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**Question 48: In your experience, what is the preferred online (non-destructive) method to identify risk of HIC (hydrogen induced cracking) in gasoline processing units?**

**Alec Klinghoffer (Coffeyville Resources)**

The preferred method of identifying the risk of hydrogen induced cracking is to measure the permeation or flux of hydrogen on the outside surface of the equipment and correlate this to the corrosion rate on the inside of the pipe. There are several manufacturers of this type of equipment where a probe is attached with straps or a magnet and the flux of H<sub>2</sub> is measured at the pipe surface. The small, portable equipment is equipped with a highly sensitive H<sub>2</sub> analyzer. The sensor registers the concentration of H<sub>2</sub> in the air stream. Since H<sub>2</sub> is highly diffusible in air, the background level of H<sub>2</sub> is usually low and stable and therefore the increase in H<sub>2</sub> in the air stream is a dependable way of measuring hydrogen at the surface. The apparatus uses correlations to determine the corrosion rate on the inside of the pipe or vessel. The advantages of these analyzers are that they are portable and dependable, the work for temperatures up to 1100F, are intrinsically safe, collect data in “real time” and are reliable. Fixed monitors are also available. Typically, these types of analyzers collect data in a small amount of time and can calculate corrosion measurements in minutes.

**Greg Harbison (Marathon Petroleum)**

If the expected damage mechanism could result in hydrogen blistering, hydrogen induced cracking (HIC), or stress-oriented hydrogen induced cracking (SOHIC) our experience has shown that automated ultrasonic (AUT) scan is the most beneficial in identifying, mapping, and sizing the damage to pressure vessel walls. In some instances, we have utilized portable hydrogen permeation probes as a precursor inspection to identify areas of high diffusible hydrogen activity to prioritize the AUT inspections.

**John Clower (Chevron)**

Shear wave may be used for external measurement of HIC but will not always find existing problems. If HIC is suspected, the best practice for detection would be an internal inspection using surface eddy current.

**Paul Fearnside (Nalco Company)** In gasoline processing units analyzing for any cyanide related corrosion byproducts (Prussian Blue) would be recommended. If found the first step would be to make sure the upstream units, i.e., FCCU and/or Coker, gascon water washes are performing up to industry best practices to reduce/eliminate the corrosives that generate the monatomic hydrogen responsible for

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the HIC. Once that has been done, then specialized filming amines and metal passivators have been used successfully to control the HIC potential.

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