

Implementation of the Chemical Leasing Business Model in Metal Cleaning

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Abstract

Many industries, especially the aerospace, automotive, measuring, medical and optical industry depend on first class cleaning results and therefore use perchloroethylene (PCE) to degrease metal parts. PCE does not only have technical advantages, but also provides economic, safety and environmental benefits when used under safe conditions. FKL, a Serbian automotive parts producer, decided for a Chemical Leasing solution from SAFECEM.

This case study presents how SAFECEM and FKL implement the Chemical Leasing model and how it leads to a noticeable improvement of resource efficiency, mitigation and economic savings.

Keywords: Chemical Leasing, Chemical Management, Metal Cleaning

1. Introduction

In many metal cleaning applications soils like organic oils and greases have to be removed from the parts. These soils have specific chemical properties like the polarity and ionic effects. There are many available cleaning options like aqueous, semi-aqueous, fluorinated and brominated solvents. In this case, organic solvents compared to water-based solutions are more efficient, with high flexibility in terms of contaminant. Many industries with high precision cleaning requirements use PCE successfully for vapor degreasing of metal parts.

Vapor degreasing is considered by experts as ideal technology for high quality cleaning. Stubborn soils such as buffing compounds, metal dust, chips, or inorganic salts can be removed. PCE has a high boiling point and thus efficiently removes waxes and resins that must be melted before being solubilized. It reaches into small crevices in parts with convoluted shapes. After vapor degreasing, the parts are completely dry. Vapor degreasing is particularly effective for parts with recesses, blind holes, perforations, crevices, and welded seams. Chlorinated solvent vapors readily penetrate complicated assemblies as well. PCE is a preferred choice for many cleaning applications, not only technically, but also in terms of economics, workplace safety and environmental protection when handled under certain conditions.

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The risks of chlorinated solvents are well researched and known and according risk management measures are available.

2. Chemical Leasing Business Model

In close cooperation with UNIDO and international working group, Chemical Leasing is defined as a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value-added approach (2).

In the classic business model producers are volume-oriented. Within a Chemical Leasing model, the performance of the solvent is sold and not the chemical. Customers pay a monthly leasing fee which is calculated on the amount of parts cleaned or on the working hours of the machine. Solvent consumption thus becomes a cost factor for the supplier and he is motivated to optimize the consumption. Chemical Leasing creates a situation in which the chemical supplier and his customer share the same objective: maximizing the efficiency of the cleaning process and reducing the solvent consumption.

Within the Chemical Leasing business models, the responsibility of the producer and service provider is extended and may include the management of the entire life cycle of a chemical. The relationship between a chemical supplier and his customer is based not only on the sale of chemicals, but also on the associated expertise (the manner and conditions of application, the concept of recycling and disposal). The chemical supplier sells chemicals including expertise for their effective use. Partners can be a user and a producer of chemicals, but like in the following case study, an equipment manufacturer, a local chemical distributor and a recycling company can participate. The Cleaner Production Centre of Serbia participates as a neutral party.

2. Case Study FKL - SAFECHEM

2.1 Partners in the Chemical Leasing project

FKL is a producer of ball bearings and cardan shafts. It supports customers in choosing, installing, exploitation, adaptation and finishing of bearing. It also provides specialized services like grinding, adaptation of bearings at a request, cardan servicing, grooving, surface protection etc.

The company is certified according to ISO 9001 and ISO 14001

SAFECHEM, a subsidiary of The Dow Chemical Company, is the service company responsible for the safe and innovative use of chemicals. In Serbia, SAFECHEM cooperates with their local distributor Resinex.

The Cleaner Production Centre of Serbia was established by UNIDO and Serbia is one of the eleven countries which are involved in a chemical leasing project.

2.2 Situation before Chemical Leasing implementation

FKL degreases its metal parts with two closed machines that operate with a standard PCE grade. The process is:

Parts to be cleaned are packed into baskets (haphazardly or tidy). The cleaning process contains an immersion phase to dissolve oils and grease with, depending of parts' typology, a baskets' rotation and/or ultrasonic to remove metallic chips. Then the basket moves into the vapor phase to be finished and dried.

Degreasing metal surfaces with chlorinated solvents leads to increased concentrations of cutting fluid, oils, fat and their decomposition products in the solvent bath. Under certain operating conditions e.g. fully enclosed equipment, high temperature and high soil concentration, the contaminants may decompose and may lead to acidification of the solvent. The working life of the solvent is significantly reduced by acidification. Metal parts to be cleaned may also corrode and the machine itself may be damaged by the acid.

Standard PCE is not stabilized for metal cleaning applications, which leads to a short solvent life-time (baths exchange of 300 l each, every week) of the solvent and heavy corrosion of machine parts.

Due to the fact that solvent gets contaminated during the week, the quality of cleaning results decreases noticeable in the course of the week.

FKL works 7 days a week in three shifts and the yearly PCE consumption is about 30 t

Production of the hazardous waste is about 25 t yearly with the solvent content over 90%.

