EnviroCare

MicroMist™ Engineered Systems

Enhanced Dust Collector Performance
Evaporative Gas Conditioning

Advanced Evaporative Gas Conditioning System Enhances Particulate Control

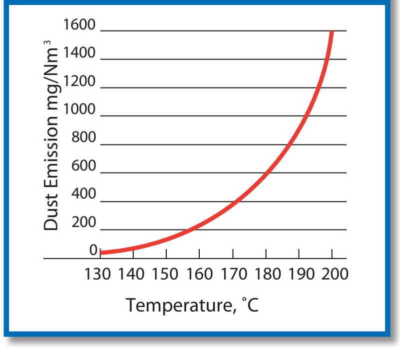
Evaporative Gas Conditioning (EGC) is a technique for conditioning flue gas prior to electrostatic precipitators and fabric filters to improve particulate collection. Unlike other flue gas conditioning techniques, EGC does not add any toxic or hazardous compounds to the plant site, flue gas, or collected particulate. Instead, finely atomized water is evaporated in the gas stream to lower its temperature and raise the moisture content. This beneficially alters particulate properties by raising surface conduction and increasing inter-particle bonding, thereby enhancing the collection of dust and trace elements in particulate control devices.

Benefits of MicroMist™ EGC

Electrostatic precipitator (EP)
- Lowers gas volume and velocity
- Increases humidity
- Increases specific collection area
- Increases particle migration velocity
- Lowers gas viscosity
- Decreases rapping reentrainment

Fabric filter (FF)
- Lowers gas volume and pressure drop
- Allows use of lower-priced filter media
- Decreases air-to-cloth ratio
- Improves dust removal from media
- Increases dust cohesivity
- Improves filter cake characteristics

Effect of Temperature on EP Emissions



"Moisture seems to be essential to the effectiveness of chemical conditioning agents. In general, the action of the conditioner increases with the amount of moisture in the gas and with decreasing temperature of the gas. Water vapor is therefore frequently referred to as a primary conditioning agent and chemicals are considered secondary conditioning agents."

Dr. Harry White — Industrial Electrostatic Precipitation

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MicroMist™ Evaporative Gas Conditioning

As a pioneer in the development and application of dual fluid atomization technology, EnviroCare has supplied EGC systems worldwide to some of the largest industrial producers and architect/engineers. EnviroCare's MicroMist EGC system has proven itself in difficult applications in various industries around the world, and is capable of achieving the low gas temperatures required to meet today's stringent emission standards consistently and efficiently.

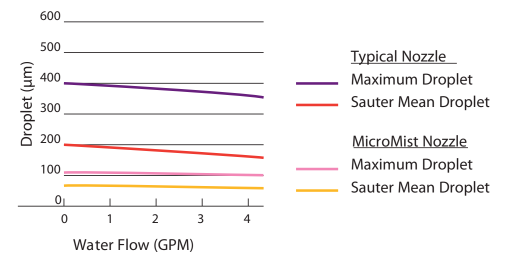
MicroMist™ Series III Spray Nozzles

With the recent development of the Series III MicroMist technology, gas cooling and conditioning systems can be installed in previously impossible locations. Some examples include power plant EP inlets, undersized cement preheater downcomers and conditioning towers, and BOF steel mill hoods. These results are achieved through a thorough understanding of droplet generation and in situ evaporation.

MicroMist™ Engineered System

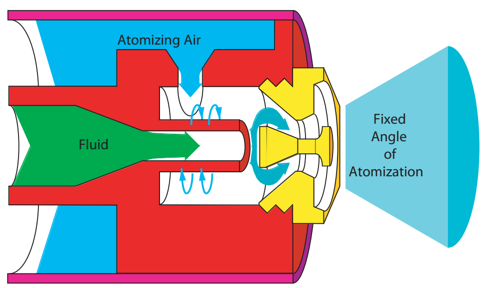
EnviroCare's control systems are designed to anticipate small changes in temperature and respond quickly with appropriate changes in water flow and atomizing air. The injection water flow rate is precisely maintained by manipulating the process variables and predicting demand. By accurately regulating the ratio of atomizing air to water, the degree of atomization is controlled across all flow ranges, and can be tailored to match specific process parameters. It is this atomization control that generates fine, uniformly sized water droplets. The resulting increase in surface area magnifies the probability of gas/water interaction and reduces evaporation time. Reduced evaporation time results in lower achievable temperatures and dry system operation.

