

Resolve® PTFE Filters for Radioactive Air Particulate Monitoring and Beyond

Three interdependent systems are necessary to accomplish the task of monitoring for the presence of radioactive particulates in air. These are an air sampling pump, filter media and radioactivity detection system. Just as the keystone is critical to proper performance of an archway, the filter is also important to the air monitoring process. For example, if the filter is too porous, the target particles may not be retained or may be trapped so deeply inside the filter medium that alpha measurements are adversely affected. Likewise, if the pore size is too small, airflow can be impeded resulting in the pump overheating or failure to draw sufficient air for the analysis.

The laminated Resolve PTFE filter introduced by Eichrom has the right combination of components to make it a strong “keystone” in air monitoring: particulate collection efficiency, low radiological background, and a mechanical structure that allows for high airflow while still maintaining structural integrity.

In the case of monitoring for the presence of alpha emitting particles in the air, the critical feature of the air monitoring filter is the surface where the air-borne particulates are collected. As air borne particles interact with the filter, surface impaction and interception interactions filter the particles out of the passing air stream (Figure 1). Alpha particles are easily shielded and when they are embedded even slightly below the surface of the filter, one can observe significant negative effects on alpha detection and alpha energy resolution. The surface of the Resolve air filter is a PTFE membrane layer with a tight configuration of PTFE fibers as seen in the micrograph (Figure 2). With a pore size of 3um the PTFE membrane has a high surface collection efficiency resulting in optimized alpha spectral efficiency and resolution.

The laminated PTFE/Polyester filter material has a lower natural alpha/beta background than other filter media such as glass fiber. The lower backgrounds lead to better alpha signal to base-line noise ratios. The reduced background then allows for shorter counting times for each filter being analyzed.

	alpha (α) dpm	beta (β) dpm
Cellulose	0.78 ± 1.12	0.17 ± 1.30
Glass Fiber	2.00 ± 1.56	4.52 ± 3.44
Resolve PTFE Filter	0.24 ± 0.70	0.31 ± 3.54
System MDA	2.24	4.20

The PTFE membrane is laminated to a stiff backing to give it good handling characteristics for moving between air sampler pump and radiological counting system. The open weave of the stiff backing does not further impede airflow through the PTFE membrane therefore it does not increase the pressure drop across the filter. The backing also keeps the PTFE membrane flat for consistent measurement.

These combined factors of reduced filter-attenuation of alpha signal, low-background materials and a stiff support add up to improvements in alpha air particulate analysis over traditional filters. Radiation protection staff at the Monticello nuclear power plant report “greater accuracy for alpha air sample results” and “faster determination of radon alpha activity contribution” when Eichrom’s Resolve PTFE filters are counted using the Canberra iSolo units over standard glass fiber filters.

A comparison of alpha spectra from filters typically used for air monitoring show a striking difference in the alpha spectra signal for filters spiked with similar amounts of actinides (Figure 3).

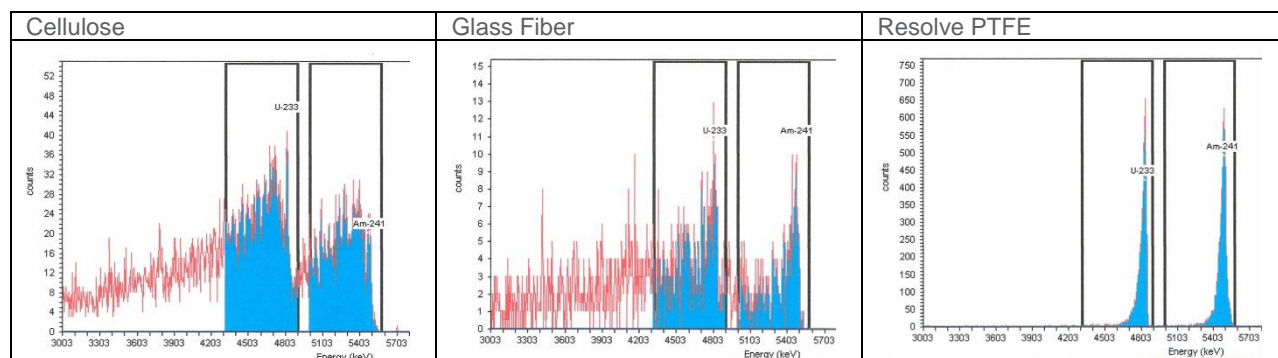


Figure 3

Spectra for filters spiked actinides and then counted by alpha spectroscopy.

