

# Ammonium Nitrate

## Mist Elimination and Pollution Control Technology



**CECO  
Filters**

A CECO Environmental Brand

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CECO Filters designs and manufactures fiber bed mist eliminators (candle filters) and mesh pad mist eliminators that are used in droplet removal applications. We have more than 50 years of droplet separation / mist elimination experience in the Nitrogen Fertilizer Industry. We are committed to delivering solutions to meet our customers' requirements, while optimizing their performance and efficiency. Our expertise ranges from design, manufacturing, installation and field services.

Our mist eliminators can be custom-designed and manufactured to meet even the most complex requirements of new installations, or to retro-fit existing installations. Our repacking services, consultancy, and testing provide you with added value to optimize your total cost of ownership throughout the life of your equipment.

Our aim is to deliver to our clients a complete solution to our clients. Our in-house manufacturing facilities are operated to the highest quality control and manufacturing standards. Upon completion of assembly, each filter is tested for pressure differential through the media to ensure that performance parameters will be met.



## How is mist (droplets) created?

### Droplet formation via chemical reaction:

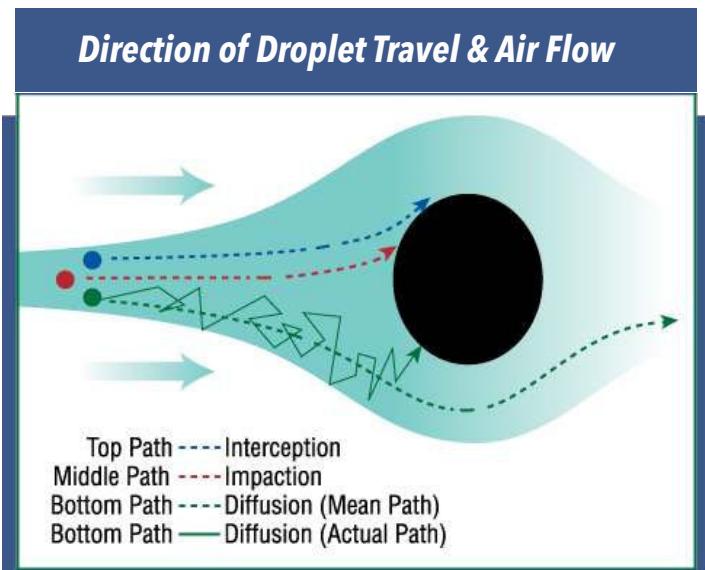
When two or more gaseous components react, they can instantly form very small liquid droplets (less than 1 micron) which are difficult to separate from the carrying gas stream.

### Droplet formation via thermal change:

Sub-micron droplets (less than 1 micron) are formed by sudden condensation of saturated gas to liquid.

### Droplet formation via mechanical action:

Droplets are formed by mechanical shearing of liquids and gas. These types of droplets are normally above 2 micron in diameter.



## Droplet Collection Mechanisms

Droplets within a gas stream are collected within the mist eliminator by a combination of mechanisms: impaction, interception and Brownian Diffusion. The droplets are directed through the mist eliminator with the gas. The droplets are removed by contacting fibers or wire media through the following collection mechanisms:

### Impaction

Droplets larger than 2 micron in diameter move along with the gas stream until the droplet comes to an obstacle such as a fiber in the filter media. The gas stream flows around the fiber and the large diameter droplet, controlled by its momentum, continues its original trajectory and "impacts" onto the fiber.

### Interception

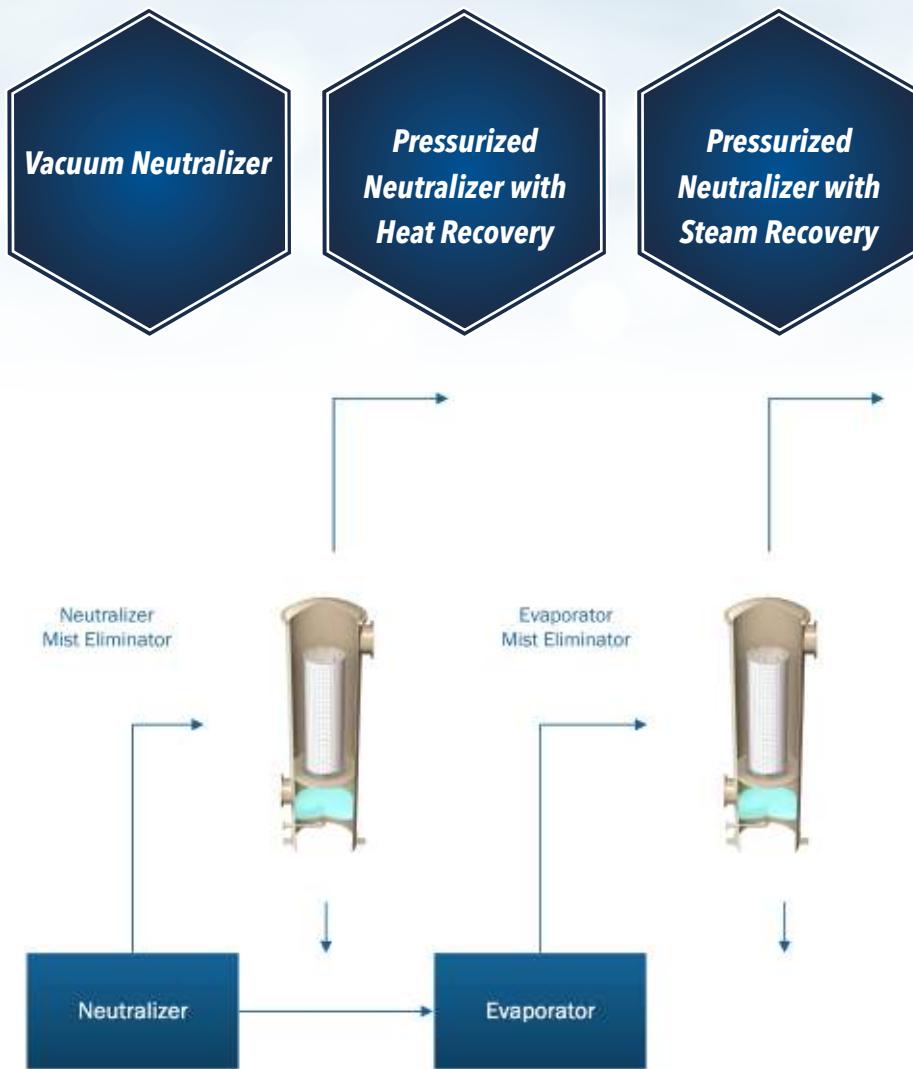
Smaller droplets of 0.5-3 microns are collected by interception. The droplet has less momentum, and the center of gravity path goes in the same direction as the gas, around the fiber. However, the droplet has a finite diameter, and the edge of the droplet is "intercepted" by one or more fibers and is collected.

