TURI
TOXICS USE REDUCTION INSTITUTE
UMASS LOWELL

Making Massachusetts a safer place to live and work

Workshop Auto Minimizes Use of Hazardous Chemicals

WORKSHOP
European Auto Service and Performance

"Our new engine washer is easy to use and has made the air in the shop so much cleaner – and I'm saving money too!"

Dana Horan, owner

Overview

Workshop Auto, located at 44 Stedman Street in Lowell, provides auto repair and engine machining services, specializing in foreign cars.

With 20 years of experience in the auto repair sector, the owner, Dana Horan, was ready to improve the working conditions of the shop for himself and his employees. The shop had been using over 1,200 14-ounce aerosol cans of engine degreaser on average each year. The aerosol cleaner contained toxic chemicals that were being sprayed in poorly ventilated spaces, negatively impacting the air quality in the shop.

Mr. Horan had experience operating a shop in California, where air quality requirements are much more stringent, and he knew there was a way to improve the shop's air quality. He decided to replace his aerosol degreaser with an aqueous engine washing machine. The new machine would use a less hazardous cleaner in an enclosed piece of equipment that further minimizes worker exposure. Using a TURI small business grant, Mr. Horan purchased a Cuda® aqueous engine cleaning machine.

Environmental, Health, and Safety Analysis

In moving to a new piece of equipment (the Cuda aqueous engine cleaning machine), it was important to ensure the cleaning products used in the new equipment had a better environmental, health, and safety profile than the old aerosol cleaners. The machine can use two cleaning products and two additives (used to improve the efficiency of the cleaning system when needed):

- Cuda APP-1000 Aqueous Parts Washer – the primary detergent used to remove greases and oils
- Cuda SMP1000 Parts Washer – for soft metal parts and occasionally for specialty cleaning applications
- Cuda Vapor Corrosion Inhibitor – added to minimize corrosion of metal parts
- Cuda Defoamer – used to reduce the amount of foam generated (Mr. Horan notes that use of this product has not been necessary at his operation)

Cuda engine parts washer at Workshop Auto

The complete EH&S profiles are presented in the supplemental EH&S analysis on the following pages; a summary of the issues associated with the materials is provided below.

EHS Summary Comparison of Products Used by Workshop Auto		
Method	Product	Environmental Health and Safety Concerns
Original engine cleaning product	Johnsen Non-Chlorinated Brake & Parts Cleaner	Acute and chronic human health effects Can degrade into harmful chemicals Certain ingredients are bioaccumulative in humans Highly flammable and reactive product
New aqueous cleaning system	Cuda APP-1000 Aqueous Parts Washer	Acute and chronic human health effects (concentrate contains respiratory irritants and suspected endocrine disruptor) Slow environmental degradation
	Cuda SMP1000 Parts Washer	Chronic human health effects (concentrate contains suspected endocrine disruptor) Slow environmental degradation High vapor pressure, acidic, and strong odor
	Cuda Vapor Corrosion Inhibitor	Strong solvent-like odor Relatively high vapor pressure
	Cuda Defoamer	No significant concerns

It is important to note that the risk to workers associated with these products is also influenced by the potential for exposure. The aerosol product is sprayed directly on parts and discharged into the atmosphere during use. The efficacy and reliability of personal and room ventilation systems is essential in minimizing the potential for worker exposure. The aqueous parts wash system is an enclosed water system with relatively small amounts of the various Cuda products added to it. Worker exposure is minimal during use because of the enclosed configuration of the system. Therefore, the risk of experiencing any of the human or environmental hazards associated with the various products is significantly less for the aqueous system than for the aerosol system.

Performance

Mr. Horan is very pleased with the performance of the new machine and states that it is cleaning better than their old system of using aerosol cans and manual wiping. An added benefit of the new system is that the shop is now using less than half the number of rags they were using before.

Financial Analysis

The purchase price of the Cuda parts washer was $11,530, and Mr. Horan is seeing an annual savings of $4,000 in material purchase costs and an estimated 50% reduction in shop rag purchases and cleaning costs. Not factoring in the grant of $10,000, the new piece of equipment will be paid back in less than three years.

Some aerosol cans are still in use at the shop for difficult-to-clean parts, but the number of cans has been reduced by at least 85%. The new piece of equipment has a life expectancy of 10 years, according to the manufacturer.

Summary

With a simple change in equipment, Workshop Auto was able to create a healthier and safer work environment for the workers and the public that comes into the shop as well as the neighboring community. The change also saved the shop money and reduced waste.

Supplemental Information: Environmental, Health, and Safety Analysis of Products

Using TURI's P2OASys tool (Pollution Prevention Options Analysis System), the aerosol and aqueous systems were compared for their environmental, health, and safety profiles. The table below shows a comparison of hazards associated with the two systems. The hazard analysis for the original aerosol cleaner that Workshop Auto used is provided in the first column. The remaining columns contain the various products used in the new Cuda aqueous system. Workshop Auto has found that the defoamer product has not been necessary.

