



**MONROE**  
**ENVIRONMENTAL**

Water & Wastewater Treatment | Air Pollution Control



# Air Pollution Control Systems

# Air Pollution Control Systems

*Does your plant need to reduce emissions — acid gasses, PM, odors, VOCs, mist, or dust?*

For over 50 years, **Monroe Environmental**® has been designing and manufacturing the highest quality air pollution control systems for industrial manufacturers, government agencies, and municipal treatment plants.

## Complete Air Quality Solutions

Monroe Environmental offers a broad range of stand-alone equipment as well as complete systems to effectively manage dust, mist, odors, acids, and fumes associated with both industrial manufacturing and municipal water/wastewater treatment.

Monroe continues to solve challenging air pollution problems with our skilled team of engineers, shop technicians, and knowledgeable service staff. The largest manufacturing companies in the world routinely look to Monroe to solve their most demanding emission control problems.

## Wet & Dry Scrubbing, Mist & Dust Collection Systems

- Packed Bed Wet Scrubbers
- Venturi Particulate Scrubbers
- Quench Towers
- Carbon Adsorbers
- Multi-Stage Scrubbing Systems
- Dust Collectors
- Mist Collectors



*Stainless steel Multi-Stage Scrubbing System to treat exhaust from a toxic gas incineration process*



*15,000 CFM Packed Bed Scrubber to remove ethylene glycol and NMP fumes from a glass coating operation*

## Value-Added Engineering, On-Site, and Support Services

Monroe also offers a variety of engineering, assessment, evaluation, and design services to help engineers, operators, and plant personnel get the most out of their air pollution control systems.

- Air pollution process assessment
- Scrubbing system evaluations
- Mist/Dust Collector evaluations
- Design and manufacture new air pollution and odor control systems
- Retrofit existing systems to maximize performance and removal efficiency
- Performance and compliance testing
- Auxiliary equipment, components, and packaged systems
- Permit assistance for EPA compliance
- Turnkey systems available

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## The Monroe Method

The Monroe Method is our superior way of doing business that saves our customers time, money, and hassle. It's based upon three main components:

- Design and fabrication
- Shop assembly and testing
- Ongoing support for the life of your equipment



*Above: Packed Tower Scrubber for SO<sub>2</sub> removal from waste incinerator exhaust, 316 SS construction*

*Left: 12,400 CFM Spiral Tube Oil Mist Collector*



*5,000 CFM Cartridge Dust Collector to capture exhaust from a CNC plasma cutting operation*



*7,500 CFM skid-mounted Horizontal Packed Bed Scrubber, polypropylene construction to capture and remove NaOH fumes from kiln exhaust*

# Scrubbing Applications & Engineering

## *Application expertise is critical for an optimized scrubber design*

Monroe Environmental Packed Bed Scrubbers have been used effectively to remove a wide range of air pollutants in many industrial and municipal applications. We will evaluate your application requirements to determine the optimum design parameters — a custom solution for your plant.

## Air Pollution Control Expertise

Monroe Environmental has experience scrubbing many air pollutants in addition to those listed below. Depending on the application other scrubbing liquids for the listed pollutants may be more appropriate.

- Acid gas scrubbing — (HCl, HF, HBr, HCN, HNO<sub>3</sub>, H<sub>2</sub>S, etc.)
- Halogen vapors (Cl<sub>2</sub>, F<sub>2</sub>, Br<sub>2</sub>)
- Sulfur compounds (hydrogen sulfide: H<sub>2</sub>S, sulfur oxides: SO<sub>2</sub>, SO<sub>3</sub>)
- Ammonia (NH<sub>3</sub>)/amines
- Chromic acids (H<sub>2</sub>CrO<sub>4</sub>, H<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>)
- Ethylene oxide (C<sub>2</sub>H<sub>4</sub>O)
- Ethylene glycol (C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>)
- Formaldehyde (CH<sub>2</sub>O)
- Boron compounds (BCl<sub>3</sub>, BF<sub>3</sub>)
- N-Methylpyrrolidone (NMP) (C<sub>5</sub>H<sub>9</sub>NO)
- As well as other water or chemically soluble pollutants



*Acid Gas Scrubbing: 1,500 CFM Packed Tower Scrubber, stainless steel pressure vessel construction to remove H<sub>2</sub>S from syngas for a diesel fuel conversion process*



*High pressure scrubbing system to remove sulphur compounds from a propane gas supply*



*Two-stage Packed Bed Scrubber to remove acids and alkalines from dryer exhaust gas*

## Common Scrubbing Liquids

- Sodium hydroxide (NaOH)
- Sodium hypochlorite (NaOCl)
- Potassium hydroxide (KOH)
- Sodium carbonate (Na<sub>2</sub>CO<sub>3</sub>)
- Sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and other acids
- Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>)
- H<sub>2</sub>S Scavenger
- And many others

## Chemical Addition

- Aqueous solutions of the scrubbing chemical react with the gaseous pollutant to increase absorption of the gas into the liquid.
- In some applications, when solubility is high, water alone may be used as the scrubbing liquid.
- Vapor pressure, solubility, and pH are some of the factors that Monroe Environmental will take into consideration when designing a system to maximize removal efficiency.



**Chemical Storage Tank Vapors:** 30,000 CFM Horizontal Packed Bed Scrubber with polypropylene construction to remove chemical fumes emitted from acid-dip tanks at a semiconductor manufacturing facility. Dual-train exhaust ductwork with automated dampers and FRP fans provides maximum control over the scrubbing process.