### Brownian Diffusion

Sub-micron mist droplets have very little mass and little momentum, so the mean path of these droplets follows the gas stream around the fiber. However, the sub-micron particle movement mimics the random movement of a gas molecule (Brownian Motion) causing deviations away from the mean stream. With a given fiber diameter, residence time, gas velocity, bed depth, and packing density, these deviations cause the sub-micron droplet to collide with the fiber and be collected.

## Ammonium Nitrate Melt

There are 3 main types of Ammonium Nitrate (AN) processing operations for creating liquid AN Melt:



## Ammonium Nitrate Reactor or Neutralizers

In the Neutralizer, excess ammonia and nitric acid achieve a partial conversion to Ammonium Nitrate in solution. This exothermic reaction produces very fine mist droplets (<1 micron) which are then effectively removed from the gas stream in a separator with a candle filter mist eliminator.

## Ammonium Nitrate Evaporator

The AN solution from the Neutralizer is sent to an Evaporator where water is driven-off as steam yielding a more concentrated AN solution. The steam exiting the evaporator contains some of the AN solution. This effluent is passed to a separator, or a mist eliminator; for product recovery.

## **CECO Filters Mist Elimination Solutions**

### **For Ammonium Nitrate Melt Production**

Our candle filter mist eliminators are the ideal solution to remove fine mist droplets from the gas stream and achieve high efficiency sub-micron droplet removal. Our candle filters separate the ammonia, nitric acid and AN. It is a simple solution for air pollution control, or to prevent corrosion to downstream equipment and minimize the loss of valuable raw materials or products.

CECO Filters can design the complete separator package system as a 'turnkey' skid mounted unit or simply replace the existing candle filters within your process. Our expert team and in-house manufacturing provides a comprehensive and competitive solution to all our customers.

***Hanging Candle***



***Standing Candle***



### ***Benefits of Filter Separators for Neutralizer and Evaporator Outputs***

- Cost effective solution
- High sub-micron removal efficiency
- Low pressure drop
- Protects downstream equipment from nitric acid corrosion
- Recovers unreacted raw materials
- Reduced environmental emissions
- Ammonium Nitrate product recovery
- Optimized processing



## ***Solid Ammonium Nitrate - Prilling Tower Emissions***

Prilling Towers are used to create solid AN prills from AN melt. The melt is sprayed from the top using a prill head to create droplets. These droplets fall due to gravity against the opposing upward flow of cooled air. The larger prills fall to the bottom of the tower as product. However, some very small (<1 micron) micro-prills are carried out the top of the tower with the air stream. The micro-prills concentration in the gas effluent can be as high as 500 mg/m<sup>3</sup> which results in a very dense plume. In order to satisfy environmental agencies and stop the loss of valuable product, irrigated candle filters are used to capture and dissolve the micro-prills for reprocessing.



## ***Dual Stage Mist Elimination Scrubber***

CECO Filters “**Dual Stage Mist Elimination Scrubber**” technology consists of two stages. The first stage is a pair of irrigated mesh pad mist eliminators that act as a scrubber to remove soluble Ammonium Nitrate micro prills, nitric acid and excess ammonia. The second stage candle filter captures any submicron droplets and ensures there is no carry-over from the first stage.



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## Excellence in Pollution Control Technology, Service and Support Worldwide

*CECO Filters' focus on unsurpassed customer service and innovative filter designs for the Ammonium Nitrate Industry has earned us a reputation as an industry leader, providing cutting edge technology solutions for the past 5 decades. CECO Filters are designed to create cleaner processing and a safer environment!*

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