

Recent Advances in Gas Cleaning

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Particle Size Distribution - Physical Properties and Chemical Nature of Gaseous and Solid Emissions

Design Guide Book for Industrial Ventilation, COST G3 project has developed a new approach to general phenomena of particle size and gas cleaning. The table is useful for demonstration of particle size and removal of particles by commercially available equipment today. Also the particle size and measuring technology and behaviour in human body is presented. This table can be used as a thumb rule by an engineer and research scientist to get a general overview of gas cleaning technology. Please see the table 1.

Table 1" PARTICLE SIZE DISTRIBUTION - PHYSICAL PROPERTIES and CHEMICAL NATURE OF GASEOUS AND SOLID EMISSIONS" shows the physical and chemical nature of particles, starting from molecular level to 10 millimetre size.

Table 1 can be divided into three sections:

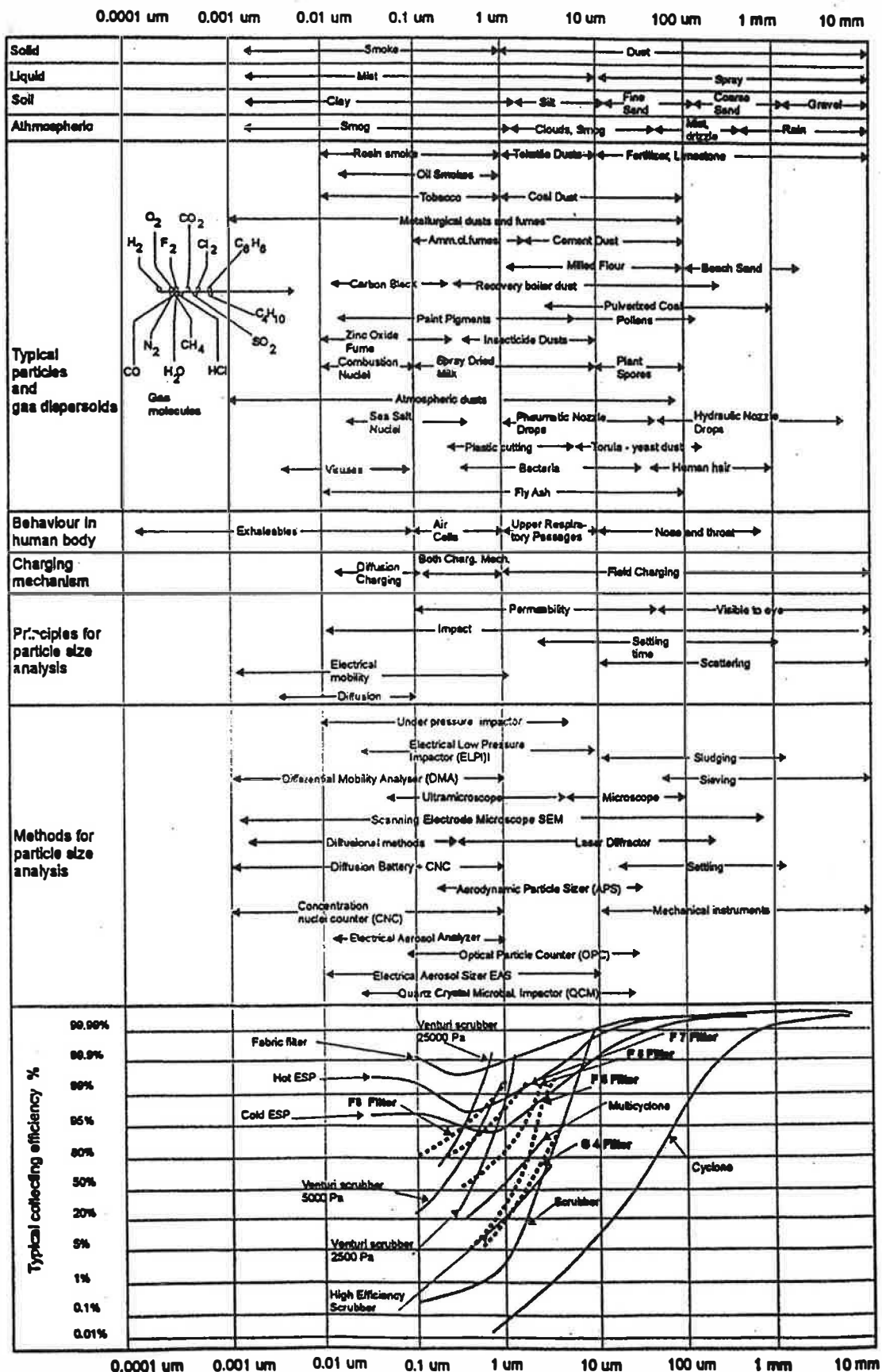
1. Chemical
2. Physical
3. Human behaviour and Methods sections.

