



PRIMARY METAL AND FABRICATED METAL PRODUCT MANUFACTURING

Various facilities across the state of Kansas
NAICS Codes: NAICS 331 and 332 • EPA Region 7

Industry description

This case study is a compilation of pollution prevention or P2 projects completed between 2015-2022 through the K-State Pollution Prevention Institute's P2 intern program. It focuses on metal manufacturing and fabricated metal product subsectors utilizing various processes that emit pollutants. These processes include smelting and refining metals to make primary metal products such as sheets, rods, wires and castings. These primary metal products are created through processes such as smelting, refining, rolling, drawing and extruding. The subsectors also include manufacturing these basic products into intermediate and end metal products such as basic metal buildings, fasteners, automotive components, and metal windows and doors. The processes used to make these products include welding, forming, bending and cutting. Finishing processes for these products include painting, powder coating and other surface treatments.

Incentives to change

The metal manufacturing and fabrication sector has several opportunities for pollution prevention, many of which reduce the release of TRI chemicals into the air and water. There are several source reduction opportunities available in this sector, including reducing scrap metal waste, extending the lifetime of coolant fluids, optimizing plating bath concentrations, as well as energy and water conservation. The EPA has chosen this sector as one of the five National Emphasis Areas, or NEAs. By improving processes through P2 the industry can reduce emissions to the environment and save money.

PROJECTS

Fluidized sand scrubber

One of PPI's multi-year industry partners, CST Storage, produces metal storage tanks, aluminum domes and specialty covers. As part of its production process, CST uses a burn-off oven to remove cured powder paint from conveyer hooks. The burn-off oven was installed in 1990 and consumes approximately 300,000 BTU per hour when in use. At the time of the assessment in 2015, it was operating six hours at a time, twice a day, with a two-hour cool down period, for 250 days per year. When the paint hooks came out of the burn-off oven, several hooks still had to be manually scraped to remove residual cured paint before reuse, increasing labor costs. It was recommended that the industry replace the burn-off oven with a fluidized sand scrubber. A fluidized sand scrubber would only have to be run for one hour to clean the parts and would allow CST to scrub and rework parts that are now being scrapped. Accounting for energy and labor savings, the PPI intern calculated a 4.4-year payback period for the fluidized sand scrubber.



1990 burn-off oven

E-room door and air curtain

Another project for CST Storage recommended in 2017 was for its E-room, which is the environmentally controlled room where CST applies a powder coat to parts. The room must maintain a constant temperature of 75°F to store the powder properly. With this requirement, the room is a continual source of energy loss due to entrance and exit openings for the paint line. The 2017 P2 intern observed that 97% of downtime energy losses could be saved by installing a door. Additionally, the intern determined that installing an air curtain over the parts entrance could save energy during operating hours, without the risk of blowing the powder coat off the parts before it cures. The combined recommendations yield a possible energy savings of 301,116 kWh of electricity and \$27,100 per year.

PROJECTS, CONTINUED

Replace HVLP paint gun with electrostatic spray gun

WEBCO Manufacturing specializes in equipment manufacturing of steel products for heavy machinery. Some industries they service include mining, construction and rail. Some of WEBCO's parts are liquid painted with spray guns. The 2021 intern conducted an analysis on the replacement of the existing high-volume, low-pressure paint gun with a more transfer efficient electrostatic spray gun. At 60% transfer efficiency, about 220 gallons of liquid paint and \$10,600 are lost every year through use of the HVLP paint gun. Switching to an electrostatic gun with transfer efficiency of 85% will result in a reduction of 180 gallons liquid paint waste at a cost savings of \$6,700 annually. Additionally, the electrostatic paint gun would reduce the cost of hazardous waste disposal by \$235 and emissions at the facility by 0.2 ton of hazardous air pollutants or HAPS, and 0.62 tons of volatile organic compounds or VOCs annually.

Vibratory tumbling improvement

Spectrum Metalcraft, owned by Vortex Global, is a metal manufacturer specializing in custom metal fabrications. To finish some of its metal parts, a process called vibratory tumbling is used. In vibratory tumbling, a metal piece is vibrated through ceramic media to smooth the surface. Rinse water is fed through the machine to wash away particulate matter. As a result, approximately 3,300 gallons of spent rinse water is sent to a treatment facility through a vendor annually. The 2021 P2 intern identified an internal treatment method to reduce the amount of spent rinse water sent to the vendor and another process using cascading bins that reduced overall water input 1,650 gallons annually. These changes resulted in annual savings of \$5,460 in disposal costs and .011 MTCO₂e in water reduction.



Vibratory tumbling

RESULTS

Overall, through the implementation of these projects, 266 MMBTU of natural gas, 301,116 kWh of energy, 179 gallons hazardous waste, 0.8 tons of VOCs and HAPS, and 1650 gallons of water were reduced annually. This equates to an annual total of 399.02 MTCO₂e in GHG Reductions, and an estimated cost savings of \$268,474.

Reductions	Annual estimated environmental impact	GHG reductions (MTCO ₂ e)	Estimated cost savings (\$/year)
Fluidized sand scrubber	266 MMBTU	82.06	\$84,900
E-room door and air curtain	301,116 kWh	316.95	\$27,100
Electrostatic spray gun	179 gallons hazardous waste 0.8 tons of VOCs/HAPs	—	\$6,980
Vibratory tumbling water reduction	1650 gallons of water	.01	\$5,460
Total	266 MMBTU 301,116 kWh 179 gallons hazardous waste 0.8 tons VOCs/HAPs 1650 gallons of water	399.02 MTCO₂e	\$124,400