

Skewed Gas Flow Technology is a cost-effective method for reducing particulate emissions in a wide range of electrostatic precipitator applications. Compared to uniform gas flow, reductions in particulate emissions of between 30% and 50% can be expected. Skewed Gas Flow Technology can be easily installed on any dry collection precipitator by modifying the gas flow control devices. Installation can normally be done during an annual outage. Precipitator operating and maintenance costs are not affected.

THE RE-ENTRAINMENT ISSUE

Precipitator design for uniform gas flow assumes there is an even vertical top-to-bottom dust concentration as the gas flow passes through the precipitator. This does not consider the re-entrainment of fine particles that takes place as dust falls from the point of collection to the hoppers below.

Figure 1 illustrates the actual distribution of dust in a precipitator when re-entrainment of the fine particles is considered. Most of the particulate emissions come from the bottom zone of the precipitator outlet where the dust concentration is higher than at the top.

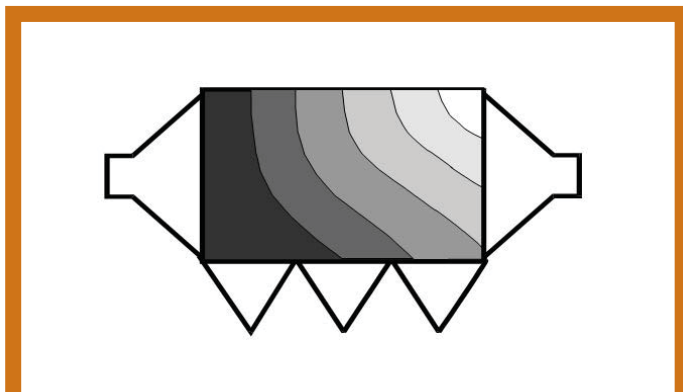
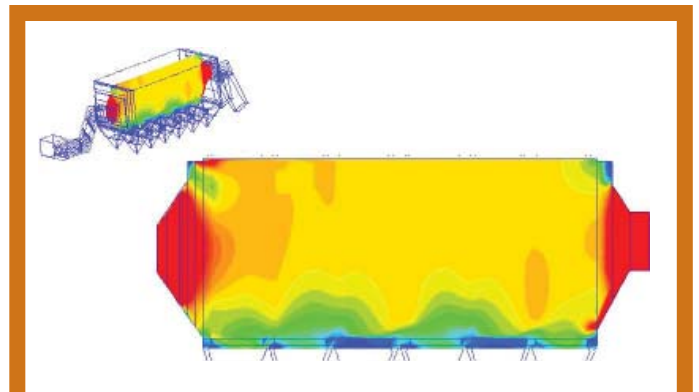


Figure 1. Actual Dust Distribution

ADVANCED ENGINEERING TOOLS

Noram Engineering offers the following services to support performance improvement using Skewed Gas Flow:

- Before and after gas velocity testing
- Development of a CFD model to assist in designing flow modifications
- Engineering and design of the modifications to the inlet/outlet screens to achieve the specified flow profile with minimal change in pressure drop
- Material supply
- Assistance during construction



Baseline CFD Model (Before Modifications)

PERFORMANCE ENHANCEMENT

Precipitator performance is improved by altering the internal gas flow patterns (as shown in Figure 2) to account for the non uniform dust distribution. Skewing the gas flow increases the treatment time in the more heavily loaded regions of the precipitator to improve the overall collection efficiency.

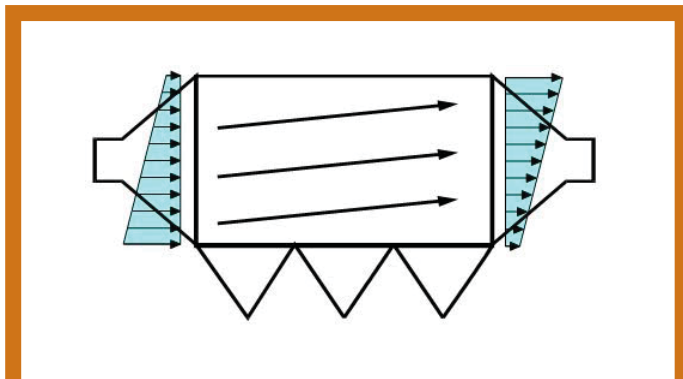
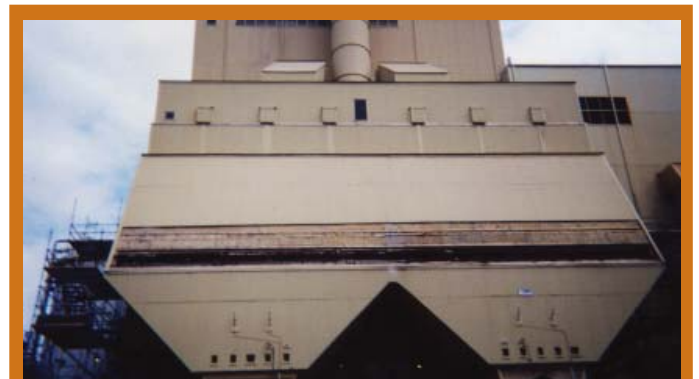


Figure 2. Skewed Gas Flow

PROVEN SUCCESS

With over twenty successful performance modifications to existing precipitators, a reduction in particulate emissions has meant a direct cost savings for many pulp and paper mills and coal-fired power stations.



Skewed Gas Flow Technology Enhanced Precipitator

Noram Engineering can prepare an estimate of performance improvement by analyzing the basic precipitator configuration and operating data you provide.

NORAM Engineering and Constructors Ltd.



COMPANY PROFILE

NORAM is an engineering and technology development firm based in Vancouver, Canada. Founded in 1988, NORAM employs a highly qualified technical staff of approximately one hundred. NORAM has a global client base and has successfully completed projects on five continents.

Today NORAM is the world's leading supplier of mononitrobenzene (MNB) plants, a key intermediate in the production of polyurethane. In addition, NORAM offers sulfuric acid equipment, biological treatment facilities, energy systems, and technologies for the chemical, minerals processing, environmental, and pulp & paper industries.

NORAM offers proprietary technology to customers through engineered equipment and complete chemical plants. NORAM's core competencies include:

- Biological Treatment Technologies
- Electrochemical Systems
- Energy Systems
- Environmental Technologies
- Feasibility Studies
- Fluid Dynamics & Finite Element Analysis
- Heat Transfer Systems Design
- Nitration Technology
- Project Management
- Pulp & Paper Technologies
- Sulfuric Acid Manufacture

PARTNERING WITH INNOVATION AND EXPERIENCE

NORAM is focused on the development, commercialization and supply of established and novel processes. With its entrepreneurial culture, NORAM has a demonstrated track record of thinking outside the box to provide innovative solutions. Technologies can be evaluated and integrated into an advanced engineering solution based on first principles.

NORAM has made its mark internationally by supplying proprietary systems to various industries world-wide. NORAM can bring this expertise and innovative ideas to your projects.

NORAM has established strategic relationships with the following organizations:

- ◆ Bateman Engineering BV
- ◆ Canadian Hydrogen and Fuel Cell Association
- ◆ Eco-Tec
- ◆ First Chemical Corporation (A DuPont Company)
- ◆ FP Innovations
- ◆ Kemetco Research Inc.
- ◆ Membrane Reactor Technologies
- ◆ Ostara Nutrient Recovery Technologies Inc.
- ◆ Radient Technologies
- ◆ Siloxy Limited
- ◆ Simon Carves Limited (Punj Lloyd Group)
- ◆ The Electrosynthesis Company

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