2.3 Implementation of the Chemical Leasing Model

After technical and chemical analysis, SAFECHEM offered an integrated solution designed to meet the quality requirements and at the same time help to satisfy all occupational health and safety and environmental requests.

Implementation of the model includes:

- Safe supply of DOWPER™ MC, PCE metal cleaning grade in the SAFE-TAINER™ system in line with the principles of Responsible Care®. Effective risk management is provided as emissions are kept to a minimum.
- Safe handling – due to completely closed SAFE-TAINER™ system for fresh and used solvent associated to SAFECHEM accessories for hermetical connections, there is virtually no contact of workers with solvent during operations.
- SAFECHEM continuously delivers consulting services related to solvent maintenance.
- Process optimization via equipment enhancement
- Safe take-back of used PCE - Take-back of used solvent in the SAFE-TAINER™ system
- CHEMAWARE™ Solvent Training of employees for proper and safe use of PCE
- Invoicing is based on the efficiency of the cleaning process. FKL pays a monthly fee for all above mentioned goods and services

2.4 Benefits for FKL

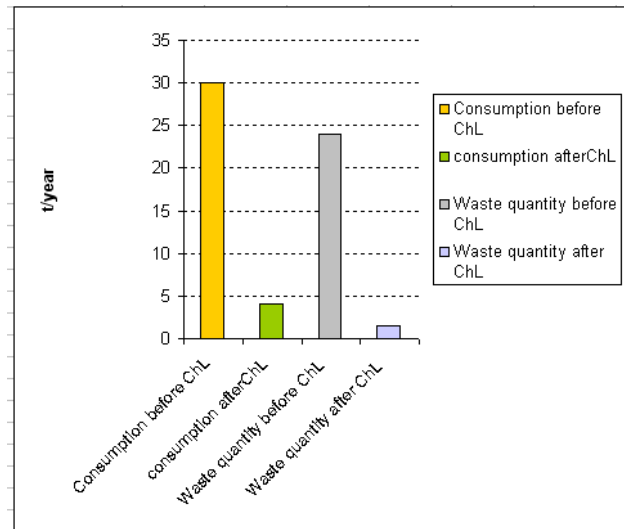
FKL benefits from the know-how transfer that results in lower solvent consumption, improved quality, higher cleaning capacities, improved environmental and occupational health and safety and economic savings.

Resource efficiency

Due to stabilizers and analytical services, alkalinity and acid acceptance are under control which noticeably reduces bath exchanges. Calculations give evidence that the consumption of PCE will significantly be reduced: instead of 30 t/year, only less than 5 t/year are needed.

Environmental benefits

- The quantity of the hazardous waste is significantly reduced. It is expected to produce not more than 1.5 t/year;
- The hazardous waste is managed in a safe way. SAFE-CHEM takes back the waste in the SAFE-TAINER™ system;
- Air emissions (both canalized and diffused) are reduced due to lower distillation temperatures



Calculated consumption of the solvent and waste quantities before and after the Chemical Leasing implementation

Health and safety

- The system is closed and the solvent transfer will be managed via hermetical connection thanks to accessories from SAFE-CHEM. There is virtually no possibility that employees get in contact with the solvent and virtually no emissions to the working environment;
- Basically all risks related to the chemical will be managed

Quality improvement

Previously, the quality of cleaning was decreasing in the course of the week, because the formerly used technology was insufficient. Oils couldn't be separated from the solvent by distillation and due to co-distillation burned particles occurred on parts.

Chemical Leasing enables the quality of cleaning results to be kept at the same level during the whole week.

The equipment enhancement will help to reduce the quantity of oil in the solvent and thus enables the cleaning machine to work at lower temperature and have uniform cleaning results during the work.

Process improvement

In the last two years FKL has strongly increased its production and cleaning process has become the key point in terms of productivity and quality.

One of the very important benefits is the increased capacity of cleaning as the number of parts per basket is increased and the cleaning cycles are shorter.

Intangible benefits

- Maintenance costs are significantly lower, as parts of the machines are protected against corrosion;
- Better line productivity (there will be no down time due to a frequent change of the solvent and maintenance);
- Higher cleaning standards
- The costs of cleaning is predictable

Economic benefits for FKL

The costs should considerably decrease and are expected to be above 10% (calculated without savings of maintenance costs and downtime costs).

2.5 Benefits for SAFECHEM

The Chemical Leasing model enables SAFECHEM to consequently apply the principles of Responsible Care®. This leads to an improved environmental profile. Chemical Leasing enables SAFECHEM to closely work with the customers and optimally adjust the cleaning process parameters. The solvent consumption can be noticeably reduced and the performance and services are sold.

With Chemical Leasing, invoicing is based on the efficiency of cleaning. Those results in an attractive win-win-situation for all parties involved and at the same time contribute to the protection of the environment and mankind.

- (1) Handbook for critical Cleaning, Taylor & Francis Group, LLC, 2011, p 183)
- (2) Jakl, Schwager, 2008, Chemical Leasing Goes Global, Springer Verlag, Wien