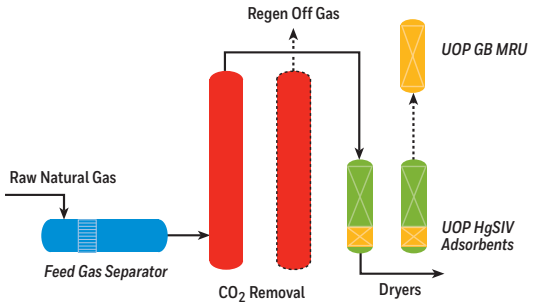
Inside the dryers

Since HgSIV adsorbent is added to the existing dehydrators, this option requires no new vessels or piping and does not add to the pressure drop. In this case, the dehydrator is typically regenerated with a small slip stream of the plant residue gas. The spent regeneration gas is cooled to remove most of the water and then put back into the sales gas line. Essentially all of the mercury goes into the sales gas line. The dehydrator acts to divert all of the mercury and some of the water around the cold box. The recovered hydrocarbon will have mercury levels that are within typical industry targets.



In the dryers and on the regeneration gas

In this case, the spent regeneration gas is treated with GB adsorbents for mercury removal before it is put into the sales gas line or used for local fuel. This option will require a separate vessel, but a much smaller one since the mercury is now in a much smaller volume gas stream.

Downstream of the dryers

Placement of the MRU downstream of the dehydrator, while not the preferred location for most natural gas plants, means that it is unlikely that the gas will have any liquid entrainment, resulting in good mercury removal performance and adsorbent life. The drawback is that because the MRU is located downstream of the dehydrator, the cold box will be protected but there will be mercury in the acid gas as well as in the molecular sieve regeneration gas. Additionally, this option requires separate vessels and adds to the pressure drop.

Safe Handling and Disposal

Most government agencies classify any equipment exposed to mercury as hazardous waste that needs to be handled and disposed of properly by local regulations. Contact your UOP representative for a copy of the applicable Adsorbent Safety and Handling brochure.

Global Service and Support for Your Adsorbents Needs

We offer unparalleled service and support to help ensure you maximize the use and life of your UOP adsorbents.

Our highly trained and experienced staff is positioned around the world, and dedicated to quickly and efficiently meeting your business needs. Some of the services we offer, include:

- Process design to determine optimal configuration and operating conditions for your application
- Start-up assistance to ensure on-time and effective product implementation
- Performance evaluations to facilitate preventative action
- Troubleshooting to diagnose problems
- Operations analysis to help improve your productivity and profitability utilizing world-class UOP laboratory, pilot plant and simulator resources

For more information

For more information, please contact your UOP representative or visit us online at www.uop.com

UOP LLC, A Honeywell Company
25 East Algonquin Road
Des Plaines, IL 60017-5017, U.S.A.
Tel: +1-847-391-2000
www.uop.com

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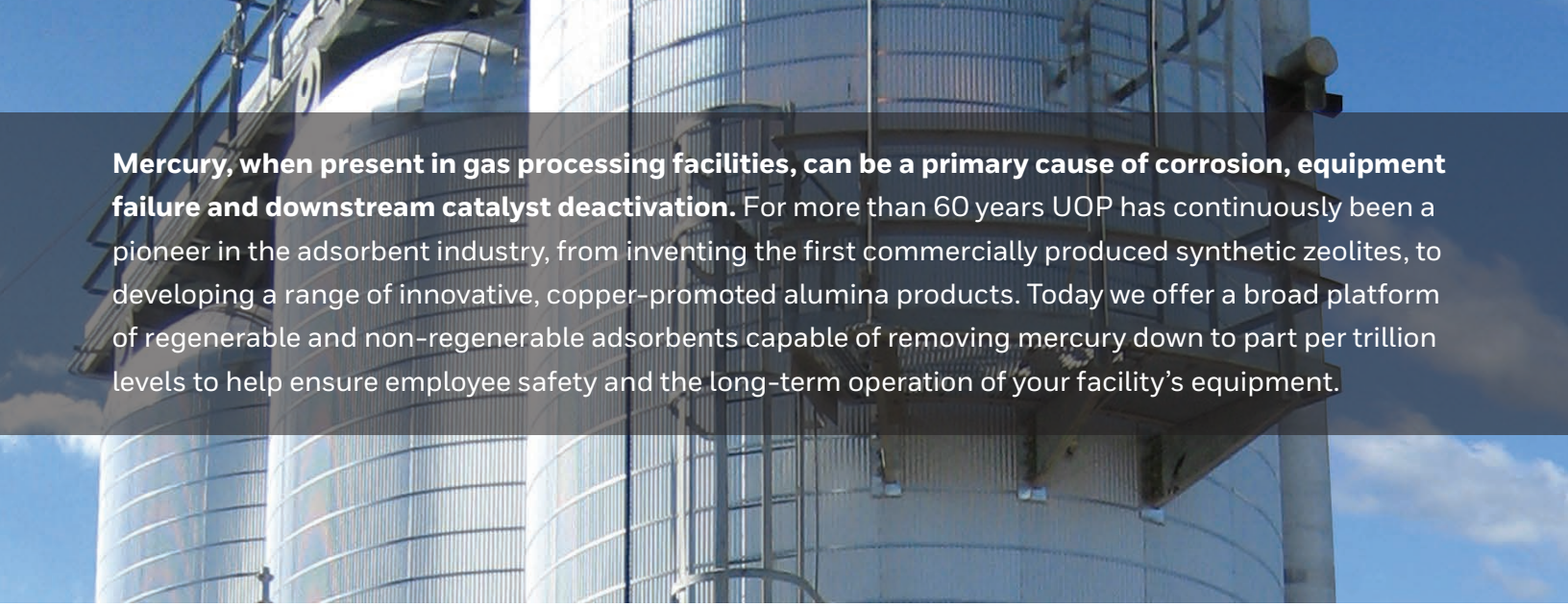
UOP Gas Processing