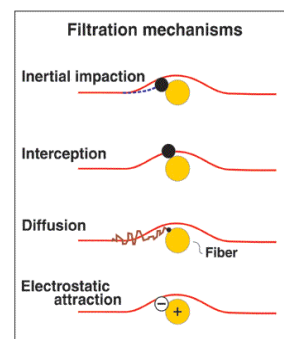


Figure 1

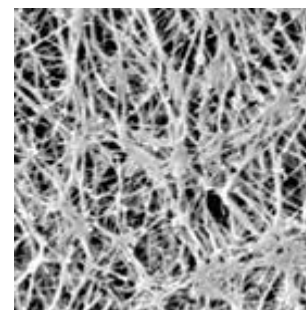


Figure 2

When the spiked filters are then used for air sampling and counted via Canberra's iSolo system the results are noticeable.

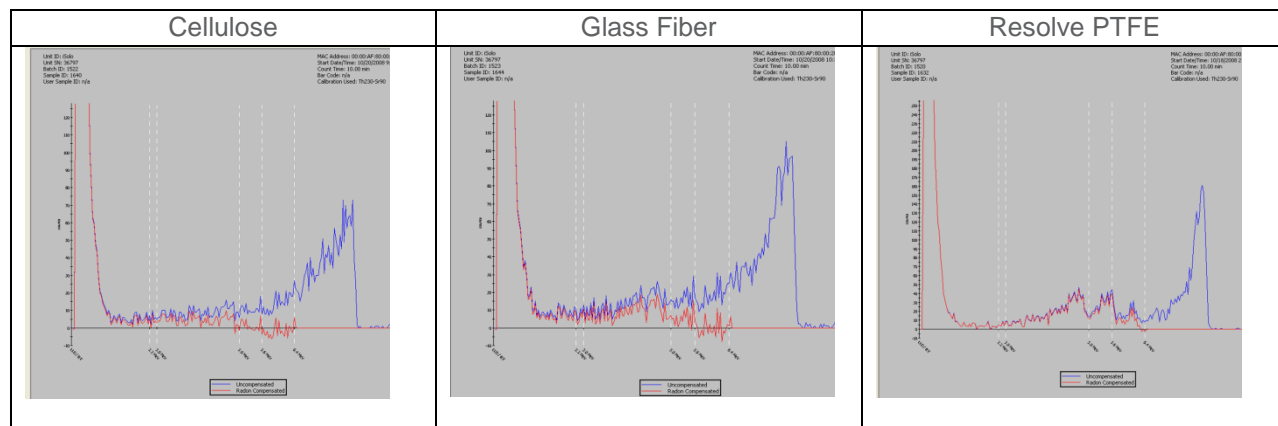


Figure 4

In the spectra above (Figure 4) the blue line represents the raw alpha spectrum as measured by the iSolo unit. The red line is a calculated spectrum from the raw spectrum where the counts from the presence of radon daughters are removed to reveal alpha emitting actinide spectrum. The resulting red line spectrum from the PTFE filter gives the most usable spectrum for identifying the actinides on the filter.

The combination of the components in Eichrom's Resolve Laminated PTFE membrane of high surface retention of radiological particulates, low background and solid filter support have also contributed to the filter being used for non-air monitoring applications as well. Some laboratories have found this filter to be a superior alternative to typical filters for collecting separated and quantifying fractions of samples for the radiological alpha counting of radium in complex and difficult matrices.

The Eichrom Resolve Laminated PTFE filter, whether used for air monitoring or other alpha radioactive analysis, can provide superior analytical results to traditional glass fiber and cellulose filter media. The PTFE filter is currently available in three different circular sizes of 25mm, 47.0mm and 47.5mm and can also be cut to customer specified sizes. Please contact us for further information and price quotations.