Nozzle Performance Comparison



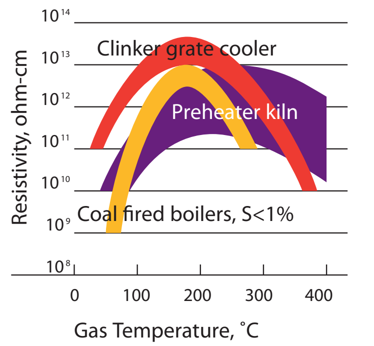
The MicroMist Nozzle

Patent No. 5,848,750



Dual Fluid, Four-Stage, Injection Spray Nozzle

Dust Resistivity Curves in Various Processes



Dry Electrostatic Precipitators

In many applications, older, existing EPs often fail to achieve specified collection efficiency. Gas conditioning systems have been utilized to regain some of this loss in efficiency. In such cases, a precipitator's performance is often based on the ability of the gas conditioning system to respond to process changes and variations in flue gas composition. These variations, even in small amounts can have a marked effect on particulate collection. MicroMist™ EGC precisely controls the flue gas properties to maximize collector efficiency.

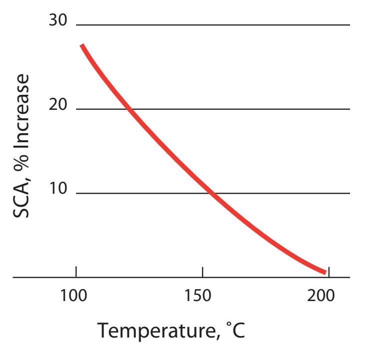
Improving Dust Resistivity

MicroMist™ EGC systems optimize the resistivity to improve electrical operation, resulting in greater particulate collection in the precipitator. If the resistivity of the dust layer on the EP collecting plates is too high, a large voltage gradient is generated across it.

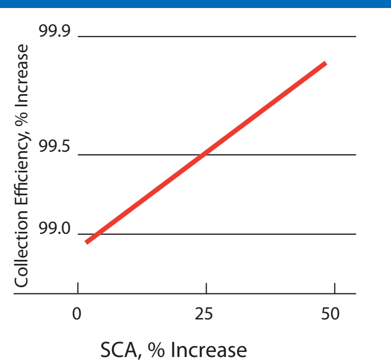
This condition limits precipitator performance, requiring low power levels to avoid electrical breakdown in the precipitated dust layer, a phenomenon called "back corona". Conversely, if the resistivity of the precipitated dust is too low, dust reentrainment occurs, resulting in high emissions.

The MicroMist™ EGC system efficiently adds atomized water to increase the moisture content of the flue gas, resulting in evaporative cooling. The reduction in temperature, combined with the higher water content, yields the optimum dust resistivity, improving electrical operation and increasing precipitator efficiency.