Reduce Equipment Corrosion and Safety Hazards
by Removing Mercury from Your Process Streams

UOP Adsorbent Solutions Help Prevent Mercury Contamination



Mercury, when present in gas processing facilities, can be a primary cause of corrosion, equipment failure and downstream catalyst deactivation. For more than 60 years UOP has continuously been a pioneer in the adsorbent industry, from inventing the first commercially produced synthetic zeolites, to developing a range of innovative, copper-promoted alumina products. Today we offer a broad platform of regenerable and non-regenerable adsorbents capable of removing mercury down to part per trillion levels to help ensure employee safety and the long-term operation of your facility's equipment.

Even low levels of mercury found in natural gas pose a threat to the structural integrity of your equipment

The Problem with Mercury

Mercury occurs naturally and is present in many of the world's natural gas fields. Concentrations have increased from single digit part-per-billion levels in localized areas of the world, to thousands of parts-per-billion in many of the world's gas reservoirs.

The brazed aluminum heat exchangers commonly found in Liquefied Natural Gas (LNG) plants, cryogenic hydrocarbon recovery plants and petrochemical plants are particularly susceptible to liquid-metal embrittlement (LME) caused by mercury. LME is a corrosive attack that can cause crack initiation and propagation within equipment. Over the past several decades, LME has been responsible for a number of failures of brazed aluminum heat exchangers, resulting in unscheduled plant shutdowns, costly repairs and even fires.

Additional consequences of mercury include:

- Mercury is mobile and will adsorb onto pipeline surfaces and other equipment; It can then desorb back into gas streams, contaminating the product for transportation
- Mercury in petrochemical plants can deactivate downstream catalysts
- Mercury can concentrate and drop out as liquid in colder sections of the plant, making subsequent maintenance difficult

UOP Mercury Removal Technologies

With the advent of better analytical techniques, it is possible to measure and remove low levels of mercury before it threatens pipeline assets, gas plant equipment and the environment. UOP offers effective fixed-bed solutions for removing mercury from natural gas and hydrocarbon liquids:

- UOP GB copper-based adsorbents
- UOP HgSIV™ molecular sieve regenerative adsorbents

As the gas or liquid flows through the fixed bed, mercury is retained by the adsorbent and remains in the vessel, resulting in effluent gas or liquid hydrocarbon that has mercury levels within typical industry targets.

UOP GB Adsorbents

UOP GB adsorbents are the most versatile non-regenerative mercury removal adsorbents available today. They are operationally flexible, as they can be used to process gas that is at or close to its dew point in a variety of process locations.

Gas and liquid streams containing thousands of micrograms or part-per-billion levels of mercury are successfully treated to extremely low effluent levels using GB adsorbents. These high capacity mercury adsorbents are engineered using a copper-based active component finely dispersed across a high pore volume substrate. This high capacity leads to infrequent change-outs and a longer lifespan, minimizing the cost of mercury removal over time. GB adsorbents can be supplied in their oxidized form or their sulfided form meaning that they can be pre-sulfided or sulfided in-situ.

Benefits of UOP GB adsorbents

- Mercury is captured chemically and contained within the adsorbent
- GB technology is "fit and forget," requiring no special regeneration cycles or purge gas
- No operational utilities means more energy savings
- GB products have a high capacity for mercury, resulting in smaller vessels with a smaller footprint

UOP HgSIV Adsorbents

Modified with silver for mercury removal properties, molecular sieve-based HgSIV adsorbents perform both water and mercury removal. Since nearly all cryogenic plants use molecular sieve dehydrators, the mercury removal function can be easily added to the dehydrator performance by replacing some of the dehydration-grade molecular sieve with HgSIV adsorbent. Silver is distributed in the molecular sieve, where it is readily available to form an amalgam with the mercury, providing a rapid rate of mercury removal.

Mercury is adsorbed by HgSIV adsorbent during the dehydration step and, when heated to the normal dehydrator regeneration temperature, releases from the silver and leaves with the spent regeneration gas. Because the mercury removal sites are regenerated with a clean gas stream each cycle, the product is refreshed each cycle and retains a high rate of mercury removal. While HgSIV adsorbent offers a simple drop-in solution, the trade-off is that there will be mercury left in the regeneration gas from the spent regeneration gas separator.

Benefits of HgSIV adsorbents

- There is no need for additional adsorption vessels
- The pressure drop commonly experienced when using non-regenerated mercury removal adsorbents is avoided
- There are no spent adsorbent disposal issues because mercury does not accumulate on the adsorbent

Mercury Treatment Locations

Mercury can be removed during different stages of your process depending on several factors, including inlet gas composition and flow rate, inlet mercury levels, site environmental concerns and available capital budget.

Upstream of the amine and dryer units

This is an ideal configuration for most natural gas plants. The benefit of this placement is that the mercury removal unit (MRU) protects the amine unit and dehydration vessels. Mercury is permanently bonded to the GB adsorbent and will not dissociate after being adsorbed, ensuring no plant contamination. Additional vessels and piping are required for this treatment location.