EHS Evaluation of Original and New Cleaning Methods Used by Workshop Auto					
Hazard Category	Original Product	New Aqueous System			
	Johnsen Non-Chlorinated Brake Parts Cleaner	Cuda APP-1000 Aqueous Parts Washer	Cuda SMP1000 Parts Washer	Cuda Vapor Corrosion Inhibitor	Cuda Defoamer
Acute human effects	VH	VH	H	M	H
Chronic human effects	VH	VH	VH	L	M
Ecological hazards	H	M	M	L	L
Environmental fate & transport	VH	VH	VH	H	M
Atmospheric hazard	H	M	M	L	L
Physical properties	VH	M	H	VH	M
Process factors	VH	H	M	M	M
Life cycle factors	VH	H	H	M	M

Key: L = Low M = Medium H = High VH = Very High

Original Aerosol Can Cleaning System

Johnsen Non-chlorinated Brake & Parts Cleaner contains the following ingredients:

- methanol
- toluene
- acetone
- heptane, branched, cyclic
- carbon dioxide, liquefied, under pressure
- n-heptane

The product was evaluated and rated based on the most hazardous ingredient for each endpoint or attribute. Ratings of VH are explained here; more information is available in the P2OASys database (www.p2oasys.turi.org).

Johnsen Brake Cleaner received a rating of VH for acute human effects because it is highly toxic if inhaled, swallowed, or comes in contact with skin. It may result in irritating effects on the skin and eyes from a single or repeated exposure. Chemicals in this product such as methanol, toluene, and heptane are suspected reproductive toxins and endocrine disrupters, giving it an overall rating of VH for chronic human effects. Prolonged or repeated exposure to Johnsen Brake Cleaner may result in respiratory irritation, drowsiness, dizziness, and damage to organs with possible irreversible effects. The product received a rating of VH in environmental fate and transport as it can degrade into harmful chemicals and has the potential to bioaccumulate. It is a highly flammable and reactive product with an extremely low flash point of -18 °C, resulting in a rating of VH in the physical properties category. Process factors that contributed to the rating of VH include the likelihood of exposure to the product. The energy and material input required for aerosol cans and the considerable waste generation results in a VH rating for life cycle factors. All of these hazards weighed heavily in the overall rating of VH for life cycle factors.

Aqueous Parts Cleaning System

The Cuda system uses one of two cleaners with the possible addition of a corrosion inhibitor and/or defoamer to improve the efficacy of the cleaning system: the APP-1000 Aqueous Parts Washer, which is the primary detergent; the SMP1000 Parts Washer, for soft metal parts or specialty cleaning applications; the Vapor Corrosion Inhibitor, which minimizes corrosion of metal parts; and the Defoamer, which reduces the amount of foam generated.

The hazardous components in these products and their maximum percentages in the concentrates are:

Hazardous Components in Cuda Products		
Product	Ingredient	Percent (%)
APP-1000 Aqueous Parts Washer (dilution ~ 1-4 oz/gal)	Ethylene glycol monobutyl ether	17
	Sodium metasilicate	39
	Sodium carbonate	9
	Sodium nitrite	2
SMP1000 Parts Washer (dilution ~ 0.25-0.5 lb/gal)	Ethylene glycol monobutyl ether	4
	Sodium metasilicate	33
	Sodium carbonate	28
	Sodium nitrite	2
Vapor Corrosion Inhibitor	Morpholine	11
Defoamer	No hazardous components listed on SDS	n/a

The APP-1000 Aqueous Parts Washer received a rating of VH for acute human effects because it may cause breathing difficulties if inhaled, is harmful if swallowed, and may result in irreversible eye damage. This product is also considered a mild skin and respiratory irritant. Both the APP-1000 Aqueous Parts Washer and the SMP1000 Parts Washer received a rating of VH in chronic effects as they contain ethylene glycol monobutyl ether and sodium nitrite, which are suspected endocrine disruptors. A rating of VH in the environmental fate and transport category is due to the slow environmental degradation and possibility of hazardous degradation products forming in the process. There is also the risk of the chemicals persisting in the air, water, and soil for long periods of time. The Vapor Corrosion Inhibitor received a rating of VH for physical properties as it has a relatively high vapor pressure, is acidic, and has a strong odor.

TURI developed the Pollution Prevention Options Analysis System (P2OASys) tool to help companies determine whether the toxics use reduction (TUR) options they are considering improve upon their existing process when looking at environmental, health and safety endpoints. By using P2OASys, unforeseen negative environmental, worker or public health impacts may be identified prior to adopting the proposed changes.

Potential hazards posed by current and alternative processes identified during the TUR planning process are compared using data endpoints for eight main categories that encompass chemical, physical, psychological and environmental hazards.

Using both quantitative data and qualitative input, the tool can rate each category based on endpoints that correlate with values, key phrases, Globally Harmonized System of Classification and Labeling of Chemicals (GHS), and other government agency designations. Scores range from 2 to 10, with the lower score being more desirable.