**Exploring New Ultra-Low Steam Consumption, High Capacity Smokeless Flaring**

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**Abstract**

This paper will introduce the technology behind, test data for, and industry challenges addressed by a new Ultra-Low Steam Consumption, High Capacity Smokeless Flare design developed by Zeeco, Inc. This flare technology is designed to further improve flaring efficiency and reduce steam consumption while continuing to meet the EPA Code of Federal Regulations, Chapter 1, Subchapter C, Part 63, Subpart CC requirements. We will focus on how the design addresses known industry challenges in high capacity, low steam consumption flaring, such as needing the ability to operate at low flare gas pressure since many applications have a maximum flare gas pressure at the flare tip of 3 psig.

The paper will detail how this new design can achieve as low as 0.17 kg steam / kg flare gas at 20% of maximum flow rate, with the maximum flow rate achieved at a flare gas pressure of 3 psig. The above data is based upon an 8 km/h (5 mph) wind with less than Ringlemann 1 opacity with a flare gas that is 100% propylene. For smokeless operation with propylene, other current designs require approximately 0.3 kg steam / kg flare gas and / or a much higher flare gas pressure at maximum flaring capacity. Ultra-Low Consumption Steam Assisted Flaring is very important since any reduction in the required steam flow rate saves not only money, but also reduces the emissions produced from the production of the additional steam.
A key feature of this technology is that the air and steam mixture leave the flare at the same elevation as the flare tip exit, meaning no pre-mixing of air into the flare stream. Other current designs mix the air and steam with the flare gas prior to exiting the flare tip and dilute the combustion zone according to the new calculation parameters required by MACT CC. Zeeco's design more efficiently mixes the steam and air together and then mixes the resulting stream with the flare gas, creating a final mixture with a significantly increased volume of air. When the resulting steam and airflow interacts with the flare gas at the tip exit, the increased air volume is readily available for combustion, meaning the flare is less likely to smoke. Since the design more efficiently mixes the air and steam together, less steam is required to achieve smokeless operation. Furthermore, the inherent efficiency of the mixing delivers a design less dependent upon using flare gas pressure to achieve smokeless operation. The flare can successfully operate at lower gas pressures at maximum flow rate.