Chemical section shows the nature of solid, liquid particles and gives one definition to solid and atmospheric phenomena related to particles or gaseous components.

Physical part of the table gives particle size information to several different usually discussed components and gives possibility to start first technical approach for equipment selection. Typical collecting efficiency presented in table can not be defined as best available removal grade, but it gives a rough estimate about the efficiency of presented equipment available in markets.

Particles in human body is shown in "Human behaviour" part of the table. This part gives a picture how small particles are penetrating to human body. This gives one reason why particle size distribution is so important today in gas cleaning technology.

Table 1. Particle Size Distribution – Physical Properties and Chemical Nature of Gaseous and Solid Emissions



Phoenix Cleaning System for Low Concentrations

PHOENIX gas cleaning system is based on using foto-oxidation for cracking chemical compounds like benzene rings to smaller compounds and oxidise components by catalytic method to carbon dioxide and other non harmful components.

The design of PHOENIX system makes it very suitable for big gas volumes including low concentration of harmful components like VOC.

Uncleaned gas is led to reaction duct where short wave ultra violet (UV) radiation cracks long molecular compounds. At the same time part of oxygen is transformed to oxygen radicals and ozone which are further used in oxidation. In oxidation process compound including C, O and H molecules are transformed to water and carbon dioxide.

In next selective catalytic step ozone and difficult compound are oxidised and gas is cleaned to final chosen target level.

PHOENIX method is used in food industry, slaughter houses, spice production industry. It is also used in rubber industry, steel manufacturing industry and method is also used in Chemical industry solutions like paint industry, printing industry and Plastic industry. PHOENIX system is developed in Germany and represented by BVM AB/Hevacents Oy in Finland. Please see the figure 1, PHOENIXprinciple.

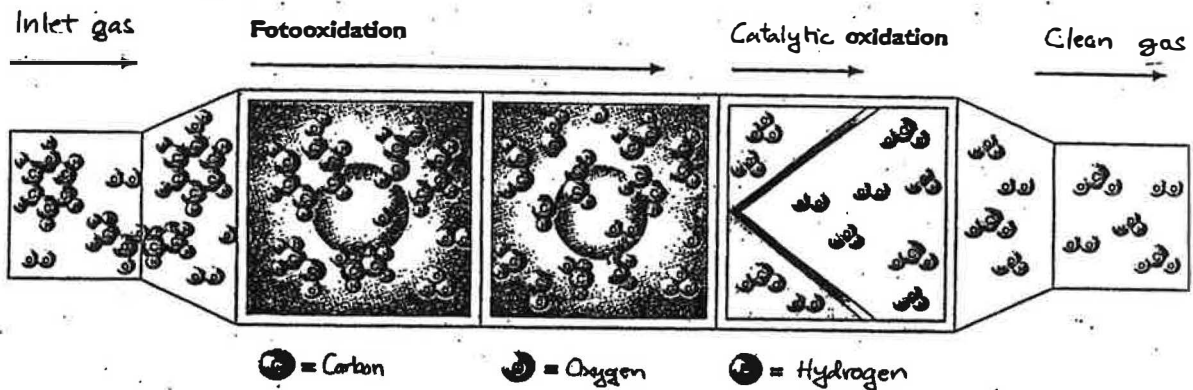


Figure 1. Phoenix principle

Latest News in Electrostatic Precipitator Technology

Latest technology presentation includes two cases: ABB ALSTOM POWER Oy SIR rectifier technology and ENVIRONMENTAL ELEMENTS CORPORATION / USA Fine Particulate Agglomerator (FPA) technology.

Abb Alstom Power Finland Oy

ABB ALSTOM is international multi technology company. ABB ALSTOM POWER has a long experience of international gas cleaning markets and it is a leading company in Europe, Asia and USA markets in different sectors of gas handling and cleaning.

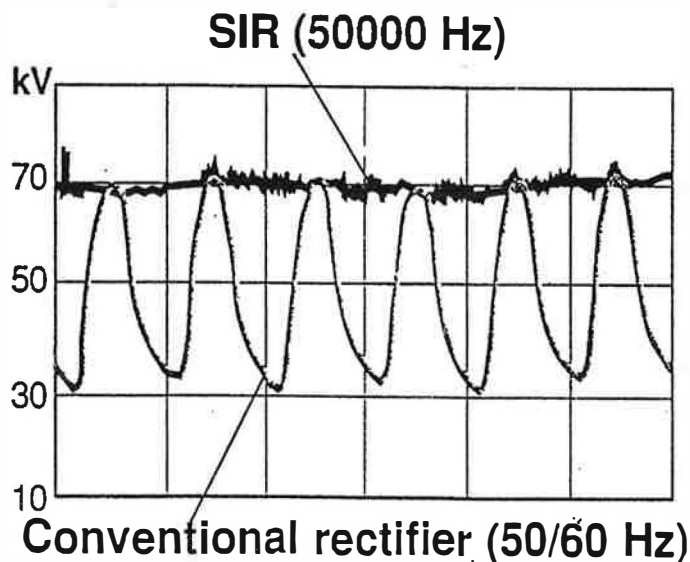
In Finland ABB ALSTOM POWER Oy has long traditions and leading role in power plant and pulp & paper plant gas cleaning and handling systems.

