

ISTC Fact Sheet: Solvent Elimination



ILLINOIS SUSTAINABLE
TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE

REPLACING SOLVENT WITH AQUEOUS DETERGENT AT A SMALL METAL FABRICATOR

ISTC's Technical Assistance Program (TAP) engineers successfully facilitated the adoption of an alternative aqueous (water-based) detergent parts cleaning, replacing use of solvent in parts cleaning at a small, rural metal fabricator.

TAP's hands-on approach is an effective methodology in facilitating adoption of pollution prevention (P2) technologies and overcoming traditional barriers to implementation. At this facility, engineers were able to show:

- **Advantage** – new product was better than current product (performance, safety, cost, etc.).
- **Compatibility** – new product was compatible with the current production process (space-footprint, corrosion protection, productivity, etc.).
- **Complexity** – new equipment was simple and easy to operate.
- **Observability** – new product performed as anticipated.
- **Trialability** – new process would work at the facility.

This detergent is safer for employees, less impactful upon the environment, and saves the company money. Also, employees like the new process: it's simple and the parts are cleaner.

“Thanks to ISTC we implemented a process change that saves money, provides a safer work environment, reduces waste, and improved the process.”
EH&S Manager

About the Company





This 5th generation family-owned manufacturer has built a reputation as cost-conscious and environmentally responsible in its tight-knit, small community. They have a well-kept workplace, pay a fair wage, and their employees like working there. They have a history of environmental compliance, profitability, and low employee turnover. The company has created a culture of continuous improvement, openness, social responsibility, and commitment to the community. However, within the company (as in others) some individuals were settled on maintaining the status quo ... focused on equipment, throughput, and direct production costs, but not waste streams. The company knew they needed help to make changes, and they turned to TAP engineers.

About TAP

TAP engineers conduct research, spread awareness, and facilitate implementation regarding practices, technology, and systems that improve sustainability.

TAP engineers focus upon minimizing waste of all types (energy, water, nonhazardous and hazardous materials) through source reduction and prevention by providing on-site technical assistance to manufacturers throughout Illinois.

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	1,600 gallons of solvent eliminated, 29 drums
	10,400 pounds of VOCs avoided
	4.7 metric tons of CO ₂ (mtCO ₂ e) emissions avoided
	\$5,000 annual savings with one year payback

CASE STUDY COMPANY STATS

Founded: 1869

Employees: 180

Ownership: privately-owned

Industry: fabricated metal product manufacturing

CUTTING OIL - TECHNICAL DATA

Manufacturer: Perkins Products, Inc.

Product Name: Perkut 309-P

Description: straight oil

Application: variety of machining operations on all metals

SOLVENT - TECHNICAL DATA

Manufacturer: Citgo Petroleum Corp.

Product Name: 142 Solvent 66/3

Synonyms: high flash mineral spirits, high flash Stoddard solvent

VOCs: 794 g/l

DETERGENT - TECHNICAL DATA

Manufacturer: Brulin

Product Name: 1990 GD

Description: mildly alkaline detergent

Characteristics: water-based, low foaming, corrosion control, biodegradable, and recyclable

Substrates: ferrous and nonferrous metals and plastics

Concentration: 5%

VOCs: none



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The Old Process

For more than 50 years, solvent (mineral spirits) had been used to remove straight cutting oil from metal workpieces in the milling department. These oil-laden pieces were hand-dipped in five-gallon buckets of solvent and placed upon a drain board to dry. Then the pieces underwent a subsequent heat treatment operation.

From a process perspective, the solvent dip operation had a small footprint, was low tech, and was an efficient means of removing oil. However from an environmental perspective, solvent is expensive, poses health and safety risks, and creates a waste stream.



Manual Parts
Cleaning System

An Opportunity

TAP engineers quickly identified this process as an opportunity for the client to reduce their environmental footprint, save money, and improve health and safety. They observed the process and interacted with the department supervisor, employees, maintenance supervisor, and EH&S manager to determine their requirements and anticipated results. The client provided the engineers with baseline solvent usage and cost. The engineers collected a cutting oil (Perkut 309-P) sample for bench trials at TAP's pilot lab.

In TAP's Pilot Lab

Based on their prior knowledge and work experience with alternative cleaners, the engineers identified two potential aqueous (water-based) detergents. They conducted simple "jar test" and metal coupon cleaning trials of each detergent to determine cleaning efficacy, oil rejection, and solution recyclability. One (Brulin 1990 GD) proved to meet the client's needs and requirements. Compared to the solvent, it would provide the client 90% in chemical savings, eliminate a hazardous material/waste, and improve employee safety.

The New Process

Subsequently, the company uses the new detergent in a small, single-stage, semi-automated spray wash cabinet. Employees load the small parts onto the rotating turntable, close the lid, set the timer, and let the spray washer do the work for them while they return to their mill machine; plus, the employees have a cleaner, safer work environment. Periodic formulation of fresh cleaning solution and routine maintenance of the system is required. These were factored into the decision-making-process and ROI.

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BENCH-SCALE JAR TEST PROTOCOL

- Ambient solution of tap water with Brulin 1990 GD @ 5% concentration in clear glass jar w/ lid.
- Add Perkut 309-P.
- Shake 1 minute and set aside, observing oil separation, solution clarity, and time.
- Repeat 2-3 times daily, for 1 week.
- Results: readily rejects oil with visible separation in 10 minutes, easily-removable oil layer atop and clean solution beneath.



Oil layer (on top)
Clean solution for reuse (below)



Oil-coated coupon (left)
Clean coupon (right)

ISTC FACT SHEETS

Find other fact sheets and more information about ISTC's Technical Assistance Program at:
istc.illinois.edu/info
istc.illinois.edu/tech