**Sulfur Dioxide Scrubbing:** SO<sub>2</sub> Scrubber with Quench Section and Packed Tower



**Fume Scrubbing:** 1,200 CFM Packed Tower Scrubber, PVC construction with top-mounted fan for removal of iodine fumes from reactor tanks



**5,000 CFM Packed Tower Scrubber,** polypropylene construction to remove acid gasses from chemical tanks at a recycling facility

# Packed Bed Wet Scrubbers

## *Fume Scrubbers remove acids, soluble gasses, chemicals, and odors*

Monroe Environmental is a single source solution for highly durable and efficient Packed Bed Scrubbers. A Packed Bed Scrubber is a wet scrubber that removes acids, soluble gasses, chemicals, fumes, and odors. Contaminated gas flows through a specially designed packing media that is wetted with recirculated liquid. The liquid solvent absorbs the gas pollutant by physical or chemical means. A blowdown from the reservoir with makeup water addition removes contaminant products before they precipitate.

## Applications

- Acid fumes and gasses
- Chemical fumes and odors
- Food processing odors
- Landfill and biogas contaminants
- Metal finishing fumes
- Steel processing fumes
- Wastewater treatment plant odors
- And many others

- Capacities: 10 – 75,000 CFM with a single unit
- Efficiencies to 99.99%
- Vertical and horizontal configurations
- Counter-flow and cross-flow models
- Cylindrical and rectangular construction designs
- Pre-quench and venturi stages available
- Pilot systems available for application and process testing

## Wet Scrubber Features

- Materials of construction include:
  - FRP
  - RTP (Reinforced Thermoset Plastic) and dual laminate
  - PVC and CPVC
  - Polypropylene and polyethylene
  - Stainless steel, mild steel, and FRP-lined mild steel
  - Nickel alloys
  - Titanium
- Wide range of packing media including rings and saddles in various materials. Structured packing is also available.
- Complete instrumentation and electrical controls are available for stand alone operation or connection with a facility's centralized control or monitoring systems.
- Chemical treatment, including oxidation and neutralization, is available to increase absorption of gaseous pollutants.
- pH control available when applicable.



*Skid-mounted Packed Bed Scrubber, FRP construction with customized instrumentation, piping, pumps, and control panel fully assembled in Monroe shop*

- Corrosion resistant AMCA rated fan on the inlet or outlet side of the scrubber.
- Corrosion resistant recirculating pumps for scrubber liquid recirculation.
- Non-plugging spray nozzles for wetting packing in a wide range of corrosion resistant materials. Special liquid distributors may also be used.
- Moisture eliminators with chevron, mist pad, or loose fill type designs.



*13,500 CFM skid-mounted Horizontal Packed Bed Scrubber, stainless steel construction to scrub acid and caustic fumes*



12,500 CFM scrubbing system for HCl and Cl<sub>2</sub> removal from RTO exhaust

## Efficient Fume Scrubber Design

Monroe Environmental Packed Bed Scrubbers are custom designed to meet or exceed the specific removal efficiency required for each customer's application and process. To optimize the performance of each unit, Monroe will analyze:

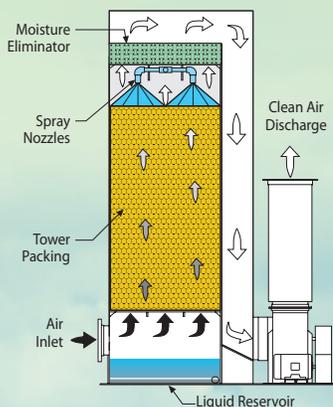
- Contaminant solubility
- Vapor pressures
- Wash liquid flow rate
- Liquid to gas ratio
- Packing chamber height, diameter, and volume
- Packing media type and size
- Chemical additives
- pH control
- Precipitation of reaction products
- Multiple solution scrubbing
- Required scrubbing stages
- Pressure drop across packing
- Materials of construction
- Site requirements



Non-plugging spray nozzles above bed of loose fill polypropylene packing

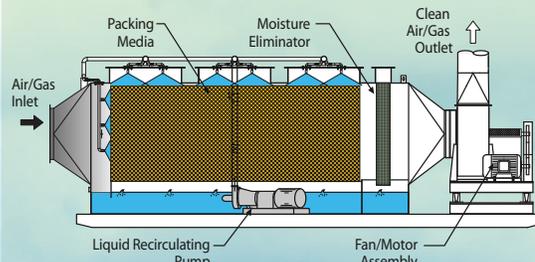
### Vertical Packed Bed Scrubber

This is a counter-flow design that has contaminated gas flowing upwards and recirculated liquid spraying downwards through the packing media. Vertical scrubbers typically have a smaller footprint and can have greater removal efficiency than Horizontal Packed Bed Scrubbers. Multiple scrubbing stages with different scrubbing solutions can be achieved by having more than one scrubbing tower in series (see page 11).



### Horizontal Packed Bed Scrubber

This is a cross-flow design that has recirculated scrubbing liquid flowing vertically downwards while the gas passes horizontally through the packing section. This design is more tolerant of solid particulate that may be contained in the air stream. A Horizontal Packed Bed Scrubber is appropriate when limited headroom is an issue, and it also allows for multiple stages in one housing with separate sumps and scrubbing solution pumps if required.



