Improving the design of the Air Purification Tower using 3D CFD

The Nederman Group is a world leading supplier and developer of products and solutions within the environmental technology sector. Their latest step is the use of 3D CFD which improved the performance of their Air Purification Tower by 15%!

Smoke, fumes and particles all have a negative impact on your working environment thereby affecting production quality and profit. The most effective method of controlling welding fumes is extraction at source. This is however not always possible and sometimes insufficient. In such cases, Nederman offers the Air Purification Tower

Nederman's Air Purification Tower is the perfect choice if source extraction is not a satisfying option. Such conditions can for example be found in large workshops with changing activities and where ducting cannot be installed. The Air Purification Tower can also be a complement to existing Nederman source extraction.

Figure 1 - Preferred welding smoke extraction: Nederman's extraction arm to extract the harmful welding fumes at the source

Nederman

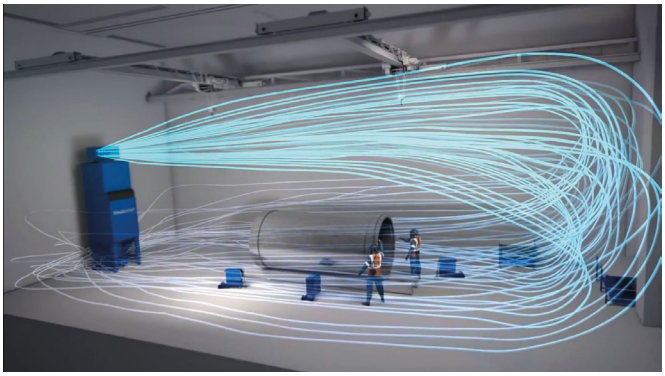
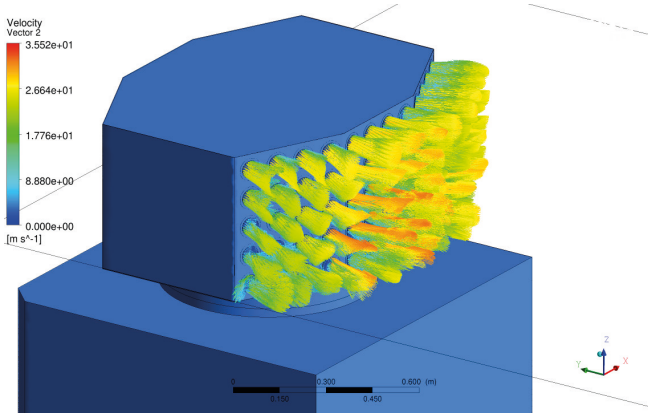


Figure 2 - Nederman's Air Purification Tower extracting harmful emissions, when it's not possible to extract at the source

By injecting air at a high velocity and at the correct altitude the Air Purification Tower sets the air in the room in to motion, see figure 2. The height and speed of air effectively removes the grey cloud of welding smoke that can form in workshops or production areas. The polluted air is extracted into the filter at the bottom of the Air Purification Tower. This means that the system continuously filters the polluted air and the filtered air is re-circulated back into the premises.



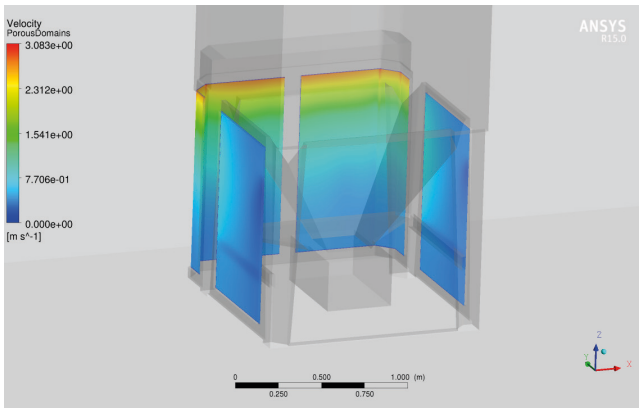


Figure 3 - To the left the injection area is shown, with vectors showing the direction and magnitude of the flow exiting the Purification tower. To the right the extraction areas can be seen, where a velocity distribution has been plotted on the walls of the perforated plates

When designing the new Air Purification Tower the target was not only to improve product performance, but also to improve the understanding of how the placement of the unit in the workshop can be optimized and how multiple units can create synergetic effects improving capturing efficiency.

Aim of the project

The aim of the CFD study was to build a model that is able to support optimization of the design and placement of the Air Purification Tower in real working environments, with the final goal of maximizing the particle separation efficiency. The project was divided into two different phases, the design phase and the room placement phase.

Phase 1: Design

When looking at the design of the tower, two main areas of interest could be identified having the biggest impact on the overall performance of the particle separation efficiency. These areas are the injection area and the extraction area, see figure 3.
Simulations were performed comparing the particle separation efficiency depending on different designs of the injection area and extraction area. By optimizing the design the particle separation efficiency could be increased by 15%.

Phase 2: Room placement

To gain a better understanding of the effects of the placement of the purification tower, several simulations were performed, modifying the dimensions of the room, the placement of the tower as well as the number of towers in the room. In figure 4 one of the multi unit simulations for a large production area can be seen.

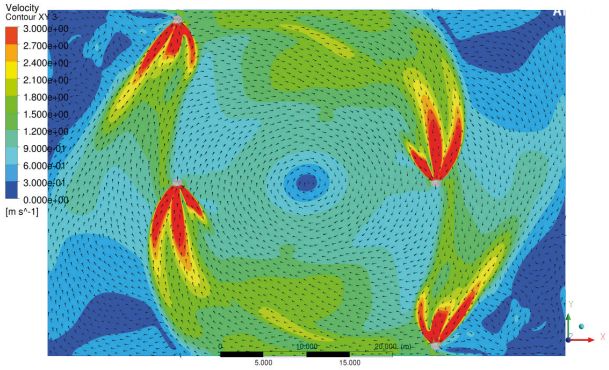


Figure 4- Interaction between 4 units in a large size production area

"By using CFD simulations we have been able to optimize the design and understand the important factors affecting particle separation from the work environment. In addition we were also able to create animations of the air stream behavior that was of great value to our sales staff"

Christian Norman,
Director Product Development Nederman

Figure 5- Nederman's new Air Purification Tower

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