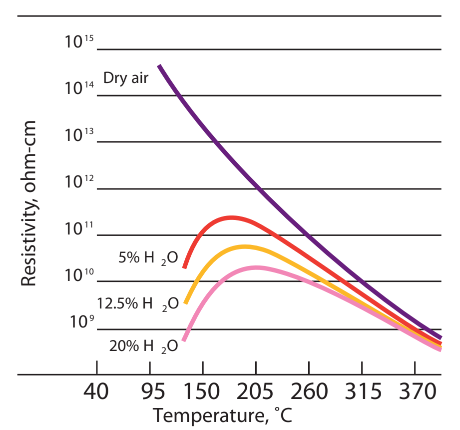
SCA vs Temperature



Particulate Collection Efficiency as Function of SCA



Dust Resistivity Characteristics



MicroMist EGC reduces resistivity by increasing moisture and decreasing temperature of flue gas

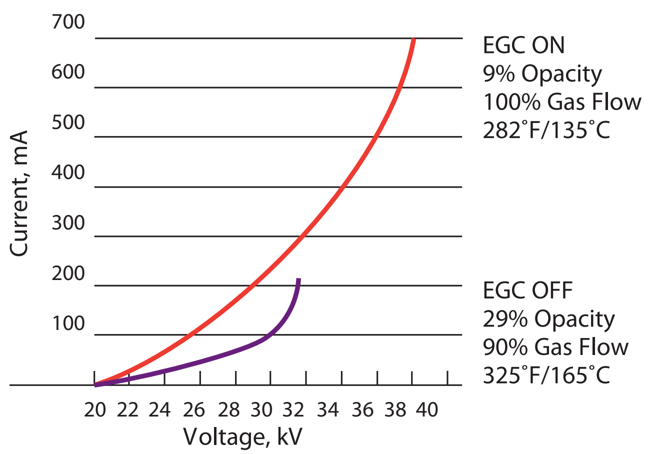
Increasing Precipitator SCA

SCA is the ratio of collecting plate surface area to gas volume. The higher the SCA, the higher the collection efficiency. Even a relatively small reduction in gas volume can increase a precipitator's SCA to dramatically reduce emissions.

Viscosity Reduction

The greatest single factor affecting precipitator efficiency is migration velocity. This term indicates the speed of the particle traveling toward the collecting electrode. MicroMist™ EGC lowers the viscosity of the gas stream resulting in increased migration velocity and thereby improving collection efficiency. This is a benefit that cannot be achieved through any chemical conditioning method.

Effect of EGC on Voltage & Current (V-I)



V-I curves for EP field collecting high resistivity dust

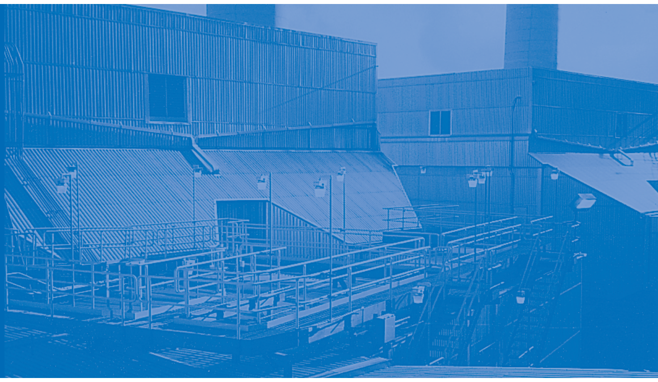
Reentrainment Control

A portion of the particulate emissions from a precipitator is attributed to dust that at one time had been precipitated onto the collecting plate. This condition is referred to as particle reentrainment. These particles are either scoured off the collecting surfaces by the gas stream, electrostatically repelled, or reenter the gas stream when the electrodes are rapped.

MicroMist™ EGC lowers the gas velocity and affects the electrical and cohesive forces. Lowering the velocity of the gases decreases the scouring effect of the gas stream. Electrostatic repulsion between dust particles is eliminated by changing the surface conductivity of the dust particles. The cohesive particle-to-particle bonds are greatly strengthened, thereby reducing reentrainment during rapping.

Energy Savings and Maintenance Reduction

Energy can be applied more efficiently with EGC by reducing sparking, thereby decreasing the energy spent in recharging the field. Further, components of a steadily operating precipitator do not see the cycling conditions found in precipitators with excessive sparking, resulting in considerable savings in maintenance.