# Venturi Particulate Scrubbers

Monroe Venturi Scrubber and Cyclonic Separator exhausting a lime kiln



High pressure drop 80 in. W.C. fixed throat Venturi

## Wet Scrubbers for PM (Particulate Matter) reduction

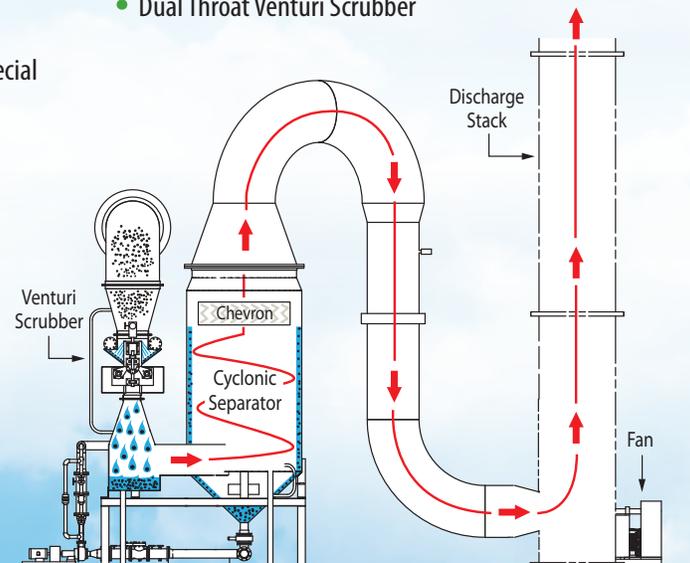
Monroe Venturi Scrubbers are designed to remove both heavy and light airborne particulate matter from exhaust systems, as well as flue and process gasses. Venturi Scrubbers bring particulate-laden air streams together with water at high velocities to transfer the particulate into the water stream. The water droplets and particulates are then removed from the air stream through centrifugal separation and mist elimination stages.

- Wet type dust collector
- Efficiencies to 99.99%
- 500 – 50,000 CFM standard unit capacities, special designs available
- No moving parts in the scrubbing zone
- Minimum maintenance
- Optional solids removal conveyor
- Optional oil skimming systems

## Venturi Wet Air Scrubber Designs

Monroe Environmental offers several venturi design configurations:

- Circular and rectangular venturi scrubbing throats
- Fixed and adjustable throat designs
- Eductor, ejector, and traditional venturi throat designs
- High, medium, and low energy pressure drops
- Dual Throat Venturi Scrubber



Venturi Scrubber with Cyclonic Separator



*Left: 9,600 CFM Dual Throat Venturi Scrubber for boiler exhaust scrubbing*

*Right: 2,800 CFM Dual Throat Wet Air Scrubber, stainless steel construction with pyramid hopper for sludge dryer exhaust scrubbing*

## Dual Throat Venturi Air Scrubber – Wet Dust Collector

The Monroe Dual Throat Venturi Air Scrubber is a completely self contained unit that needs only to be connected to normal plant electrical, water, and air systems. The Monroe Dual Throat Scrubber is one of the most versatile venturi scrubber designs available because of its ability to handle a wide range of dry, wet, sticky, tacky, and oily particulate loads. Additionally, the system is an excellent choice for explosive dust applications.

### Recirculate Clean Air to Reduce Climate Control Costs

In many installations, such as buffing and polishing, metal finishing and grinding operations etc., it is possible to recirculate clean, contaminant-free air back to the work area. This reduces the cost of plant ventilation systems and climate control needs.

### Dual Adjustable Scrubbing Throats

High velocity atomization takes place as the inlet air is directed through the fixed and dual adjustable scrubbing throats. The easily adjustable dual throats balance the pressure drop through the air flow system at start-up or after system changes are made.

This design feature can eliminate the need for ductwork dampers and blast gates that are prone to particulate build-up and require periodic maintenance. In addition, the increase in pressure drop in the wash zone improves the overall efficiency of the system.

### Many Configurations Available

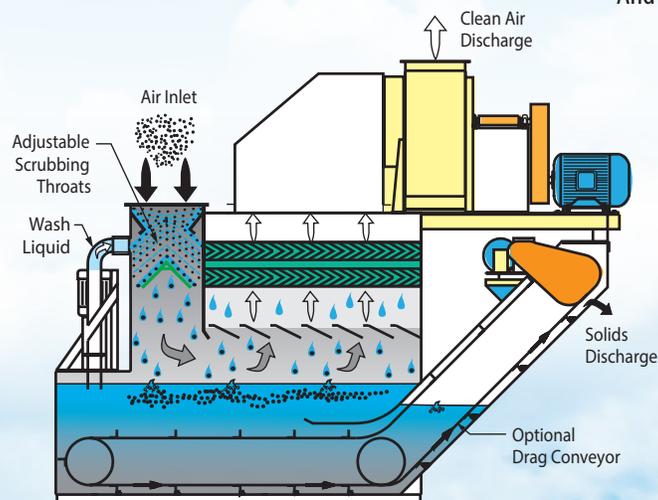
Monroe Dual Throat Venturi Air Scrubbers can be configured to meet specific needs. Units can be equipped with drag conveyors to remove heavy, settled particulate and oil recovery units to remove accumulated oil.

### Minimum Wash Liquid Requirements

Wastewater disposal problems can be reduced or eliminated under normal operating conditions. Each unit has a self-contained wash liquid reservoir and recirculating pump. An automatic water valve replenishes wash liquid lost through evaporation.

### Applications:

- Automotive manufacturing
- Glass manufacturing
- Machining operations
- Buffing & deburring
- Wax spraying
- Flame laminating
- Synthetic resin fines
- Grease manufacturing
- Explosive dust collection
- Foundry dust & fumes
- Sludge dryer exhaust
- Incineration processes
- Kiln exhaust scrubbing
- Frac sand & proppants
- And many others



*Dual Throat Wet Air Scrubber with drag conveyor option*

# Multi-Stage Scrubbing Systems

## Complete scrubbing solutions for multi-pollutant emissions reduction

### Applications

- Solid waste incineration
- Boiler exhaust
- Chemical gas incineration
- Kiln exhaust scrubbing
- RTO exhaust scrubbing
- Oven/furnace exhaust scrubbing
- Flame laminating
- Dryer exhaust scrubbing
- Glass coating
- Grease and chemical production
- Textile manufacturing
- And many others

Monroe Environmental can provide complete multi-stage air scrubbing systems for a wide variety of applications. High temperature and volatile chemical processes often require a more complex, customized air scrubbing solution than what a simple packed tower scrubber or venturi particulate scrubber can provide.

