The U.S. EPA/NIST Program to Phase-Out Mercury-in-Glass Thermometers Used in Industrial and Laboratory Applications

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Abstract

In 2006, the Quicksilver Caucus, a coalition of State environmental associations, requested that United States government agencies and standards organizations collaborate together to reduce the industrial and laboratory use of Hg thermometers.

• ASTM International found over 850 standards with references to Hg thermometers.
• NIST and the EPA are providing science-based support to assist in the transition of ASTM standards to allow for the use of alternative thermometers.

As part of that support, the EPA and NIST completed a pilot study to phase out the use of Hg thermometers in petroleum field activities.

• A NIST developed protocol to compare Hg and alternative thermometers was implemented at two petroleum product distribution terminals.
• Observations from these tests provided valuable information for understanding measurement differences encountered in the field.

Outcomes from the EPA and NIST work

Web-based user-friendly guidelines
- Replacement of Mercury Thermometers
- Selecting Alternatives to Mercury-Filled Thermometers
- Verification Methods to Alternatives to Mercury-Filled Thermometers
- Non-Mercury Thermometers for Validating Autoclave Operating Temperatures
- What is Traceability?

Web-based videos
- Alternative Thermometers
- Ice Melting Point
- Steam Point
- Traceability

Alternative thermometer testing
- Intrinsically-safe alternative thermometers field tested at two Refined Product Terminals (RTPs)

Repeatability testing protocol performed at NIST
• Thermometers cycled through full calibration cycle 3 times
• Measurements performed by two NIST metrologists
• Temperature range of –21 C to 99 C

Phase I: NIST Laboratory Results

Phase II: Field Testing of Protocol and Thermometers

Protocol to field-test thermometers at RTPs
• Measurement instructions and data-collection worksheets
• 8 measurement sets performed once per week
• Feasibility of different technicians measuring several thermometers
• Survivability of transfer standards (e.g. thermometers)
• Different measurement conditions
  - Time of day / night
  - Gasoline and Ethanol
  - Weather conditions

Thermometers Tested at RTPs

- Organic
- Digital

Notes From the Field

Thermometer field measurements needs improvement
• Analog Thermometers
  - RPT-1: ±0.6 C field measurement resolution
  - RPT-2: Drain time only 5 minutes for Organics
• Digital Thermometers
  - RPT-1: results reflect staff training issues
  - RPT-2: results reflect NIST & EPA metrologists capabilities

Digital thermometer manufacturers need to solve various issues
• Ergonomics, EMI, Training tutorials – online videos