

The venturi wet scrubbers at Colstrip Units 3 and 4 remove approximately 99.7% of fly ash particulate from the flue gas and 95% of the SO₂ via a sequence of removal processes. The flue gas enters the scrubber vessel and is accelerated by the converging surfaces of the plumb bob and venturi bowl. The flue gas and slurry meet in the venturi throat where turbulence atomizes the slurry. Acceleration of the flue gas causes the particulate to collide with and be absorbed by slurry droplets. The majority of the fly ash particulate and most of the SO₂ are removed in the venturi section. The wet venturi scrubbers utilize the alkalinity of the fly ash particle removed to help meet the high level of SO₂ removal. The throat area of the venturi is adjusted by moving the plumb bob up or down to obtain the desired pressure drop across the plumb bob of each scrubber. The flue gas velocity caused by this pressure drop ensures optimum fly ash removal. The slurry and collected fly ash are separated from the flue gas as it turns up to enter the absorption area. The flue gas then enters the absorption spray area in the annular space between the downcomer and shell of the scrubber vessel. The flue gas is contacted with recycle slurry for additional removal of SO₂. Above the absorption section is the wash tray which uses recirculation water to contact the flue gas and remove entrained recycle slurry from the flue gas. The flue gas then flows through the mist eliminator where entrained droplets are removed.

As EPA recognized, Colstrip does not have a FF or an ESP and would need to install one to comply with the proposed 0.010 lb/MMBtu fPM limit, as the current venturi wet scrubbers will not be able to meet the proposed limit.² While EPA recognizes that Colstrip's venturi wet scrubbers would not be able to comply with the proposed limit, EPA assumes Colstrip could make a "minimal cost (\$10/kW) for [wet scrubber] maintenance or minor upgrades . . . to meet a potential 0.015 lb/MMBtu standard."³ This assumption, however, is inaccurate. Colstrip has typically been able to remain just below the current limit of 0.030 lb/MMBtu. However, due to occasional variability in fuel and operating condition, Colstrip has, since 2018, hired consultants and engineers to explore ways to further enhance the efficiencies of the venturi wet scrubbers. This work, as described below, has made the venturi wet scrubber emissions more stable. But, as reflected in Attachment A (Colstrip's MATS PM CEMS compliance data from September 2018 to April 2023), the work demonstrated that 0.015 lb/MMBtu fPM is not achievable with upgrades to the existing wet scrubbers and further that the efforts to reduce fPM emissions with the existing control technology has reached its limits:

- The original operating condition for the plumb bob delta P (pressure drop) was 17" to meet particulate and SO₂ removal requirements. In an effort to optimize the performance of the scrubbers, the plumb bob delta P is currently operated at 27-28", the maximum delta P achievable which is limited by the capability of the induced draft ("ID") Fans.
- The original mist eliminators have been upgraded with improved performance to better control entrained droplets in the flue gas. In 2018, the mist eliminator supplier (Munters)

² See 2023 Technology Review for the Coal- and Oil-Fired EGU Source Category ("Technical Memo"), Doc. ID: EPA-HQ-OAR-2018-0794-5789, at PDF p. 9, posted Apr. 24, 2023.

³ See *id.*