In many cases, several technologies must be integrated together to provide adequate removal and treatment efficiencies. Monroe's experience includes the engineering and fabrication of customized multi-stage systems utilizing the following equipment:

- Packed Bed Scrubbers
- Venturi Particulate Scrubbers
- Wastewater Clarifiers
- Oil Recovery Units
- Carbon Adsorbers
- Quench Towers
- Cyclonic separators
- Separators and Oil Recovery Units
- Heat exchangers and temperature controls
- Sub-cooling systems
- Dry injection fabric filters (DIFF)
- Fiberglass filters
- WESP and submicron particulate filters
- Specialty ducting systems

Monroe has the experience and knowledge to evaluate your process and recommend a customized scrubbing system for your specific application. Monroe has successfully treated contaminated air streams resulting from:

- Solid waste and/or chemical gas incineration
- Boiler, kiln, and RTO exhaust scrubbing
- Flame laminating and glass coating
- Grease and chemical production
- Textile manufacturing
- Chemical and compound reclamation
- High temperature scrubbing processes
- And many others



15,000 CFM Scrubbing System to condense and reclaim vaporized grease and remove hydrocarbon fumes from a chemical manufacturing process. The system includes a Dual Throat Venturi Scrubber with drag conveyor, Oil Recovery Unit, and Packed Bed Scrubber for odor control.



1,000 CFM Scrubbing System to remove lime dust from a chemical manufacturing process. (From left): Ejector Venturi, liquid clarification tank, high energy Venturi Scrubber, and cyclonic separator. The unit was designed to achieve 95% efficiency on 0.5 micron particles.



Two-stage wet scrubbing system with eductor venturi and packed tower for HCl and SO<sub>2</sub> reduction from pharmaceutical manufacturing process exhaust



20,000 CFM Multi-Stage Scrubbing System for solid waste incineration process. (From right): Ceramic-lined inlet duct, rapid water quench, adjustable Venturi Scrubber, liquid clarification tanks, Packed Bed Scrubber, and Carbon Adsorber.



Multi-Stage Scrubbing system with inlet quench, 3-stage Packed Bed Scrubber, high energy Venturi Scrubber, electric gas reheater, and Carbon Adsorber for toxic gas incineration

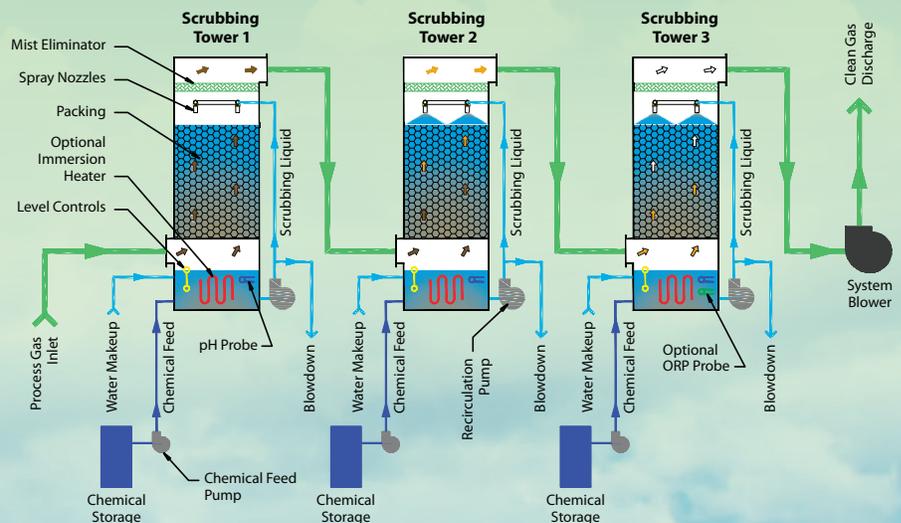


Packed Tower Scrubber followed by Carbon Adsorber for H<sub>2</sub>S and VOC reduction from a rubber manufacturing process

## Multiple Packed Bed Scrubbing Stages

Multiple scrubbing stages with different scrubbing solutions can be achieved by providing multiple scrubbing towers in series.

This type of system is common when there is a high pollutant loading, multiple pollutants, or when removal efficiencies greater than 99.9% are required.



# Quench Towers

## Applications

- Pre-conditioning of gasses before scrubbers and other air pollution control technologies
- Treating off-gasses from:
  - Incinerators and thermal oxidizers
  - Furnaces, boilers, and kilns
  - Dryers, reactors, and gasifiers

## Temperature reduction and pre-conditioning of process gasses

Monroe Environmental Quench Towers provide temperature reduction and control of hot process gasses through evaporative cooling or direct heat transfer. A Quench Tower is often the first step in conditioning a high temperature, polluted air stream so that particulate, acid gasses, metals, and other emissions can be adequately removed. Quench Towers are often used following thermal treatment systems such as incinerators, reactors, kilns, boilers, furnaces, oxidizers, and other process systems that produce contaminated gas streams at elevated temperatures.

Monroe Environmental engineers have the experience to provide a customized Quench Tower design that will meet the needs of your application without the use of excessive water consumption. Using the air temperature and moisture content (lb. water per lb. of dry air), the temperature at full saturation can be predicted. Systems which require only partial saturation to meet specific temperature targets can also be designed by Monroe engineers.

## Quench Tower Design

The proper design of a Quench Tower takes into account many factors, including:

- Inlet temperature
- Inlet moisture content
- Target temperature
- Target moisture content
- Effect of quenching on particulate formation and control
- Chemicals present in air/gas stream
- Velocity of the gas stream and gas retention time
- Nozzle design and spray patterns
- Materials of construction to withstand temperature and chemical attack
- And many others

Monroe Environmental can assess these and other application factors and custom design a quench tower that is suitable for your application.



