PHARMACEUTICAL PROCESSING®

Pharmaceutical Processing®

Solutions For Pharmaceutical Processing

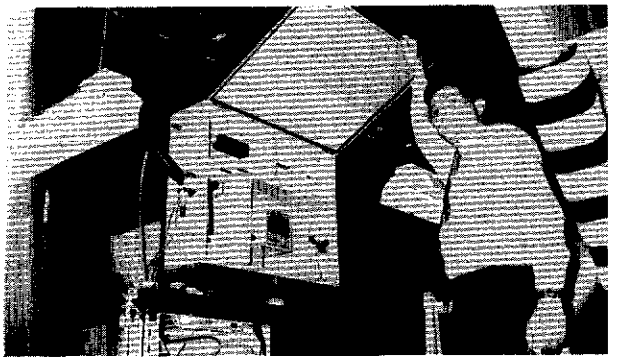
Pharmaceutical Facility Gets "Green" Light With Gas Analysis Sampling System (GASS™)

by David A. Leighty, President
Perma Pure Inc.

Increasingly stringent environmental regulations for stack gas emissions are forcing more industrial operations to install elaborate Continuous Emissions Monitoring Systems (CEMS). Unfortunately these systems often suffer performance or reliability limitations due to the problems with sample conditioning. A new technology has overcome this difficulty, even for a challenging CEMS task like hydrogen chloride (HCL) analysis. This new conditioning system is intended to accept virtually any hot, wet, dirty sample and transform it into a cool, dry, clean sample ready for analysis.

Removal of water is typically the problem. Until recently the preferred sample clean-up method has been condensation within a chiller system, followed by collection of water and other coalescable liquids. Unfortunately chiller/condensation systems have numerous limitations, in particular loss of water-soluble analytes, as well as difficulty with samples that are highly corrosive or that have very high water content or flow rate. Since chiller/condensation systems normally operate above freezing, at least 0.6% water remains in the sample even under the best circumstances.

A pharmaceutical manufacturer in North Carolina discovered chillers are sometimes inadequate to the task. The company monitors their stack gas emission of HCL then neutralizes the HCL with lime to comply with permit conditions as part of their "green" (environmentally friendly) policy. The gas filter correlation analyzer for HCL used at their research and development facility in Research Triangle Park worked only sporadically without sample conditioning because water in the sample corroded the gold-filled mirrors in the system, requiring frequent replacement at an approximate cost of $900.



A Gas Analysis Sampling System (GASS™) from Perma Pure Inc. helped a pharmaceutical company in North Carolina meet emissions monitoring requirements and get back in operation.

Dilution of the sample with dry air to reduce the water content of the sample proved ineffective because the HCL content in the diluted sample could not be detected. Installation of a chiller would not solve the problem; since HCL is highly water soluble, it would pass down the drain with the condensate instead of into the analyzer.

The solution was a Gas Analysis Sampling Systems (GASS™) from Perma Pure Inc. The GASS device utilizes a Nafion® gas dryer to very selectively absorb water vapor from stack gases. Nafion is a corrosion-resistant fluoropolymer that functions as a semipermeable membrane to water vapor. The system removes water from the sample stream while still in the vapor phase, so there is no contaminant loss of water-soluble gases such as HCL. Dew points as low as −25°C (corresponding to only 600 ppm of water) are achieved while handling sample flow rates up to 25 liters per minute.

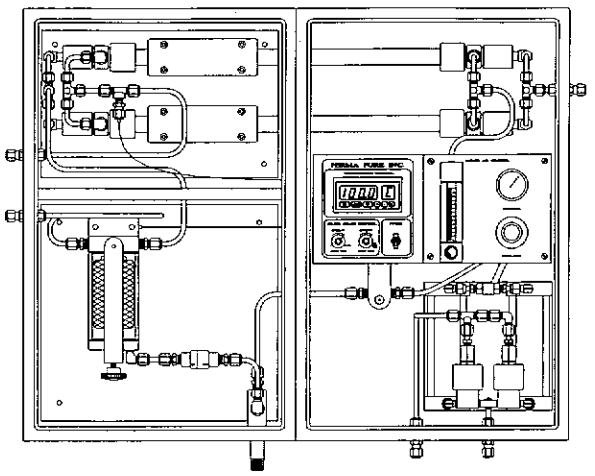


Figure 1: GASS System Schematic

The GASS system quickly proved its merits at the pharmaceutical facility by restoring the gas filter correlation HCL analyzer to operation. Elimination of HCL losses during sample conditioning dramatically improved the accuracy and precision of the analysis. When the water content of the sample dropped substantially, the mirrors inside the analyzer ceased corroding, eliminating frequent mirror maintenance. According to one plant engineer, the GASS system paid for itself in just a few months based on this benefit alone.

Once the results became more accurate and reliable, the analyzer could also be used as a process control device in addition to environmental monitoring. Lime was originally added in excess to control the HCL in the stack gas emissions. Continuous HCL monitoring permits more accurate lime additions, eliminating waste and expense.

Pharmaceutical processing is not the only industry benefiting from the GASS system. Although hydrogen chloride and sulfur dioxide are particularly water soluble, even nitrogen oxides are moderately water soluble and are consequently lost when passed through a chiller/condenser system. Nearly every CEMS location is required to monitor one or more of these gases. Utilities, refineries and other major industries are now turning to the GASS systems as an alternative to chiller/condensation or dilution systems to achieve more accurate, reliable CEMS data.

Another reason many industries are turning to the GASS system is its adaptability. A wide range of options are available to tailor the system to any particular applications. The transformation of a hot, wet, dirty sample into one suitable for analysis is accomplished in stages as the sample passes through three zones within the system: *Coalescing/Filtration, Drying and Control.*

In the *Coalescing/Filtration Zone,* the sample is equilibrated to the desired temperature regardless of its initial temperature. Particulated and high-boiling point liquids such as sulfuric acid (if present) are then removed by a coalescing filter with an automatic drain. In the *Drying Zone,* the sample temperature is raised slightly before introduction in the dryer(s). The temperature is then steadily reduced to ambient levels. Water is removed at the same time, so the sample remains non-condensing as it exits into the final zone. In the *Control Zone,* drying is completed; the sample can then pass through unheated tubing to the analyzers without risk of condensation. Also included in this zone are flow controls for the dryer purge gas, electronics for temperature control in the two heated zones, drain cycle timers for the coalescing filter's automatic drain, and an optional heatless dryer for the purge air. The entire assembly is mounted with an environmentally sealed enclosure for trouble-free field installation. While not perfectly selective, the GASS system avoid losses of most analytes of significance in CEMS applications. Among the compounds typically monitored, only ammonia is lost through the Nafion dryer while water is being removed. As monitoring requirements become more stringent, condensation systems used for CEMS are proving more problematic, with unacceptably high analyte losses, high residual water, and attendant reliability problems. As a product incorporating new technology that overcomes these shortcomings, GASS systems have proved their suitability for CEMS applications.

Perma Pure Inc., 8 Executive Dr., Toms River, NJ 08754.

Reprinted from **PHARMACEUTICAL PROCESSING** September, 1995