



CASE STUDY

Air Pollution Control System

Overview: Air Dynamics Industrial Systems Corporation was approached by Armstrong World Industries to engineer a new hydrodynamic scrubber.

The new design realized savings in tens of thousands of dollars annually in operations & maintenance costs, eliminated an air pollution problem and reduced energy expenditures.

This versatile wet scrubber was then re-purposed by Air Dynamics to accommodate changes in Armstrong's product and process.



Air Dynamics' Industrial Hydrodynamic Scrubber

INDUSTRIAL HYDRODYNAMIC (AIR) SCRUBBER

The Application

Armstrong World Industries is a leader in the ceiling and flooring industry in the United States. Located in Lancaster County, Pennsylvania, Armstrong World Industries manufactures resilient flooring. The PVC flooring is composed of 100% synthetic materials that produce a gaseous chemical discharge. Armstrong was interested in renovating their old air scrubbing process to achieve a more efficient, cost effective air scrubbing process operation.

The Challenge

After resolving to replace their 70's era air scrubber due to deteriorating performance, excessive maintenance and energy deficiencies, Armstrong contacted Air Dynamics Industrial Systems Corporation for a solution.

Air Dynamics careful analysis and technical solution for Armstrong's replacement air scrubber design enabled a 74% reduction in operating energy cost,



Obsolete Wet Scrubber

40% reduction in air pollution, and a 96% total reduction in operations and maintenance (O&M) costs. The impact of these reductions is clear when the old scrubber's annual operating cost of \$187,200 was reduced to only 3.5%, roughly \$6,593.

The existing air scrubber was installed in 1974, and the inefficiencies were readily apparent upon inspection by the engineers from Air Dynamics. The design of the previous

system required sixteen hours of maintenance per week. Leaks around the equipment were readily apparent to Air Dynamic's engineers (See photo below). Several chemical compounds such as Diisoheptyl¹, Diisononyl Phthalate², and Isopar Hydrocarbon Fluid³ are used in the production of vinyl flooring.⁴ The high O&M costs were key reasons to renovate the previous design. Armstrong World Industries decided to move forward with Air Dynamics' design offering to provide a high efficiency, low energy wet scrubber.



Rear View of Obsolete Wet Scrubber

¹ <http://www.sigmaaldrich.com/catalog/product/aldrich/376671?lang=en®ion=US>

² https://pubchem.ncbi.nlm.nih.gov/compound/diisononyl_phthalate#section=U-S-Production



Air Dynamics' Industrial Wet Scrubber
*Featuring Easy Access Maintenance Doors

Principle of Operation

Air Dynamics' design assured a clean and efficient system via the four-stage scrubbing process. The duct work transports the collected gaseous chemical vapors from the vinyl ovens into the first stage of the wet scrubber where it decelerates and cooled rapidly. Cold water is combined with the hot vapors, rapidly decreasing the temperature from 350 degrees Fahrenheit out of the ovens to approximately 100 degrees Fahrenheit. The cooler, condensed concentration of chemicals pass through a combination of mechanical separation and water cooling. After passing through a media, the majority of the chemicals filter through the bottom of the unit into a sump for storage and later disposition and processing.

³ See <https://www.exxonmobilchemical.com/Chem-English/Files/Resources/isopar-m-fluid-product-safety-summary.pdf>

⁴ See https://www.epa.gov/sites/production/files/2015-09/documents/phthalates_actionplan_revised_2012-03-14.pdf

The remainder travel into the third phase, wherein low pressure passes the air through another level of mechanical separation that removes the remaining chemicals from the air stream. Finally, any chemical droplets are separated in the last chamber through a final permanent media. The air is discharged into the atmosphere via the fan on the clean side of the scrubber. The result is a clean and energy efficient scrubbing process.

Providing the Best Solution by Designing the Best Product

Air Dynamics Industrial System Corp. assessed the deficiencies in the old system and additionally identified several ways to reduce the O&M costs of the unit while making the new design easy to operate and maintain. The new system cut the size of the old scrubber from 50,000 lbs. of equipment to roughly 25,000 lbs. This eliminated the necessity to replace filters and thus delivering a more efficient and compact solution.

The new system Air Dynamics delivered is a low energy industrial scrubber, or an air pollution control device (APCD). The product is a hydrodynamic scrubber, or wet scrubber. This scrubber is designed to convert the chemical vapors from the vinyl ovens into liquid/solid particulate droplets for mechanical separation. The new design was manufactured with 304 stainless steel, and equipped with PLC automation and controls.



Opposite View of Air Dynamics' System



Side View of System

As requested by Armstrong World Industries, Air Dynamics designed the new system horizontally for ease of access. The design additionally improved the scrubbing process with selection of permanent medias within the low energy scrubber. Air Dynamics further increased the efficiency of the scrubber by utilizing a combination of process cooling coupled with progressive mechanical separation.

Conclusion

Air Dynamics Industrial Systems Corporation designed and produced from the ground-up a cleaner, more efficient scrubber tailored specifically for the issues that Armstrong World Industries was facing. The new system met all requirements from Armstrong. The new system additionally realized monetary savings in O&M, and reduced excessive energy expenditures that the old system required to operate. A specific example would be the reduction of a weekly 16-hour maintenance routine to a mere four hours a month. Furthermore, the new systems' permanent media saved an average of \$100,000 a year in annual replacement fees compared to the previous fiberglass media in the old scrubber.

After quantifying the savings realized for Armstrong World Industries by adopting a new hydrodynamic scrubber system the results are markedly cost effective. By utilizing Air Dynamic's best solution, best product model Armstrong World Industries was provided with the ultimate long-term solution to their problem, and now represent the cutting edge of wet scrubbing technology.

Call our specialists today to discuss your application!

Air Dynamics Industrial Systems Corporation

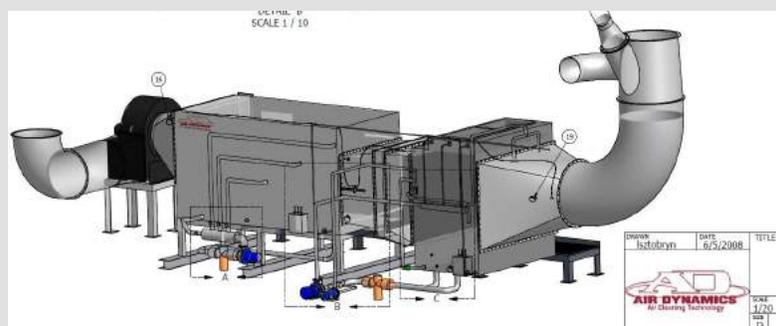
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Obsolete High Energy Wet Scrubber



New Air Dynamics Low-Energy Wet Scrubber



**Low-Energy Hydrodynamic Scrubber
3D Design Concept**