*High temperature and corrosion resistant evaporative Quench Tower*

## Configurations

**Vertical Quench Tower:** The traditional and most common quench design. Incoming gas stream usually enters at the top of the tower and exits at the bottom or the side of the unit. Nozzles and spray patterns may operate in a co-current or counter-current mode depending on application specifics.

**Inlet Duct Quench:** Inlet duct quenching can often be achieved when the inlet gas temperature is only moderately higher than the desired quench temperature and the gas is relatively dry.

**Dry Sump Quench:** A dry sump quench uses a carefully controlled water feed to achieve partial quenching (not fully saturated) with no excess liquid in the quench sump, hence the name "dry sump quench".



*Quench Tower for gas conditioning prior to baghouse dust collector, AL6XN alloy construction*

# Carbon Adsorbers



Tray-type Carbon Adsorber for odor control at a grainery



Two 15,000 CFM Deep Bed Carbon Adsorbers, mild steel construction with specialty exhaust stacks for odor control at a grease manufacturing facility

## Physical and chemical adsorption of VOCs and other gas-phase pollutants

Monroe Environmental manufactures Dry Adsorbers for both physical and chemical adsorption of gas-phase pollutants. Adsorption involves the adhesion of pollutant gas molecules to porous solid surfaces that the contaminated air stream passes through. Physical adsorption relies on intermolecular forces while chemical adsorption involves the formation of chemical bonds.

## Overview of Adsorber Types

**Deep Bed Adsorber:** In horizontal or vertical configuration with a single deep bed or multiple beds in series within the adsorber vessel.

**Carbon Tray Adsorber:** Flow passes through several removable carbon trays in parallel. Each tray contains activated carbon pellets and may be removed and refilled when pellets are saturated.

**Multiple Adsorber Vessel System:** Two or more separate adsorber vessels allow for air flow to be

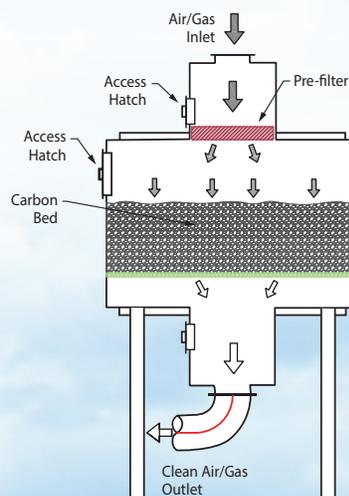
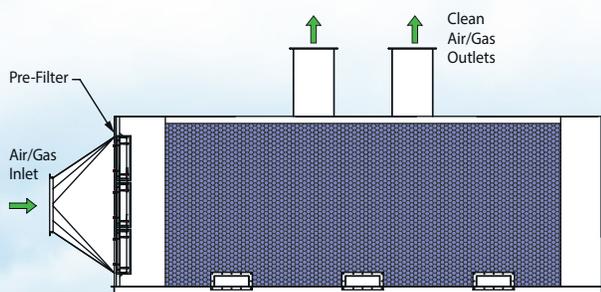
directed through one or more vessels for adsorption of contaminants while the other vessel(s) are regenerated with steam, allowing for uninterrupted adsorption and regeneration.

## Design Features

- Wide range of adsorbents: carbon, zeolite, synthetic polymers
- Capacities to 50,000 CFM for a single unit
- Efficiencies to 99.9%
- Construction available in mild steel, stainless steel, PVC, FRP, and other materials
- Complete instrumentation and electrical controls available
- Corrosion resistant AMCA rated fan on the inlet or outlet side of the adsorber, if required

## Applications

- VOC removal and solvent recovery
- Industrial emissions from: degreasing, paint spraying, paper coating, plastic filming, metal foiling, rubber-coating, and printing
- Removal of H<sub>2</sub>S and other odors



Horizontal and vertical configurations of a Deep Bed Carbon Adsorber

# Mist Collectors

## Self-contained, single unit designs to suit your application

Monroe Mist Collectors are designed to collect and remove airborne oil, mist, smoke, and sub-micron vapors generated by operations such as high production machining and cold forming. It is a multiple stage collector that has proven capabilities exceeding 99% efficiency on many installations. After installation of a Monroe Oil Mist Collector, high production machining areas using water soluble, synthetic, or mineral coolants can discharge clean, filtered air back into the work area, significantly reducing climate control costs.



Monroe Mist Collector exhausting multiple machining operations at once

## The Test:

A major American automotive manufacturer commissioned the University of North Carolina to perform efficiency testing on various Oil Mist Collectors for possible use in their machining facilities. The following quote is from the findings at the conclusion of this test period:

***“The Monroe Three Stage Collector removed virtually all mist droplets of Mineral Oil, Soluble Oil and Synthetic Fluid to the limit of our ability to detect them.”***

Department of Environmental Sciences and Engineering  
University of North Carolina  
at Chapel Hill

## Features

- Oil, mist, coolant, smoke, and vapor removal
- Efficiencies to 99.9% on 0.3 micron
- 500 – 80,000 CFM standard unit capacities, special designs available depending on plant requirements
- Ductwork can be provided, including evaluation, recommendations, design, and manufacture
- Continuous drain for oil removal and reclamation
- Reduced costs associated with maintenance, energy requirements, and climate control
- Single units to fit an existing operation, or multiple mist collectors for complete in-plant air-quality control
- Ergonomic considerations — Ease of access to all key points on the mist collector
- HEPA filter option is available as final filter stage

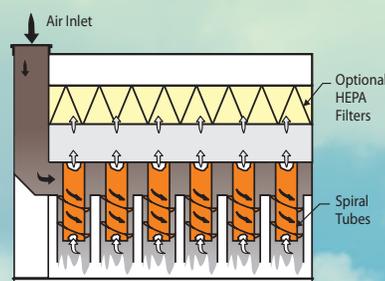


Left: 1,000 CFM Spiral Tube Mist Collector, stainless steel construction to filter mist from a washer at a food processing facility

Right: The Monroe Fiber Bed Mist Collector removes particles as fine as 0.3 micron and below. Monroe's self-draining filter is designed to prevent re-entrainment and recirculate clean air to the atmosphere.