Fabric Filters

Fabric filter dust collectors are often chosen for their efficiency in capturing particulate. Unfortunately, higher gas temperatures require the use of expensive filter bags. Furthermore, any increase in gas volume can upset a marginal air-to-cloth ratio and severely affect emissions and pressure drop.

MicroMist EGC is beneficial to the performance of fabric filters because of the reduction in gas volume (lower air-to-cloth ratio) that occurs from evaporative cooling. This effect is similar to the effect of raising SCA in precipitators. Increased humidity can also improve the filterability of particles resulting in lower pressure drop and higher collection efficiency. This is especially true for ashes that are inherently non-cohesive. Cooling the process exhaust gas will reduce both the temperature and the gas volume, allowing the selection of reasonably priced filter media and reducing the gas volume through the fabric filter.

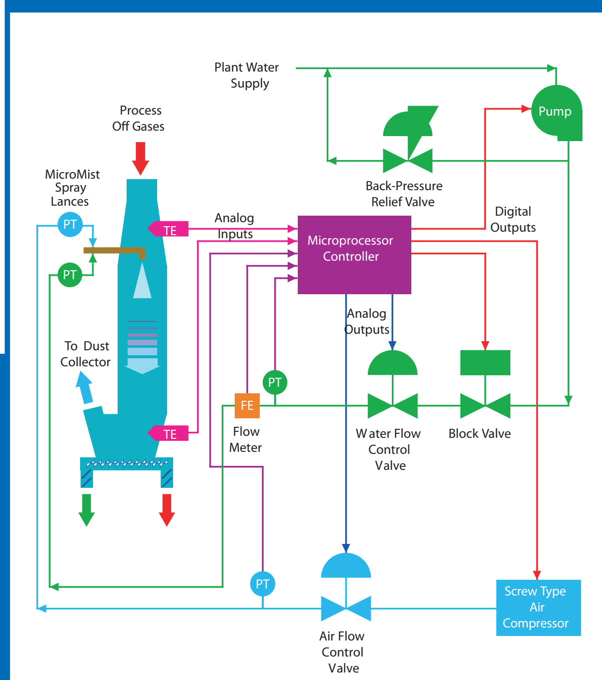
Improving Air-to-cloth Ratio

As with the increase in SCA for precipitators, the cooling of flue gases by evaporation of water droplets is beneficial to fabric filter performance. The lower gas volume means lower filtering face velocity, also called the air-to-cloth ratio. Lowering the air-to-cloth ratio allows for production increases with the same dust collector or decreased emissions if bleed-through is occurring.

Process & Instrumentation Diagram

A typical MicroMist installation follows this schematic. The signals from the thermocouples are compared against a temperature setpoint, and a signal to increase or decrease the water flow is transmitted to the water flow control valve. The air flow control valve is then modulated to control the proper air-to-water ratio. Alarms and interlocks are utilized to prevent poor atomization of the injected water.

Process & Instrumentation Diagram

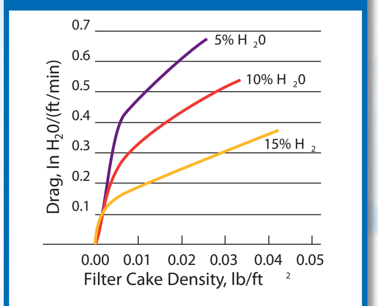


Decreasing Pressure Drop

MicroMist™ EGC is an effective means of lowering pressure drop of a fabric filter by lowering the filtering drag through the filter cake.

Large reductions in drag can now be achieved through moisture conditioning. The reduction in drag is a result of higher cake porosity. The porosity is increased because water absorbed onto the dust strengthens particle-to-particle bonds so that the resulting agglomeration structure is more open.

Particulate Collection Efficiency as Function of SCA



Pressure drop is proportional to the air-to-cloth ratio. For many reverse-gas fabric filters, the pressure drop is typically three times the air-to-cloth value. That means that a small reduction in the air-to-cloth ratio will produce a marked influence on the pressure drop of the system. The combined effect of lowering the air-to-cloth ratio and lowering the filtering drag results in a dramatic reduction in pressure drop in the dust collector.

