PROCESS, METHOD, AND SYSTEM FOR REMOVING MERCURY FROM PIPELINES

TECHNICAL FIELD

[001] The invention relates generally to a process, method, system, and management plan for removal and control of heavy metals such as mercury accumulating on pipes.

BACKGROUND

[002] Heavy metals such as mercury can be present in trace amounts in all types of produced fluids such as hydrocarbon gases, crude oils, and produced water. The amount can range from below the analytical detection limit to several thousand ppbw (parts per billion by weight) depending on the source. Mercury has been predominately managed with mercury removal adsorbent beds in facilities handling hydrocarbon gases, and by operationally managing mercury with mercury specific personal protection equipment ("PPE") and procedures.

[003] Some gas processing facilities may operate for extended periods of time, e.g., years, before mercury is detected in the inlet facilities. It is known that mercury slowly accumulates in the flowlines from the wells to the gas processing facilities via adsorption. Once the flowlines become "saturated" with mercury, mercury will "breakthrough" and be detected at the inlet facilities. After "breakthrough," the rate of rise in mercury at the inlet facilities can be low, giving some notice time to implement a solution.

[004] There is a need for a management scheme to/ leverage the flowline adsorption capacity to manage, control, and remove mercury in produced fluids from a reservoir, e.g., gas, crude, condensate, and produced water.

SUMMARY

[004a] In one aspect, there is provided a process for producing a produced fluid having a reduced concentration of mercury from a pipeline, comprising: transporting a produced fluid containing mercury along the pipeline for a sufficient amount of time for the mercury to accumulate in the pipeline as elemental mercury, mercury sulfide and combinations thereof, wherein the sufficient mercury accumulates on the pipeline for the produced fluid to reach a first mercury concentration at a check point downstream from an entry point of the produced fluid into the pipeline; stopping the transport of the produced fluid in a section of the pipeline; injecting a leading pig into the pipeline, wherein the leading

pig is equipped with any of a laser tool, an induction coil, and a combustor capable of treating a section of the pipeline by heating and maintaining an interior surface temperature of the section pipeline of at least 300°C for at least 5 seconds; vaporizing at least a portion of the elemental mercury accumulated on the pipeline; decomposing at least a portion of the mercury sulfide on the pipeline as elemental mercury in vapor form; providing a gas flow to capture the elemental mercury in vapor form; resuming flow of the produced fluid; and recovering the produced fluid having a mercury concentration of less than 50% of the first mercury concentration at a location downstream from the treated section.

[004b] In one aspect, there is provided a process for removing mercury accumulated in a pipeline, comprising: providing a pipeline having mercury accumulated on the pipeline as elemental mercury, mercury sulfide and combinations thereof, wherein the mercury accumulates on the pipeline has a first mercury concentration; injecting a leading pig into the pipeline, wherein the leading pig is equipped with any of a laser tool, an induction coil, and a combustor capable of treating a section of the pipeline by heating and maintaining an interior surface temperature of the section pipeline of at least 300°C for at least 5 seconds; vaporizing at least a portion of the elemental mercury accumulated on the pipeline; decomposing at least a portion of the mercury sulfide on the pipeline as elemental mercury in vapor form; providing a gas flow to capture the elemental mercury in vapor form; and capturing the elemental mercury in vapor form for treatment by any of condensing, adsorption, absorption, and combinations thereof; wherein a mercury concentration on the section of the pipeline after treatment is less than 50% of the first mercury concentration.

[004c] In one aspect, there is provided a process for producing a produced fluid having a reduced concentration of mercury from a pipeline, comprising: transporting a produced fluid containing mercury along the pipeline for a sufficient amount of time for the mercury to accumulate in the pipeline as elemental mercury, mercury sulfide and combinations thereof, wherein sufficient mercury accumulates on the pipeline for the produced fluid to reach a first mercury concentration at a check point downstream from an entry point of the produced fluid into the pipeline; stopping the transport of the produced fluid in a section of the pipeline; injecting a leading pig into the pipeline; injecting a composition comprising an aqueous sulfidic solution comprising at least 0.1 wt. % of any of a sulfide, a polysulfide, and combinations thereof, forming a first slug at rear of the leading pig, wherein the aqueous sulfidic solution reacts with elemental mercury accumulated on the pipeline along the first slug forming soluble mercury complexes in the aqueous sulfidic solution; injecting a first trailing pig into the pipeline at rear of the first slug; resuming flow

of the produced fluid; and recovering the produced fluid having a mercury concentration of less than 50% of the first mercury concentration at a location downstream from the first slug.

[005] In one aspect, the invention relates to a method to producing a produced fluid having a reduced concentration of mercury from a pipeline remove mercury contaminants from gas and / or crude productions. The method comprises: transporting a produced fluid containing mercury along the pipeline for a sufficient amount of time for the mercury to accumulate in the pipeline as elemental mercury, mercury sulfide and combinations thereof, wherein mercury accumulates on the pipeline for the produced fluid to reach a first mercury concentration at a check point downstream from an entry point of the produced fluid into the pipeline; stopping the transport of the produced fluid in a section of the pipeline; injecting a