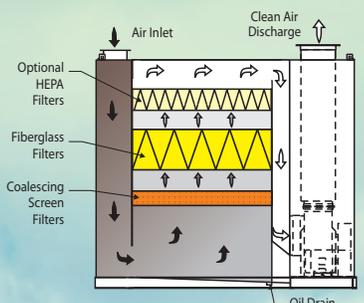
## Spiral Tube Mist Collector

The Spiral Tube Mist Collector is a two-stage mist collector that uses spiral tubes to provide a high level of mist agglomeration and removal without using filters. Centrifugal force and impaction provide the mechanism for primary mist removal. Stainless steel separation tubes provide lower lifetime maintenance costs than filter bags which must be periodically replaced.



## Multi-Stage Mist Collectors

The Monroe Multi-Stage Mist Collector collects and removes airborne oil, mist, smoke, and sub-micron vapors generated by operations such as high production machining and cold forming. Using a series of filters to separate and remove mist from the air stream, the Multi-Stage Mist Collector includes a drop-out chamber, separator mesh elements, fiberglass filters, and an optional HEPA filtration stage.





*Mist Collector exhausting a high production machining line at an automotive plant*

## Applications

- Machining operations
- Metal cutting
- Metal forming
- Steel & aluminum
- Rolling mills
- Tool & die
- Parts washer exhaust
- Food processing
- Packaging systems
- Produced oils & coolants
- Asphalt operations
- And many others

## Design Leadership

Monroe Environmental Mist Collectors, with longer operating cycles and higher efficiencies, outperform all other collectors. Because of slower internal velocities through the collector, media replacement and maintenance labor costs are reduced. Collected oil, mist, and solids are continuously drained from the media without shut-down, significantly prolonging filter life and lowering overall operating costs. Monroe can integrate new units into existing ductwork and ventilation systems or design and furnish new ductwork depending on customer requirements.

## HEPA Type Filters

Monroe Mist Collectors are available with specially constructed HEPA type fiberglass filter cartridges as the optional final filter system. These filters are normally supplied with a 95% efficiency rating at 0.3 micron. These filters have a long service life, normally 4,500 hours or more, because the majority of contaminants are removed during the preceding stages and are continuously drained from the unit.

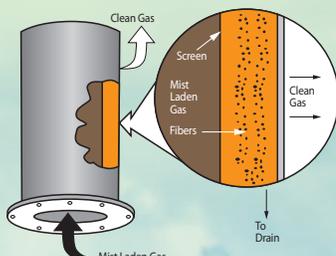
Air processed by a Monroe Mist Collector meets air quality standards for in-plant discharge as well as outside exhaust. Discharging clean, filtered air back into the work area can significantly reduce climate control costs.



*Compact Mist Collector*

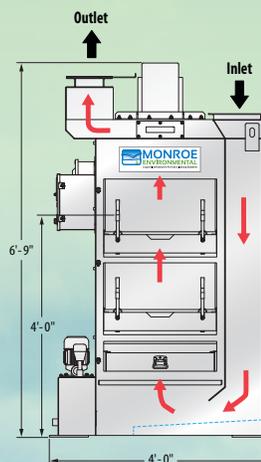
## Fiber Bed Mist Collectors

Custom designed mist collector consisting of a continuous-duty aerosol coalescing filter, fan assembly, and when needed, an optional pre-filter stage. Mist is collected using filter elements consisting of micro-fine fiberglass or synthetic fibers. These long-life filters can provide several years of service before replacement is necessary. When the mist contains heavy droplets and/or dust particles, pre-filtering is provided by separate filter screens. Efficiencies of 99.5% on 0.3 micron mists are typical.



## Compact Collectors

Monroe Compact Mist Collectors minimize the maintenance requirements and floor space issues of competitive mist collector designs. This unit is available with spiral tubes, multi-stage filters, or fiber bed box filters.



# Dust Collectors

## Applications

- Bulk solids handling
- Chemical processing
- Dry machining operations
- Grinding
- Powder coating
- Shot blast
- Welding operations
- MQL machining
- And many others

## High performance dust collectors for dry dust and MQL applications

The Monroe Cartridge Dust Collector is designed to provide continuous-duty collection and removal of airborne dust and particulate matter produced by manufacturing and processing operations at 99+% efficiency on many installations. Through the use of a Monroe Cartridge Dust Collector, these operations can discharge clean, filtered air back into the work area thereby reducing climate control costs.

Continuous collection and removal of airborne dry dust and particulate matter (PM) with reverse pulse cleaning of bags or cartridges allows operation without shutdown.

- Long life pleated cartridge dust filters
- Broad range of dust collector filter media available
- Applications up to 350°F
- Easily install and remove dust collector cartridges
- Modular construction
- Ductwork can be provided — including evaluation, recommendations, and design
- Capacities from 500 – 50,000 CFM
- AMCA rated fans on the outlet side of the collector
- Integral pressure gauges indicate filter performance
- Specialty filters available for MQL machining applications

Monroe also has the capability to design and build custom baghouse dust collection units when applicable, including dry injection systems for acid reduction.

## Top Performance with Better Cartridge Filter Cleaning

The cartridges in the Monroe collector are mounted in a vertical position. This assures that when the collected dust is pulsed from the cartridges, it falls to the bottom of the collector.

In units with horizontal cartridges, dust pulsed from above cartridges falls onto cartridges below. This reduces filtration capability and requires additional maintenance for rotating cartridges. This is avoided in the Monroe unit. The Monroe cartridges are easily accessed with pull out racks when replacement is necessary.



