



# Chemical Alternatives - TCE Elimination



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## Organization Background

This global outsource manufacturer supplies quality components to global OEMs. This location creates products for numerous different industries, all with the common goal of creating reliable and quality components. Primary operations are metal forming processes including stamping, drawing, and trimming.

*“Working with MnTAP and this company this summer was an invaluable opportunity. It taught me many things, ranging from how a manufacturing floor runs to how Lean/ Six Sigma tools are used as solutions to real problems. This experience allowed for me to see how Industrial and Systems Engineering and sustainability are not mutually exclusive but rather go hand-in-hand. I’m very thankful for the experience I have had and for this company’s commitment towards creating a safe and environmentally conscious facility!” ~ AS*

## Project Background

Over the past year, the company has been working with MnTAP to eliminate TCE in order to improve the safety and environmental sustainability of their processes. Trichloroethylene (TCE) is a hazardous solvent that is used for cleaning and degreasing for metal parts. An alternative cleaning process has been identified using a modified alcohol solvent and a vacuum degreaser. Plans are in place to eliminate TCE from all product value streams as quickly as possible in compliance with the Minnesota TCE ban which goes into effect in July 2022.

## Incentives To Change

The installation of the new vacuum degreasers poses an opportunity to simultaneously address yield issues. This project worked to validate the effectiveness of the new machine while also determining whether supplemental cleaning steps are necessary. This will allow for the elimination of unnecessary processes, reducing chemical usage and related costs. This project focused on providing quality and a risk-based approach and centering safety and environmentally conscious decisions as priorities on the manufacturing floor.

*“Anja did an excellent job working with the Engineering team at the site to help move the project ahead!”*

*~ Senior Engineering Manager*

## SOLUTIONS

### Elimination of Mineral Spirit Pre-Wash

A manual pre-wash with mineral spirits was previously a part of the value stream in order to more effectively clean parts. However, with the effectiveness of the new vacuum degreaser, this step was found to be unnecessary. Since mineral spirits are not only flammable but also have a myriad of other potential negative side effects for workers, the environmental, health and safety benefits of removing mineral spirits from the cleaning system are significant. Additionally, as the mineral spirits are not reusable, eliminating them will save \$2,400/year in replacement costs.

### Replacement of TCE with Vacuum Degreaser

By altering production lines to use the vacuum degreaser instead of the TCE degreaser, around 15,000 lbs of TCE will be eliminated. Due to the proximity of the operators who load and unload parts, removing TCE has significant effect on operator health and safety. The new modified alcohol solvent has been determined to be a safer alternative to TCE while working effectively in cleaning products by targeting the removal of both polar and non-polar contaminants. Additionally, the vacuum degreaser is a closed loop system that continually separates the solvent from the contaminants through the use of a boiler, requiring only very small quantities of make-up solvent.

# Solutions

## Optimize Annealing

Past studies have been conducted that suggest changes to the current annealing processes could improve product quality. Through altering cleaning processes and optimizing annealing, we hope to reduce parts scrapped due to scoring by 35 lbs, saving \$9,000 and improving lead times.

## Removal of Washer

The majority of products are run through an aqueous cleaning step following the TCE degreaser. This step was thought to be essential to remove any contaminants that the TCE degreaser was unable to remove. However, due to the higher level of cleaning provided by the new degreaser, there is potential to reevaluate the necessity of this step. This may ultimately result in the removal of the aqueous washer system entirely from the facility, resulting in water, chemical, and labor savings.

## Monitor Solvent Life and Effectiveness Through Dyne Testing

Although the manufacturer has stated that the modified alcohol solvent should never require replacement, its effective life has not been verified. Therefore, a dyne test was investigated to monitor alcohol purity and establish part cleanliness standards.



Recommendation	Annual Reduction	Annual Savings	Status
Elimination of mineral spirit pre-wash	2,100 lbs	\$2,400	Recommended
Replacement of TCE with vacuum degreaser	15,000 lbs	\$9,300+	Implementing
Optimize annealing	35 lbs titanium	\$9,000	Recommended
Removal of washer	250,000 gallons RO water 150 lbs cleaner	\$3,000	Requires further study
Monitor solvent life and effectiveness through dyne testing	4,800 lbs	\$20,700	Requires further study

**MnTAP Advisor:** Jane Paulson, Senior Engineer