



Application Note #1803

Handheld XRF Screening of Mercury Contamination in Oil & Gas Processing Equipment, Vessels & Storage Tanks

Mercury (Hg) occurs naturally in virtually all crude oil. This is true for both unconventional resource plays and conventional plays. Concentrations in reservoirs vary from low part per billion (ppb) to low parts per million (ppm). Hg in crude oil is typically elemental and/or an inorganic compound such as mercuric sulfide. Unfortunately, these Hg compounds tend to accumulate in process equipment, vessels and storage tanks over time.

This accumulation not only poses maintenance concerns for corrosion, catalyst poisoning and liquid metal embrittlement (LME); but, unchecked Hg may harm workers and the environment by escaping into the atmosphere, ground and marine ecosystems. A worker's health and safety is especially vulnerable through volatile sources, surface contamination and particulate contamination during hot work such as welding and cutting. A direct impact to decommissioning workers who dismantle, remove and dispose of systems is of particular concern.



Bruker's S1 TITAN 800 or 600 XRF is ideal for fast and straightforward Hg contamination screening in a preventative maintenance program.

Assets exposed to Hg must be decontaminated

Although Hg can start at low ppm or ppb levels in feedstock, it can develop into much higher concentrations over time in process streams, vessels and storage tanks. Costs associated with decontamination of equipment can be significant. Consequently, it is important to screen for mercury contamination as part of a regularly scheduled preventative maintenance program.

Bruker's S1 TITAN 800 or 600 handheld XRF offers a quick and cost effective way to determine Hg levels in equipment. Two measurement options are available. The *Alloy2*

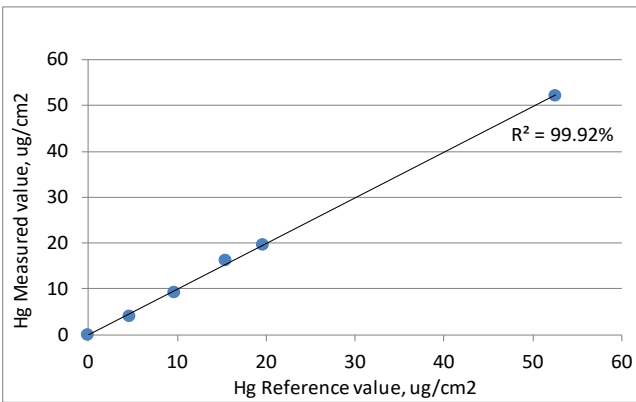
Multimatrix calibration provides quick pass/fail screening and can report mercury as % weight or ppm concentrations. The *Hg Coatings* calibration provides the precise amount of Hg based on Hg coating reference samples and reports Hg as coating weight ($\mu\text{g}/\text{cm}^2$).

Mercury is always a surface contamination, which makes the coating weight analysis the best way to analyze mercury in process equipment. S1 TITAN models 800 and 600 are capable of detection limits of Hg at less than $1 \mu\text{g}/\text{cm}^2$.

Measurement	Hg, $\mu\text{g}/\text{cm}^2$
1	9.24
2	9.17
3	9.75
4	9.54
5	9.23
6	9.52
7	9.79
8	9.48
9	9.68
10	9.29
Average	9.47
Ref. VAlue	9.70
STDEV	0.23

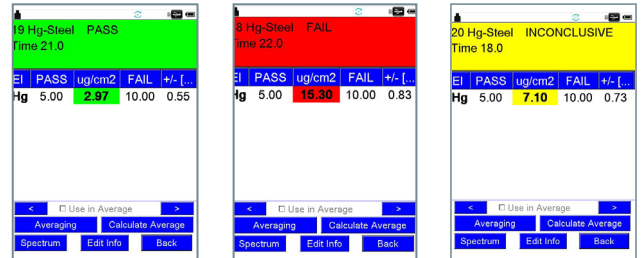
S1 TITAN 600 repeatability using coatings calibration

Correlation of Hg Reference Samples



Correlation of NIST Traceable Hg Reference materials using S1 TITAN 600

Hg Pass/Fail/Inconclusive Action Limit Results Screens



Example:
PASS results for
Hg contamination
screening with
HHXRF

Example:
FAIL results for
Hg contamination
screening with
HHXRF

Example:
INCONCLUSIVE
results for Hg
contamination
screening with
HHXRF

S1 TITAN 800 or 600 users can set up pass/fail/inconclusive action limits

Fast, Cost Effective Handheld XRF to Screen for Mercury (Hg)

Advantages

- Fast, accurate assay
- Intuitive user interface
- Quick & easy report generation
- Secure encrypted data storage
- Lightweight - only 1.5 kg / 3.3lbs, including battery
- Non-destructive
- Measure in-situ
- Analyze hot samples / pipes

Features

- Rh 50kV excitation source
- Automated 4 filter wheel
- High resolution SDD detector
- TITAN Detector Shield™
- 8, 5 or 3mm spot size
- SharpBeam™ Optimized Geometry
- Optional camera
- IP54 rated
- Operating temperature of -10°C to +50°C
- Multiple fields for sample identification
- Data may be stored in internal instrument memory and/or a USB flash drive



Bruker's S1 TITAN 800 and 600 Handheld XRF models can be equipped for mercury analysis

Fast, straightforward screening for Hg in process equipment

Bruker's battery operated S1 TITAN 800 or 600 Handheld XRF can be preset with action limits to provide results as a simple "PASS" or "FAIL". Additionally, they can provide the precise amount of mercury based on Hg coating reference samples, reporting mercury as coating weight in $\mu\text{g}/\text{cm}^2$.

Summary

Although Hg can start at low ppb/ppm levels in feedstock, it can develop into much higher concentrations over time during processing, transport and storage. Costs associated with decontamination of equipment can be significant. Consequently, it is important to screen for mercury contamination as part of a regularly scheduled preventative maintenance program. Bruker's handheld S1 TITAN 800 or 600 XRF offers a quick and cost effective way to determine Hg levels in equipment.



Intuitive touchscreen user interface for operation and results

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