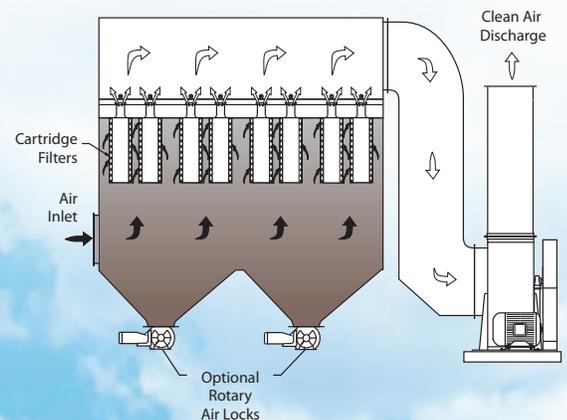
6,000 CFM Cartridge Dust Collector with inlet duct and storage drum exhausting a sandblasting and paint spraying operation



Custom configurations, including ceiling or roof designs, are available where a standard collector cannot be used. 30,000 CFM Dust Collector with multiple pyramid hoppers and screw conveyor options shown above.

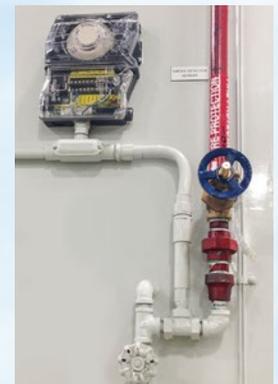


Vertically mounted, pleated fabric filters ensure high efficiencies for both dust collection and filter cleaning





*Monroe Cartridge Dust Collectors equipped with fire suppression systems operating in the field*



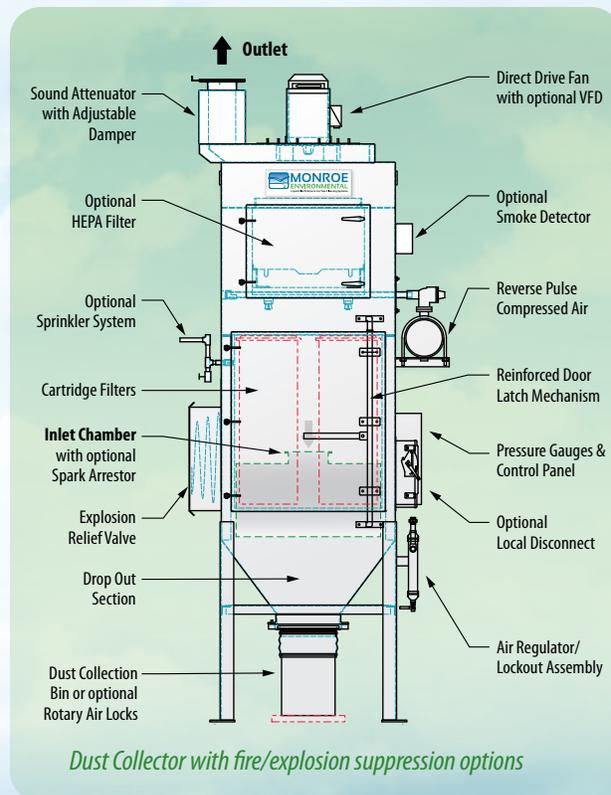
*Smoke detector and sprinkler system options*

## Fire/Explosion Suppression Options

Monroe Environmental offers a wide variety of state-of-the-art features to maximize worker safety and minimize equipment damage, including fire and explosion suppression options for hazardous applications.

The Monroe Cartridge Dust Collector can also be fitted with specialty polypropylene cartridge filters to accommodate MQL (minimum quantity lubricant) machining operations, which is a highly attractive waste and energy reducing machining technology gaining acceptance in a variety of production plants.

- Backdraft damper — NFPA 69-2014 compliant
- Explosion relief valve — resealing pressure relief valve with opening detection
- Spark detection sensor — ductwork mounted single-infrared (IR) spark/flame detection sensor
- Spark arrestor — inline ductwork spark arrestor to smother and quench sparks and embers
- Smoke detector
- Sprinkler system with flow switch
- Inlet/outlet chemical suppression
- Flame retardant filters
- Spark resistant fan
- Explosion proof motor



*Dust Collector explosion panel*

# Explosive Dust Collection

## *Removal and suppression of explosive dust with both wet and dry collection technologies*

Monroe Environmental has extensive experience with explosive dust collection. We offer both wet and dry collection solutions depending on your specific application.

### Wet or Dry Collection?

Several factors must be taken into account before selecting the best explosive dust collection method. Both wet and dry systems can be utilized depending on the physical properties of the dust such as particle size, moisture content, ignition potential, and dust concentrations.

In general, wet collection systems suppress and neutralize the dust's explosive properties so that it no longer poses an explosion threat. Additionally, wet systems can better handle highly abrasive dusts that may tear, shred, and damage dry filter media. However, by design these wet systems consume fresh water and generate wastewater that must be treated, impacting the operating cost of the units.

Dry collection systems are designed not only to prevent explosions, but to contain and minimize the dangerous effects of explosions should they occur. Dry collectors are often required to have several NFPA approved mechanical instruments and fire suppression components such as explosion vents, spark arrestors, backdraft dampers, smoke detectors, and emergency sprinkler systems which can significantly impact the cost of the unit.