ABB ALSTOM POWER Oy's new Switched Integrated Rectifier -SIR- is compact rectifier technology for traditional electrostatic precipitators.

SIR-high frequency energizer rectifier T/R is a compact solution which has following benefits compared to conventional technology rectifier technology. Conventional rectifier works in frequency of 50/60 Hz. The frequency limits the T/R operation in control point of view. In SIR the used frequency is 50000 Hz.

High frequency technology improves electrostatic precipitator (ESP) efficiency specially in dust types like lime kiln and recovery boiler dust. Conventional ESP-rectifiers generate peak voltages which can be as much as 25 per cent above average voltage. The peak voltage triggers the sparking in ESP field. Sparkling quenches the ionisation and effectively limits the average voltage applied to the electrodes and thus the efficiency of the ESP.

SIR provides an almost ripple-free DC output compared with conventional T/Rs, which allows the ESP to operate at full voltage up to the point at which sparking occurs. SIR therefore increases useful ESP current, which provides substantial ESP emission reduction for processes that generate very fine particles and low resistive dust. Please see the figure 2 ABB ALSTOM SIR.



The ripple-free DC output from SIR compared with a conventional rectifier

Figure 2. ABB ALSTROM SIR operation principle

Environmental Elements Corporation / USA

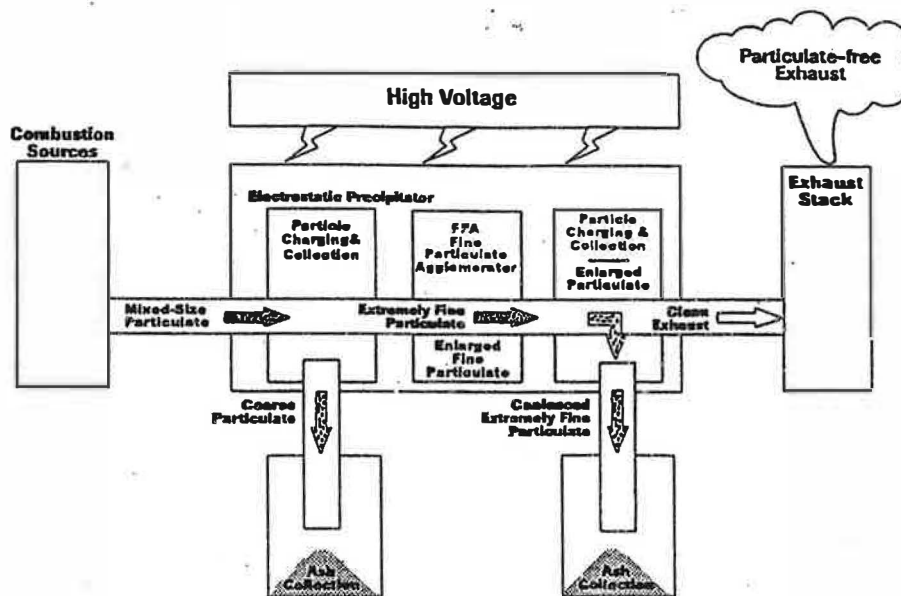
Environmental Elements Corporation, the Advanced Air Quality Research (AAQR) parent company, is a leading supplier of air pollution control systems in USA serving the power generation and industrial markets.

Environmental Elements Corporation's (EEC) Fine Particulate Agglomerator (FPA) provides a new way to control sub-micron sized particulate emissions from utility and industrial stack discharges. The control of fine particulate emissions is important as they contribute significantly in stack emissions. EPA has identified sub-micron sized particulate emissions as a health risk.

Fine particles has been historically very difficult and expensive to control and collect using electrostatic precipitators and fabric filters. In FPA technology the particle size is enlarged via agglomeration effect in laminar flow agglomeration field in a ESP.

The development of the FPA is the result of an exhaustive five-year development effort by EEC. Extensive laboratory tests and modelling programs resulted in a system design that was ready for field demonstrations in a pilot scale projects. Pilot studies have been completed in both conventional utility installations, as well as pulp & paper utility installations. In 1996, the first commercial industrial power plant demonstration unit was installed in Lynchburg, Virginia USA.

Then in 1998, the first full scale utility demonstration unit was installed at Wisconsin Electric's Presque Isle station. Please see the figure 3.



**ENVIRONMENTAL
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The Fine Particulate Agglomerator™

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Figure 3. EEC FPA™ principle