

5.3

A Washable Porous Metal HEPA Filter

Kenneth L. Rubow: Krubow@mottcorp.com, (860) 747-6333

Mott Corporation
75 Spring Ln.
Farmington, CT 06032

Abstract

Glass fiber High Efficiency Particulate Air (HEPA) filters are used on High Level Waste (HLW) tank ventilation systems at various nuclear sites around the country. The glass filters are subject to a shortened life span due to their deterioration from moisture condensation and therefore must be disposed of when spent. The disposal process is costly and hazardous because the site personnel are at risk of exposure to radiation.

The Westinghouse Savannah River Company (WSRC) is looking to replace the glass fiber HEPA filters with a regenerable and more durable filter. A cylindrical, nickel sintered porous metal filter is one of the two media being examined by WSRC. The nickel filter is cleaned by washing the dirty surface with an in situ spray wash. Temperature, humidity, moisture, and other factors associated with the HLW tanks do not affect the metallic media; thereby resulting in an anticipated long service life of at least 15 years. The filter has multiple tubular elements welded to two tube sheets for reliable sealing and integrity. All materials of construction are stainless steel or nickel.

The filter design incorporates two means by which particles are collected - cyclonic inlet separator and metallic HEPA filter elements. The cyclonic inlet separator, which assists to remove heavy particles or droplets, has demonstrated removal efficiencies of 50 to 70% of AC fine test dust. After exiting the cyclonic filter separator, the dirty gas stream then passes into the inside of the cylindrical metal filter elements and flows radially from inside to outside of the filter media, with particulate collecting primarily on that inner diameter surface. When a terminal pressure drop is reached, the particles that collected on the inner diameter surface are removed with an in situ spray wash. Each filter possesses its own spray-wash nozzle.

The nickel filters have achieved removal efficiencies, of a 0.3 micrometer DOP aerosol, ranging from 99.975 to 99.999% when tested according to the standard ASTM DOP test for HEPA filters. A total of 32 filters have undergone HEPA efficiency testing. One of the elements that achieved 99.999% removal was then tested at WSRC. The filter was plugged and cleaned in situ 7 times with simulated sludge/salt particles and atmospheric dust. After these rigorous tests, the filter again achieved 99.999% removal.

The media design flow specification is 30 CFM/ft² at a maximum differential pressure of 3.5 psi. All nickel metal filters have tested at or below that design pressure drop. While this is a higher pressure drop than traditional glass fiber HEPA filters, this system pressure is accommodated by a vacuum pump of appropriate capacity.

Future work will entail optimizing the cleaning procedure by examining spray nozzle configurations, possible cleaning agents, and backwash variations.