*Spotlight:* Longwall shearer scrubber reduces dust concentrations in face walkway by 74 pct and with 56 pct less dust leaving the longwall face.

*Alpha Foundation Grant AFC113-10:* The Application of Flooded Bed Dust Scrubbers to Longwall Mining Systems

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Longwall operations generally exhibit greater difficulty in maintaining compliance with federally mandated dust regulations because of the difficulty of capturing the generated dust at the source. This project developed a flooded-bed dust scrubber that is integrated into the longwall shearer design to capture the dust directly from the leading cutting drum that extracts the coal from the longwall face.

The system functions by drawing dust-laden air into the scrubber inlet by the negative pressure created by a vane-axial fan located near the discharge. Once inside the scrubber chamber, a water spay is used to wet a woven screen mesh that causes the dust particles to be encapsulated by the water droplets and subsequently removed from the air stream by the demister unit. A full-scale working prototype was built and tested at the NIOSH Longwall Dust Gallery in Pittsburgh PA, which replicates a portion of an actual longwall face with 19 roof-support shields and dust-generating mechanisms for simulating respirable dust produced by a shearer while cutting coal.



Forty tests, plus 10 base-case tests, were conducted using ThermoFisher Scientific Personal Dust Monitors to measure the dust levels during the experiments. Three factors at two levels were used in the experiments: the presence and absence of an extension to the scrubber inlet, the scrubber capacity at 6300 cfm ( $2.97 \text{ m}^3$ /s) and 13,700 cfm ( $6.47 \text{ m}^3$ /s), and face-air velocities of 500 fpm (2.54 m/s) and 700 fpm (3.56 m/s). The results of the study are shown in the table below, which shows a reduction in walkway dust concentration of 74 pct when the scrubber is utilized. When the when splitter arm sprays are also active, this walkway dust reduction increases to 97 pct, essentially providing a clean air environment for the shearer operators. Total dust removal exiting the longwall face was also reduced by 56 pct.



Test set up in Longwall Dust Gallery showing full-scale shearer mock-up and dust injection locations.

Location	Best performance configurations	Dust Reduction
Return	Inlet extension included 100% scrubber capacity Face air velocity 700 fpm	56.4%
Walkway	Inlet extension included 100% scrubber capacity Face air velocity 700 fpm	74.2%
Face Area	Inlet extension included 100% scrubber capacity Face air velocity 700 fpm	65.1%
Shearer Body above scrubber module	Inlet extension included 100% scrubber capacity Face air velocity 700 fpm	60.6%
Shearer Body above tailgate module	Inlet extension included 100% scrubber capacity	80.6%