

### Using Atomic Fluorescence Spectrometry for the online determination of Mercury (Hg) in Oil, Gas & Petrochemical Process Streams



It has never been more important to understand the fate of Hg in all aspects of oil and gas exploration, refining and production. The corrosive nature of Hg reacting with aluminium; the fate of Hg within a process itself; the concentration of Hg in feedstock's that could destroy expensive catalysts; as well as the OH&S concerns that Hg poses are, of course, well documented and are often a key driver in operational decisions. For these reasons much effort is spent on Hg removal technology and PSA partners with many companies to monitor and help manage this Hg removal process. This partnership happens from the research bench through to production with PSA taking a pivotal role in ensuring successful removal technologies are deployed in the real world.

Extreme instrument sensitivity (ng/m<sup>3</sup>) is an analytical requirement and so this presents challenges during both the sample collection and analysis stages. Indeed, **ASTM D6350 and ISO 6978 part 2** methods are followed to determine the total mercury concentration in natural gas streams down to 1 ng/m<sup>3</sup>.

Coupling **Atomic Fluorescence Spectrometry (AFS)** with effective sample collection modules has been PSA's core competency for over 35 years and we offer powerful analytical tools to help production facilities maintain safe and efficient working environments.

### Sample Matrices – Hg in Gases & Liquified Streams

- Natural Gas
- Sour Gas
- Fuel Gas
- LNG
- Ethane
- LPG
- Butane
- Ethylene
- Propylene
- Hydrogen
- Carbon Dioxide
- Syngas

### Sample Matrices – Hg in Liquids

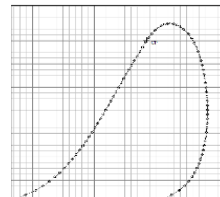
- Condensates (stabilised and unstabilised)
- Naphtha (heavy and light)
- Liquid Feed Stocks
- Produce and Wastewater

### Product Selection for Online Systems

Selecting the correct sampling system and overall analytical configuration may be a daunting task. The step by step process is as follows;

#### 1. Scope

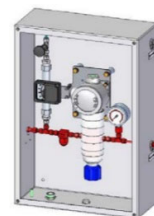
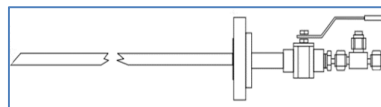
In the initial stages we ask lots of questions regarding the sample composition. Phase calculations are carefully considered in order to offer the correct instrument configuration. PSA guides you through the scoping process provided with a full technical proposal along with all associated documents.



#### 2. Sample Transfer & Conditioning

##### Probes, Transfer Lines & Primary Pressure Reduction

Typical probes include direct insertion as well as membrane probes (to reject moisture) and a primary pressure reduction step is often required for gas sampling of high-pressure streams or liquified gases prior to further handling



##### Sample Conditioning Zone 1 Hazardous Area ATEX / IECEx Dual Certified

Both gas and liquid samples require management prior to analysis to ensure the sample is a representative one and that the temperature and pressure conditions are suitable for successful mercury determination.

For gases, a representative sample is normally achieved using both a heated pressure reduction stage with a controlled speed loop



Hydrocarbon liquids are injected into a flash vaporisation chamber (@400°C) with the resulting vapour being carried to the analyser.

### 3. Hg Analysis in Gases and Liquids



Having passed through the sample conditioning process the Hg is carried to the AFS detector. During the detection process, mercury is collected on a gold trap (amalgamation) which allows effective analyte concentration for total Hg whilst removing the sample matrix.



Since AFS provides for low absolute detection limits (approaching 0.1 pg), these methods avoid difficulties associated with prolonged sampling time.

- **All systems include;**
  - Explosion proof purged analyser cabinets
  - Stream selector module to allow for multiple sample and calibration streams.
  - Automated Hg Calibration
  - Sir Galahad AFS with dual amalgamation
- **Key User Benefits;**
  - Full automation of sample collection and analysis
  - Wide dynamic range
  - Low carryover – no flow cell
  - Robust
  - Easy to use and maintain

### 4. Turnkey Solutions



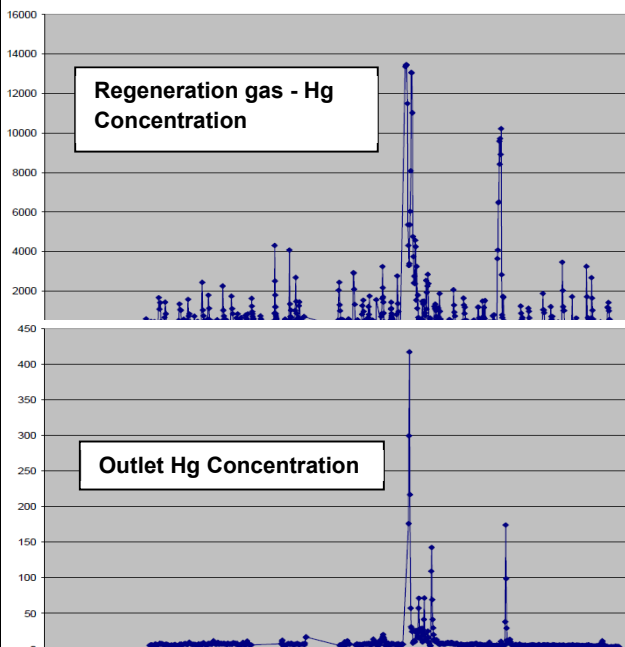
- Preassembled in skid form
- Rapid installation
- Permanent or semi-permanent installations
- Liquids and Gases

### Consulting Services

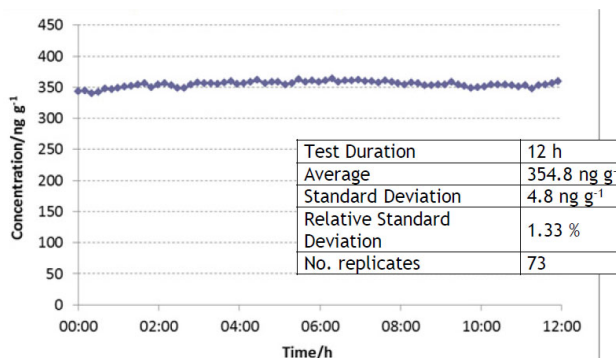
PSA offers independent Hg surveys and consultancy services to establish and verify results across a plant or process. We perform mass balance studies for natural gas processing plants, liquid extraction processing plants and petrochemical plants. Mercury occupational exposure studies and the deployment of mercury management plans are also provided using our team of mercury experts.

### Real World Data

Typical data for a Gas Plant Hg removal process showing Regeneration gas and MRU and Outlet Mercury Concentrations (ng/m<sup>3</sup>)



Typical results for a Natural Gas Condensate



For Further Details

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