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EXTENDED ABSTRACT

Effectively removing mercury contamination in Oil and Gas Exploration and Production systems

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Objectives

Mercury is a highly toxic, naturally occurring element encountered in various chemical and elemental forms throughout nearly all Oil and Gas production and processing systems.

The Presence of mercury creates substantial health, safety and environmental issues that reduce efficiencies in maintenance activities and considerably add to costs in demolition.

The decontamination of mercury from the facilities during maintenance activities will eliminate the risk of mercury exposure during confined space entry and hot works. Eliminating mercury risk also increases efficiencies during peak maintenance activities as extra precautions are not required such as substantial personal protective equipment and delays caused by elevated atmospheric mercury requiring further preparation and increased costs.

The key objectives of the study and chemical investigation were:

1. To produce enhanced chemical formulations with modified surface reagents that are effective in cold water
2. Develop a process to remove mercury mass at near total or total removal
3. Address the challenges of disposal and treatment of mercury waste.

Methods

Mercury decontamination trials were conducted on oil and gas processing equipment that was either 1) equipment scheduled for decommissioning or 2) high value equipment for re-use. Verification of difference between initial and final mercury mass loading was measured by portable XRF instrumentation.

The chemicals were modified for the mercury mass loading and different lengths of time were investigated. Analysis results were used to determine initial levels of contamination and pre-determined points within the system. Continuous analysis was used to monitor mercury saturation levels in the solution, until spent.

Samples of the decontaminated metal were sent to laboratories for confirmation of decontamination.

Results

By utilising cutting edge and low toxicity chemicals, the trials were able to remove the mercury up to 99%. The result was the most effective chemical decontamination and decommissioning technologies were developed and tested while retaining the integrity of the equipment and metals. The chemicals were able to have similar results across low temperatures required for offshore equipment. The chemicals were able to be regenerated for future mercury removal and the concentrated mercury waste was disposed of as hazardous waste.

Conclusions

Studies of mercury accumulation in metals (carbon and stainless steels) have led to an improved understanding of mercury distribution and accumulation in hydrocarbon processing systems. This has been applied to the development of improved chemical decontamination and waste minimisation techniques used during chemical decontamination of contaminated process systems and in the decontamination of downhole equipment during well intervention operations.

The outcomes benefit the environment and people who are maintaining plant and equipment that previously was mercury contaminated. Other commercially available mercury reduction methods are available however they focus on reducing the atmospheric levels of mercury and blanket solutions that can be very costly. This technology is transferable to other industries that contain mercury contaminated equipment, examples gold mining, paper milling, coal power stations,

Keywords

Mercury, mercury exposure, exposure assessment, risk reduction, environmental risk reduction, oil and gas, chemical decontamination, hazardous waste management.