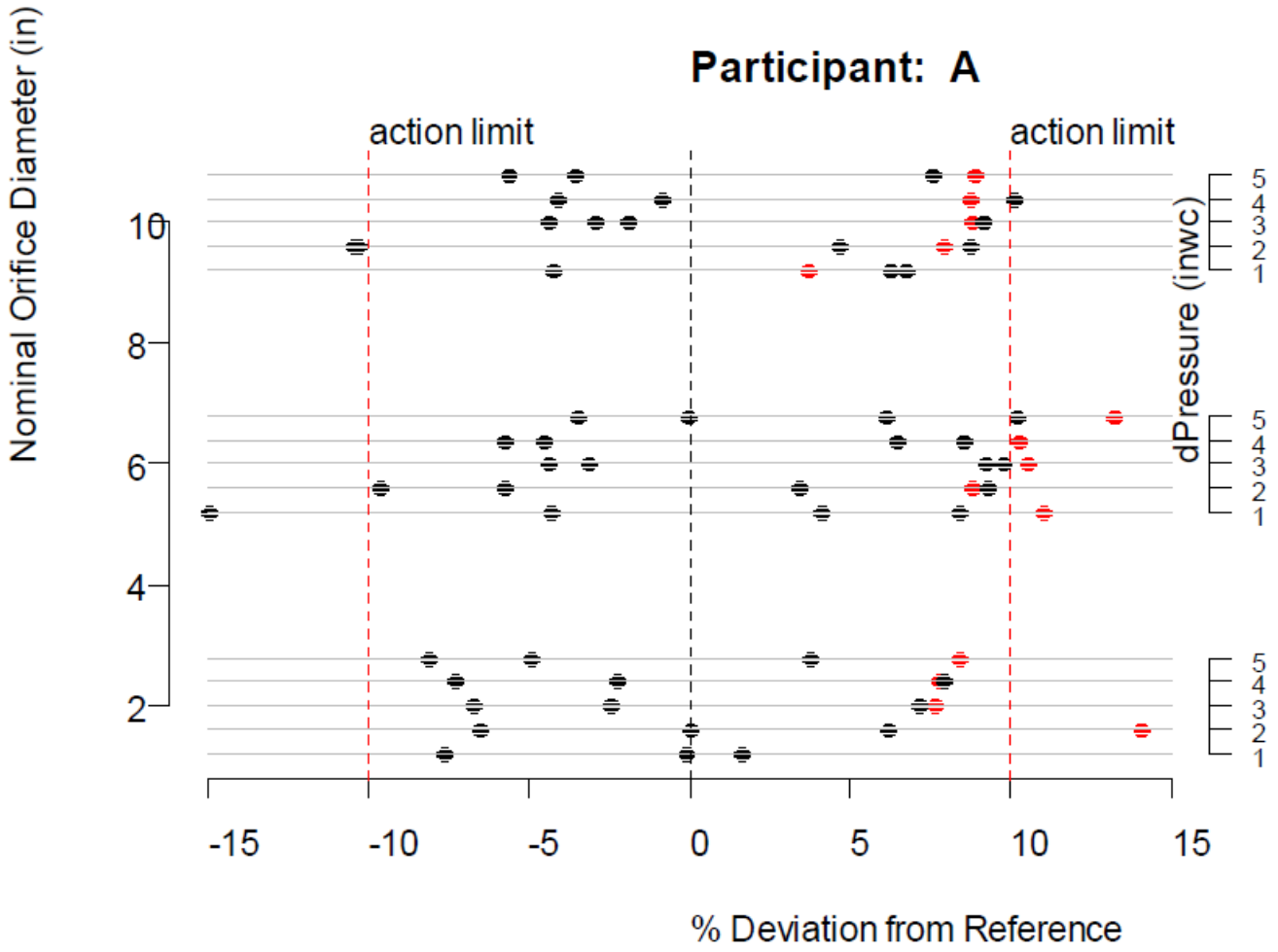


Figure 2 % Deviation Report.