*Monroe Cartridge Dust Collector with explosion control system*

In general, the following application and site data should be taken into account when determining the best solution for explosive dust collection:

- Process to be exhausted
- Physical properties of the dust
- Particle size, shape, and concentration
- Moisture content
- Ignition sources/potential
- Kst and Pmax values
- Site layout, ductwork, and enclosure/hood design
- Water sources
- Wastewater treatment/disposal capabilities
- Worker exposure and safety

## Explosive Dust Applications

- Aluminum
- Magnesium
- Titanium
- Zinc
- Coal dust
- TNT
- Wood products
- Specialty textiles
- Grain, sugar, and starch
- And many more



## Dual Throat Venturi Scrubber: Wet Dust Collector for Explosive Dust

The Monroe Dual Throat Venturi Scrubber is a wet type dust collector that provides efficient collection and suppression of explosive dusts for a variety of applications. It is designed to provide continuous-duty collection and removal of airborne dust and particulate matter produced by manufacturing and processing operations at 99+% efficiency on many installations.

The Dual Throat Venturi Scrubber contacts the dust with water to reduce its explosion potential and transfer the particulate into the water stream. The water droplets and particulates are then removed from the air stream through separation, baffling, and mist elimination stages. This unit is excellent for explosive dust applications (*see page 9*).

*Dual Throat Venturi Scrubber with particulate reclamation system, integral mist eliminators, fan, sound attenuator, and controls.*

# Pilot & Testing Programs



Some of Monroe's pilot systems for air pollution control: (Left to right) Venturi Scrubber, Packed Tower Scrubber, and Dust Collector

Monroe Environmental Pilot Systems are an excellent option for testing a technology's performance capability and suitability for a particular application. This is a cost-effective way to evaluate an environmental solution before making a capital investment in a full scale system. Monroe has several Pilot Systems available for rent as well as the support services required to install, operate, and evaluate its performance.

- Pilot scrubbers and collectors available for rent
- Installation and operation services
- On-site support
- System optimization
- Data and analysis reports

Upon completion of a Pilot System test, Monroe Environmental can evaluate and analyze the system's performance and present a written report summarizing the results and recommendations in order to properly scale up for a full system. We work with your operators, engineers, and maintenance personnel to design a true solution that will meet the needs of your plant and application.

Please contact a Monroe Environmental Applications Engineer to learn more about our pilot system capabilities.

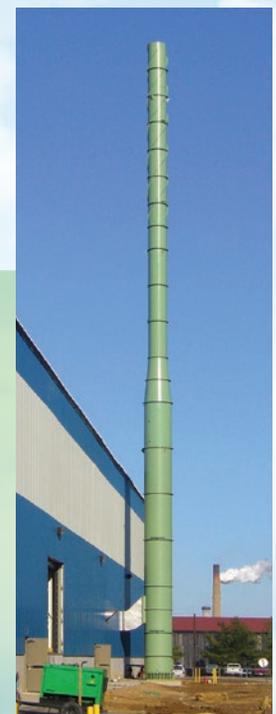
## Auxiliary Equipment, Components, & Packaged Systems

In addition to providing air pollution control systems, Monroe offers an array of equipment, components, and devices typically needed for enabling a complete turnkey installation. These include but are not limited to the following:

- Ductwork design and supply
  - Plenum or tapered systems
  - Dampers and louvers
  - Discharge and no-loss rain stacks
  - Capture hoods and enclosures
- Control and instrumentation systems
- Chemical storage and feed systems
- Blowdown and water treatment systems
- Carbon and filter media
- Pumps, piping, valves, and fittings



Tapered ductwork system with individual source hoods for multiple Oil Mist Collectors on a high production machining line



Free standing 145 ft. tall steel discharge stack for a hydrocarbon removal system at a steel mill

# Water & Wastewater Treatment

Monroe Environmental® provides liquid clarification technologies for a variety of water treatment processes at nearly every type of industrial manufacturing plant and municipal treatment works, including those in the following fields:

**Automotive Manufacturing | Chemical Processing | Food Processing | Glass & Plastics**  
**Mining & Metals | Oil & Gas | Pulp & Paper | Steel Processing | Utilities/Energy | Waste Management**



## Circular Clarifiers

- Primary and secondary clarification
- Solids Contact and flocculating designs for lime softening and chemical treatment
- Sludge thickeners
- **Clarifier Rebuilds** for existing units
- Steel tanks available or internals for concrete tanks
- Variety of sludge collection designs
- Heavy duty and high torque designs available



## API Oil/Water Separators

Oil/water separation and recovery at industrial wastewater treatment plants

- Oil refineries
- Tar sands
- Power plants
- Steel manufacturing
- Chemical manufacturing
- Applications removing oil from water



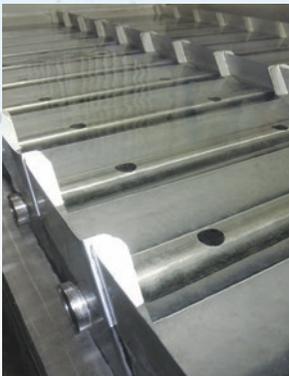
## Vertical Plate Clarifiers

- Suspended solids and dissolved metals removal
- Industrial process/wash liquids clarification
- Filter backwash clarification
- Integral flocculation and pH adjustment capabilities
- Variety of sludge thickening and removal configurations
- Integrated systems with chemical treatment and sludge processing



## Horizontal Plate Clarifiers

- Same settling characteristics as Vertical Plate Clarifier
- Able to collect floatable materials as well as settleable solids
- FOG (Fats, oils, grease) removal and recovery
- Reduced headroom requirements
- Able to replace circular clarifier in many applications



## Plate Settlers and Sludge Collection

- Increase solids settling capacity of new and existing sedimentation basins for municipal and industrial water treatment applications
- Low cost alternative to building new settling tanks
- New, retrofit, and rebuild services
- Can include a **Monroe Sludge Collection System**



## Air Strippers

- Groundwater remediation at water treatment plants to remove VOCs
- Remediation of surface or ground water for use in industrial manufacturing processes
- Removal of odorous compounds and VOCs from water streams



**MONROE**  
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