

DIRECT ASSISTANCE PROGRAM



CASE STUDY

Environmental, Physical & Economic Footprint: Optimizing the effectiveness and efficiency Industrial Metal Coating

Gorbel is a manufacturer of overhead material handling, ergonomic lifting, and fall protection systems for use in a wide variety of industrial and manufacturing environments. Headquartered in Victor, New York, Gorbel has 40 years of experience producing high quality products like workstation cranes, jib cranes, gantries, and ergonomic lifting devices.

CHALLENGE

Gorbel's handling systems are used to lift and transport heavy loads in a wide range of industries, like automotive, aerospace, oil and gas, pharmaceuticals, and more. Ensuring the structural integrity and durability of Gorbel's crane components is paramount to product success. Currently, Gorbel applies iron (III) phosphate to crane parts before they are painted in an effort to both prevent oxidation of the base metal and improve adhesion of the protective paint layer. In all cases, the iron (III) phosphate coating is applied through a steam-based spray system in which parts pass through a contained, ventilated tunnel where the coating is manually applied to parts.

Gorbel utilizes a high pressure steam application process to apply phosphate to improve adhesion of their protective paint layer. Because the spray process uses steam as the carrier for the iron (III) phosphate coating, all sizes of parts can be effectively coated through a single process. In addition, the high temperature of steam accelerates the chemical reaction of the phosphate chemistry to the steel, allowing production flow to move continuously and consistently. Similarly, using steam rather than liquid water minimizes the volume of water consumed in the process; as a result, smaller amounts of water-based coating spray waste can be dried in the curing oven and subsequently disposed as a solid rather than as hazardous wastewater.

However, these benefits come with some challenges. The current spray tunnel infrastructure occupies a significant amount of floor space that could be better used as additional manufacturing space. In addition, the spray methodology itself requires extensive use of personal protective equipment (PPE) to ensure the safety of Gorbel's employees, which can be uncomfortable for workers during warmer weather. Further, residual acid present in the spray waste renders the sludge a hazardous material that must be treated and disposed as such.

SOLUTION

Potential solutions focused on two possible areas of improvement. First, alternative coating chemistries that might reduce hazards were explored and tested to evaluate their performance in corrosion resistance, abrasion resistance, and paint adhesion. Second, a variety of different coating application methods and technologies were investigated to determine their physical footprint, ease of operation, coating effectiveness, and efficiency.

The New York State Pollution Prevention Institute (NYSP21) conducted a comprehensive search for alternatives to the existing iron phosphating chemistry

CHALLENGE

- Gorbel sought to explore alternative surface treatment methods and technologies that could maintain the effectiveness and efficiency of the current spray process while reducing its physical, economic and environmental footprint, mitigating exposure risks, and creating less waste

SOLUTION

- Gorbel collaborated with NYSP21 for assistance in identifying alternative coating chemistries that might reduce hazards and investigate a variety of different coating application methods and technologies to determine their physical footprint
- NYSP21 conducted a comprehensive search for alternatives to existing iron phosphating chemistry and worked with Gorbel to finalize a list of alternate chemistries for testing

RESULTS

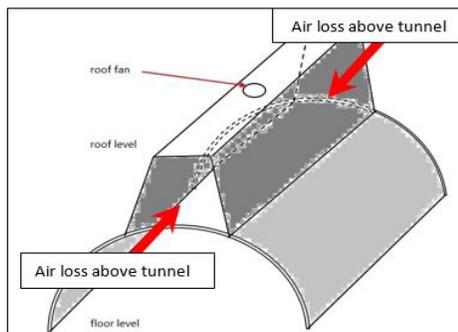
- NYSP21 noted that the existing roof fan was operating at suboptimal speed, and that a higher-performance fan could improve ventilation and thereby reduce residual mist within the tunnel
- NYSP21 identified that equipment changes could offer significant improvements
- While additional work is needed to evaluate additional potential alternative chemistries, Gorbel can consider either a modification of the current spray tunnel or purchase of a spray booth to optimize ventilation and the working environment

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and worked with Gorbel to finalize a list of alternate chemistries for testing. None of these chemistries were found to be significantly different than the existing chemistry for health and safety ratings. After testing the performance of these alternative chemistries on representative Gorbel parts, NYSP2I engineers found that none of the alternate chemistries were able to successfully pass both the paint adhesion and corrosion resistance tests. As a result, both NYSP2I engineers and Gorbel management concluded that the current iron (III) phosphate chemistry is still the most effective in meeting Gorbel's product requirements, but that the process could be optimized through changes to their existing infrastructure or through new equipment for spray applications.

RESULTS

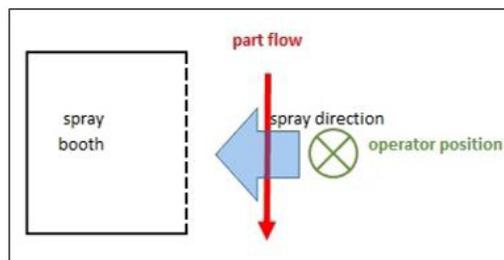
To this end, NYSP2I investigated alternative systems for coating application, as well as different strategies for improving the current spray area ventilation. Gorbel's spray tunnel was observed to have open airspace directly above the spray area that both allowed dissipation of fugitive spray emissions and reduced direct airflow to the ventilation fan in the roof. NYSP2I developed recommendations to seal some of this open space in order to increase airflow within the spray tunnel itself and direct airflow more precisely to the ventilation fan. In addition, NYSP2I noted that the existing roof fan was operating at a suboptimal speed, and that a higher-performance fan could improve ventilation and thereby reduce residual mist within the tunnel. These adjustments, then, could reduce worker exposure to the spray during this process.



Current spray tunnel diagram showing airflow loss areas

Beyond this, NYSP2I engineers found that equipment changes could offer significant improvements. The first equipment solution was to employ self-contained water-wash spray booths to both reduce physical footprint and improve ventilation. These spray booths, as used in many industrial painting applications, contain overspray to a confined area and limit airflow losses by restricting fugitive mists. This system would significantly improve the ventilation compared to the phosphate spray tunnel, while simultaneously reducing the overall footprint of spray operations.

While additional work is needed to evaluate additional potential alternative chemistries, Gorbel can consider either modification of the current spray tunnel or purchase of a spray booth to provide an optimal work environment. An industrial hygienist can help to determine the level of PPE required based on equipment and ventilation changes.



Proposed self-contained spray booth setup to reduce footprint

NYSP2I PARTNERS



New York Manufacturing Extension Partnership

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