PROCESS OPTIMIZATION

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BACKGROUND:

GREENHOUSE GAS REGULATORY/ PERMITTING BASIS

TO MANAGE AIR QUALITY ACROSS THE U.S., CONGRESS PASSED THE CLEAN AIR ACT IN 1970, WHICH SET FORTH CRITERIA FOR SEVERAL POLLUTANTS IN THE ATMOSPHERE IN THE FORM OF NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS). TO MANAGE AIR QUALITY IN TEXAS, THE STATE PROMULGATED THE TEXAS CLEAN AIR ACT IN THE TEXAS HEALTH AND SAFETY CODE, WHICH REQUIRES AUTHORIZATION FOR ALL CONSTRUCTION IN SUPPORT OF ACTIVITIES THAT WOULD RESULT IN THE RELEASE OF AN AIR CONTAMINANT.

Although the impetus for GHG minimization remains in the realm of major source permitting, it should be recognized that New Source Performance Standards for GHG are also on the way.

GHG POLLUTANTS

The GHG pollutants are carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), also known together as CO2 equivalents (CO2e) based on their global warming potential relative to CO2.

By far the most common source of CO2e is the combustion of fossil fuels leading to CO2 and marginal amounts of N2O. CH4 is an important fossil fuel with a high global warming potential, and uncombusted amounts or fugitive releases of CH4 can add up to an appreciable percentage of a project's predicted GHG emissions.

For practical purposes and in light of the analyses, EPA has generally not pressed for implementation of carbon capture and sequestration once site-specific cost information is submitted. Rather, the minimization of CO2 and hence CO2e relies heavily on optimized processes in which energy management measures and work practice standards can be defined and used to comply with requirements resulting from the PSD permitting.

PERMITTING STRATEGIES FOR THE FUTURE

As we do for other pollutants, Sage manages or assists with the permitting process for GHGs. The GHG permitting strategies of the future, however, have a very different effect on project planning, monitoring and compliance demonstration due to the unique nature of this class of pollutants. With six permits issued at the end of 2012, Sage has noticed that the first precedents have already been set.

DEMONSTRATING AN EFFICIENT PROCESS

In the nascent world of GHG PSD permitting, sources are required to demonstrate to EPA that the proposed process is comparatively efficient. In turn, this requires (1) a thoughtful selection of the process parameters that can be measured, and (2) benchmarking the process design.

IDENTIFYING PROCESS PARAMETERS

Identifying process parameters takes close collaboration with design team process engineers. Through meetings and correspondence Sage identifies the instrumentation needed for process unit-wide production metrics or appropriate surrogates. These instruments include composition analyzers, flow meters and calorimeters. Their locations within process lines, as well as integration with distributed control systems or process logic control, are things to consider for compliance demonstration with an output-based GHG standard. Startup and shutdown scenarios, partial load, ambient conditions, and catalyst degradation issues are all things to consider when defining an appropriate output-based limit. Sage also communicates EPA expectations on calibration frequencies and works these into environmental scheduling or compliance systems. Improving the monitoring devoted to the process has the collateral benefit of greater process control.

MAXIMIZING EFFICIENCY

Maximizing efficiency in a chemical or refining process involves consideration of waste heat boilers, air pre-heaters, refrigerated condensers, or variable speed fans instead of single-speed fans. Sage does not offer process design; however, we participate in early meetings with design engineers to identify what energy-saving features a proposed design uses. We then communicate expectations from the permitting process where energy-saving opportunities are available. More importantly, we compare the design to other designs in the market to establish comparability measures and strategically select benchmarking parameters. This helps tell the designers' story when it's time to permit.

THERMAL EFFICIENCY OF HEATERS

Combustion from steam boilers, process heaters, and process furnaces is usually the lion's share of a project's GHG emissions, and thermal efficiency demonstration should be an expected requirement. It is thus important to select a thermal efficiency equation that is transparent enough for regulatory authorities and that is reasonable to track.

Establishing limits on stack O2 and exhaust temperature can be proposed as good indicators of combustion and energy efficiencies. Sage also helps brainstorm

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alternative efficiency tracking measures. Burner inspections, tune-ups and energy assessments are all key work practices and are often required through the Boiler MACT. Sage offers these and other process optimization capabilities to assist with any boiler MACT or GHG challenges.

FUGITIVE LEAKS – CH4

Fugitive CH4 emissions can exist in large quantities from the components around unstabilized crude tanks. While the tank emissions themselves can be mostly eliminated by a vapor recovery system, the equipment leaks are assumed to be constant in emission calculations. The control measures consist of a Leak Detection and Repair (LDAR) program.

LDAR programs using organic vapor analyzers for other VOCs have matured over the decades through permitting and rule requirements and can now also use infrared technology. LDAR used to target CH4 may yield emission savings as high as 90% according to EPA, which correlates to saved product and increased efficiency.