

OVERVIEW: Air Dynamics Industrial Systems Corporation manufactures an industrial dust collector ventilation system for PPG. The dust collector was designed to be used by their workers to reduce personal exposure limits for airborne nickel dust in their factory while simultaneously protecting the workers from silica dusts.

PPG Carlise - Nickel and Glass Dust - Silica Containment and Control

The Application

Air Dynamics Industrial Corporation was approached by PPG Industries for assistance to comply with OSHA mandates by designing and installing an industrial ventilation system for their process. PEL (Permissible Exposure Limit), or *Threshold Limit Value* for OSHA, levels of heavy metal in their Carlisle facility were concerning, and PPG wanted to be sure safety was a priority. Heavy metal or nickel dust is known to affect lung function, cause cancer, and possibly even death depending on the extreme levels of exposure. OSHA has a set of guidelines and standards that are to be used wherever employees are being exposed to these toxic dusts¹.

The Challenge

PPG, formally known as Pittsburgh Plate Glass Co., was first founded in the late 1800's with a focus on innovation and quality. During WWII, PPG was a premium manufacturer for the military due to their large facilities and numerous employees. PPG has had their hand in many

products in a variety of industries such as laminated aircraft glass, solar collectors, synthetic printing, and athletic footwear just to name a few. PPG continues to be a leader in their industry while staying true to their founder's notion of, *"Bring innovation to the surface"*, by continuing to improve their products and facilities.

The major challenge faced by PPG was a high amount of silica dust being produced in their glass cutting process. Glass, like many



materials used in industry such as cement, ceramics, and abrasive blasting, produces silica dust. Silica is known to cause silicosis, a deadly and debilitating lung disease².

Controlling worker exposure in accordance to OSHA's occupational health regulations requires the following three conditions be met: airborne dusts (silica in this case) are below or at PEL (TLV) permitted levels, flammable or explosive vapors must be controlled, and oxygen levels need to

¹ For more information on Silica dust and Nickel and the health effects see OSHA's website
<https://www.osha.gov/SLTC/metalsheavy/nickel.html>

² See <https://www.osha.gov/dsg/topics/silicacrystalline/> for details

remain above or at the required threshold for employee safety. In this case, the first and second conditions required mitigation and therefore needed to be reduced as quickly as possible.

Providing the Best Solution, By Designing the Best Product

When contracted by PPG, Air Dynamics begins its systematic approach to solving a customer’s challenge. Air Dynamics is a turn-key manufacturer, which means the project is taken from concept to installation by Air Dynamics’ project managers. An initial site visit assessment is conducted to determine the exposure assessment and risk analysis. In addition, the project managers focus on not just the main problem for the client, but determine other factors that may improve the overall process. Using the information gathered from site visits, a preliminary design is presented using 3D Auto CAD and CFD simulations to determine the most efficient method.

Once the client has reviewed and approved preliminary designs, the project manager works with the design team to produce a detailed concept design. The process then moves to fabrication. Once the system is ready, the fourth phase begins which consists of the install, start-up, commissioning and training. The final step is the hand-off, where the project manager walks through the operations and maintenance with the facility’s operator, and



Dust Collection Unit

training necessary for operation, followed by an industrial hygiene retesting. Air Dynamics supplied PPG with a cartridge dust collector system to handle their silica dust challenge. The site visit

by Air Dynamics’ engineers revealed uncontrolled dispersal of silica dust at the saw blade which spread throughout the facility. A general exhaust system would not be sufficient to maintain safe PEL’s. This led Air Dynamics’

engineers to select a localized exhaust system featuring an enclosed source capture hood. The system was designed with 2000 CFM capacity and two 24” x 24” HEPA



Source Capture Hood

filters functioning as safety filters, or final filters. These HEPA filters are extremely efficient, capable of 99.97% efficiency at .3 micron. The source capture hood was designed with a 3D Auto CAD program to ensure proper fabrication and installation. The hood itself was a three-piece hinged hood that was specifically designed to control the grinding and cutting of plate glass.

The design for the hood was engineered to not interfere with the cutting cycle's movement or accuracy. The source capture hood of the ventilation system was uniquely constructed with a one inch gap in between the conjoining walls which is where the suction air and the dust are conveyed. This design element was crucial in the overall design of the ventilation system because without it, there would be higher exposure to the silica and nickel dusts when cutting the glass. The fan was selected to match the system resistance (total system effect) to ensure that pickup velocity was sufficient. The enclosed hood was attached to industrial ductwork that transports the silica and nickel dust to the dust collection unit located away from the source. All ductwork was designed per SMACNA guidelines to prevent failure due to the cutter bridge movement and particle abrasion.

The dust collector itself was equipped with features to improve the process at PPG and ensure easier maintenance. The collector was supplied with a drum cover, hose, and clamps to retain the collected material. A differential pressure switch was installed to alert operators when filter differential levels are at capacity. This alert feature included a flashing annunciator light on the control panel. The control panel itself is a NEMA 12 combination starter panel that integrates a 10 HP air mover separate fusing

for all motor loads, start and stop buttons, and running indicator lights. Additionally, two magnehelic gauges were installed on the door panel to assist the operator in monitoring system performance.

The overall dust collector design and operation is very reliable and maintenance can easily be conducted with basic hand tools. After installation and startup of the industrial ventilation system, the employee exposure was reduced to acceptable levels per an industrial hygienist test protocol.

Conclusion

The industrial ACGIH certified ventilation system was designed to reduce the fugitive silica dust as flat glass was being cut in the Carlisle factory. Air Dynamics was contracted and successfully helped PPG with this issue by designing a complex ventilation system that would perform its job to the fullest while not disturbing the other machines that were already in place. With the new ventilation system, the PPG facility became a safer working environment and a better production facility.

Founded in 1991, Air Dynamics Industrial Systems Corporation designs and manufactures Turn-key Industrial Vacuum Cleaning Systems, Portable Industrial Vacuum Cleaners, ACGIH Certified Industrial Ventilation Systems and Pneumatic Conveying Systems. See our advanced capabilities at www.airdynamics.net, or call in to talk with our engineers at **717-854-4050**.

Before Dust Collection

Note the exposed saw blade and silica dust coating the machine



After integration of source capture hood and ventilation system installation

