

Performance Improvement for Electrostatic Precipitators

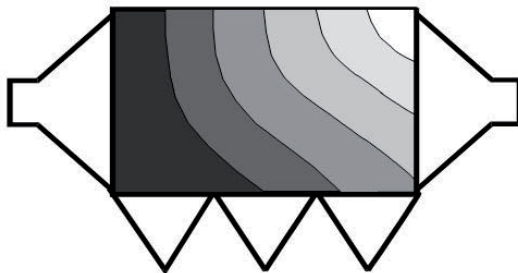
Skewed Gas Flow Technology is a cost-effective method for reducing particulate emissions in a wide range of electrostatic precipitator applications. Compared to uniform gas flow, reductions in particulate emissions of between 30% and 50% can be expected.

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.



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.

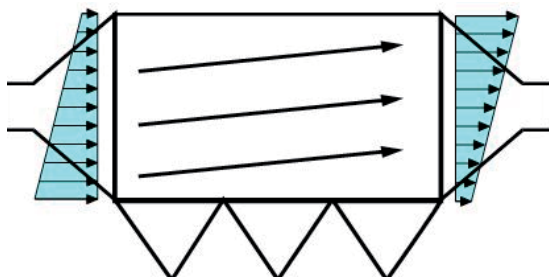
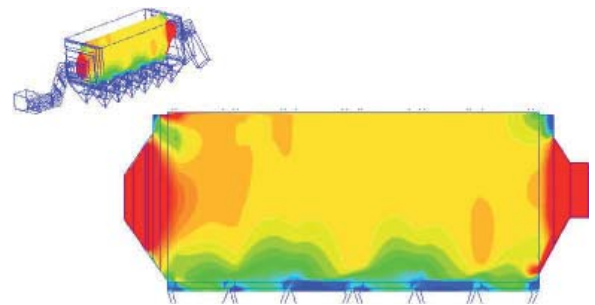


Figure 2: Skewed Gas Flow

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
- Material supply
- Assistance during construction



Baseline CFD Model (Before Modifications)

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.

technology and engineering solutions for the process and resource industries



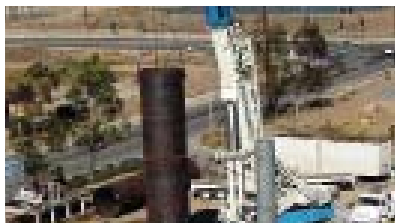
Nitration



Sulfuric Acid



Electrochemical



Biosystems



Pulp&Paper



Environmental

Company Profile

NORAM is a private engineering and technology firm based in Vancouver BC, Canada. We specialize in the development, engineering and commercialization of new chemical processes, and in the improvement and optimization of existing technologies. Since 1988 NORAM has provided leading-edge technologies to the chemical, pulp and paper, minerals processing, wastewater and electrochemical industries.

Today NORAM is the world's leading supplier of nitration technology. In addition, we offer sulfuric acid plants, biological treatment facilities, energy systems, and technologies for the clean-tech sectors.

Our business has developed around the supply of proprietary engineering and equipment packages to our clients.

Core competencies include:

- Nitration and NO_x Technology
- Electrochemical Systems
- Sulfuric Acid Manufacture
- Biological Wastewater Treatment
- Computational Fluid Dynamics & Finite Element Analysis
- Heat Transfer & Heat Exchangers
- Hydrogen, Sulfur and Chlorine Chemistry
- Fluidised Bed Systems
- Energy Storage
- System Closure

Partnering with Innovation and Experience

NORAM works extensively with early-stage technology companies. We draw on established competencies in process design and engineering, provide custom in-house fabrication capabilities, and offer pilot plant and contract research facilities to support the commercialization process.

We've teamed up with organizations around the globe to allow project execution on 5 continents. Our strategic relationships include:

- Bateman Engineering BV
- Canadian Hydrogen and Fuel Cell Association
- ECO-TEC Inc.
- First Chemical Corporation (a DuPont Company)
- FP Innovations
- Kemetco Research Inc.
- Membrane Reactor Technologies
- Ostara Nutrient Recovery Technologies Inc.
- Radiant Technologies Inc.
- Siloxy Limited
- Simon Carves Ltd (Punj Lloyd Group)
- Electrosynthesis Company Inc.

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