



H2S Exposure of STD Equipment

MSI Technical Bulletin 034

Subject: Information and recommendation regarding exposure of STD equipment to H2S.

The National Association of Corrosion Engineers (NACE) publishes a document (MR0175) that provides guidelines for material selection for use in sour wells. In very general terms, an H2S partial pressure of 0.05 psia (pounds per square inch, absolute [absolute pressure = gauge pressure + atmospheric pressure]) or greater means the well is sour. According to API 6A, carbon steels used for contact with the sour fluid or gas must meet the conditions of MR0175. One of those conditions is the hardness of the steel shall not exceed 22 HRC. Hardness is a primary factor that distinguishes MSI sour and non-sour service equipment.

When high strength steel with hardness of greater than 22 HRC (STD service) comes in contact with H2S, there is increased potential for the steel to be negatively affected by free hydrogen and sulfur. Again, NACE states this effect becomes detrimental at an H2S partial pressure of 0.05 psia or greater. If STD equipment comes in contact with H2S at greater than 0.05 psia, it must be assumed that some level of attack on the metal has occurred. The effects of this attack may not be noticeable by normal inspection techniques because it occurs at an atomic level, can produce microscopic cracks, and is usually on an internal surface that is not readily accessible. As such, any equipment which does not comply with NACE MR0175 and has been exposed to H2S, has potential for rapid and unexpected (unpredictable) failure.

Below is an excerpt from NACE MR0175 Part 2, Annex A which provides some guidelines for conditions where materials that do not comply with NACE come in contact with H2S.

A.2.3.2.3 Drilling, well construction and well-servicing equipment exposed only to drilling fluids of controlled composition

Given the high strength often needed, drilling equipment might not comply with ANSI/NACE MR0175/ISO 15156 (all parts). In such cases, the primary means for avoiding SSC is control of the drilling or well-servicing environment. As service stresses and material hardness increase, drilling-fluid control becomes increasingly important. Care shall be taken to control the drilling environment by maintenance of drilling-fluid hydrostatic head and fluid density to minimize formation-fluid in-flow and by the use of one or more of the following:

- a) maintenance of pH 10 or higher to neutralize H2S in the drilled formation;*
- b) use of chemical sulfide scavengers;*
- c) use of a drilling fluid in which oil is the continuous phase.*

Given the potential for catastrophic and unpredictable failure when STD service equipment has been exposed to H2S, MSI's recommendation is to remove the affected equipment from service. Spot checks and sampling are not effective to determine if damage has occurred since any and all exposed surfaces are at risk.

You may contact an MSI representative at sales@diwmsi.com or engineering@diwmsi.com if you have any further questions or concerns.

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