PURITY TECH
Advanced Lung-Gard®

# Reduction of PM10 and PM2.5 through the Abatement of Precursors (NOx, SOx, VOC)

Technical–Scientific Report – PURITY TECH carbon-based technology
(Activated Carbon / Activated Carbon Fibers)
Date: 05/02/2026

## 1. Purpose and Key Message

This report summarizes and documents, based on international sources, the cause–effect relationship between the main gaseous precursors (NOx, SO2/SOx, VOC and NH3) and the formation of fine particulate matter (PM2.5) and, in part, PM10. It explains why a PURITY TECH filtering and adsorbing system that reduces NO2, SO2 and VOC also indirectly contributes to the reduction of the secondary fraction of fine particulate matter. A significant share of PM2.5 (and part of PM10) is not emitted directly as particles, but is formed in the atmosphere or in indoor and near-field environments through reactions that transform NOx, SO2/SOx, VOC and NH3 into nitrates, sulfates and secondary organic aerosol (SOA). By reducing exposure to these precursors, the potential for secondary particulate matter formation is reduced.

## 2. Primary PM and Secondary PM: Operational Definitions

Atmospheric particulate matter (PM10 and PM2.5) is a mixture of solid and liquid particles. Primary PM is emitted directly as particles from sources such as brake and tire wear, resuspension, combustion and industrial processes. Secondary PM forms in air through chemical transformation of gaseous precursors, generating condensable species that enter the particulate phase. The two most important families of secondary PM are secondary inorganic aerosol (sulfate, nitrate and ammonium) and secondary organic aerosol derived from VOC oxidation.

## 3. International Evidence on PM Precursors

International agencies and peer-reviewed literature consistently recognize NOx, SO2/SOx and VOC, together with NH3, as fundamental precursors of secondary PM2.5. The European Environment Agency (EEA) explicitly identifies these gases as key precursors, while the U.S. Environmental Protection Agency (EPA) details the chemical pathways leading to ammonium sulfate, ammonium nitrate and secondary organic aerosol formation.

## 4. Main Mechanisms: From Gas to Particulate Matter

Sulfur dioxide is oxidized to sulfuric acid, which generates fine particles and forms ammonium sulfate in the presence of ammonia. Nitrogen oxides participate in photochemical processes leading to nitric acid and ammonium nitrate formation. VOC oxidation produces low-volatility compounds that condense into secondary organic aerosol, contributing significantly to PM2.5.

## 5. Evidence of PURITY TECH Effectiveness on Precursors

Activated carbon and activated carbon fiber media are widely studied for the adsorption of gaseous pollutants due to their high surface area and porosity. Scientific studies demonstrate that, when properly engineered, such media can effectively reduce NO2, SO2 and VOC in indoor air, consistent with the primary function of PURITY TECH.

## 6. Why Precursor Abatement Also Reduces PM2.5 / PM10

Because a significant fraction of PM2.5 is secondary in nature, reducing precursor availability directly lowers the potential for secondary particulate formation. The effect is particularly relevant for PM2.5, while impacts on PM10 depend on the contribution of its secondary fraction.

## 7. Conclusions

NOx, SO2/SOx and VOC, together with NH3, are internationally recognized as key precursors of PM2.5. Scientific literature confirms that PURITY TECH activated carbon media can reduce these gaseous pollutants. Consequently, reducing precursors also reduces the capacity of the air system to generate secondary particulate matter, with a particularly relevant impact on PM2.5.

## International References


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