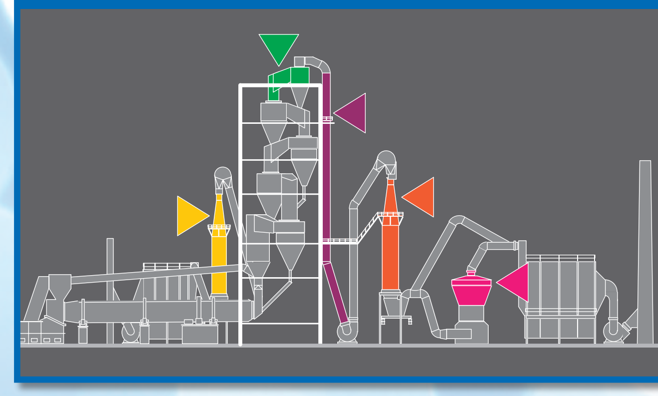
The MicroMist™ Advantage

As in the case of the EP, an impressive amount of energy is saved and maintenance is reduced with the implementation of a MicroMist EGC system. The lower pressure drop will continue to save energy day after day, and the lower velocity of the gas stream traveling through the filtration membrane equates to savings in bag replacement and associated maintenance.

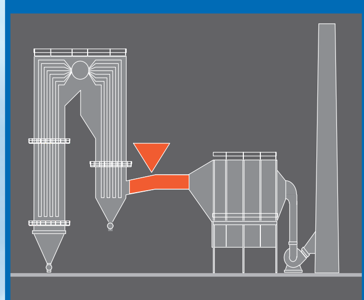
Typical MicroMist™ Applications

MicroMist™ EGC systems are used throughout the world to improve the efficiency of dust collection systems, to condense out vaporized substances and to create an inert process environment by means of a false evaporative load. Industries using EnviroCare's systems include cement works, power plants, municipal and hazardous waste incinerators, non-ferrous metals, lime plants, coal drying facilities, electric arc and basic oxygen furnaces, and glass plants.

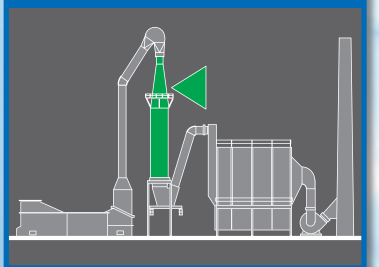
Cement Dry Process



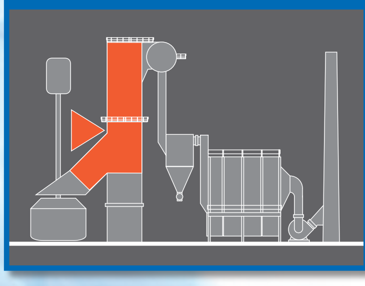
Power Plant



Non-Ferrous Metals



BOF Steel Mill



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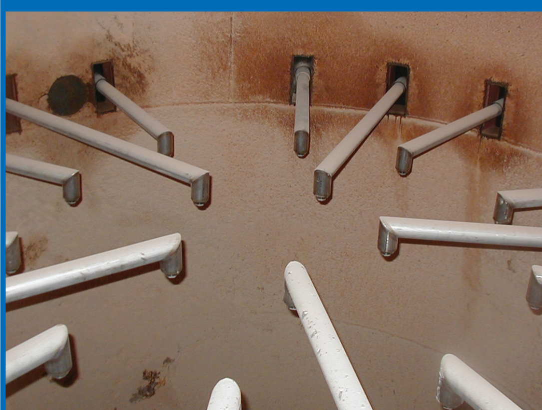
Valve Rack

Lance Layout



Alkali Tower

Gas Conditioning Tower

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