Jet Engine Overhaul Environmental Management System 14001

Larry McCarthy, Lufthansa Airmotive Ireland, Dublin, Ireland.

Lufthansa Airmotive Ireland received an Integrated Pollution Control License (IPC) from the Irish EPA in January 1999. To fulfill the requirements of the license, the company was required to establish an Environmental Management System (EMS). The EMS was required to assess all operations plant-wide and to review all options for the use of cleaner technology, cleaner production and the reduction and minimization of waste. The company received the ISO 14001 Environmental International Standard in April 2000, the award was formally presented by the Minister of the Environment in July 2000. This presentation will discuss the environmental management programs that have been established and the cleaner technology processes that are being commissioned for the repair and overhaul of jet engine components.

For more information, contact:
Larry McCarthy
Lufthansa Airmotive Ireland
Naas Road
Rathcoole
Co.Dublin
Ireland.
353-1-4011218

Introduction

The Environmental Protection Agency (EPA) is the statutory body in Ireland with responsibility for issuing Integrated Pollution Control (IPC) Licenses to businesses and industrial organisations within the country. Lufthansa Airmotive Ireland was granted an IPC Licence in 1999 which sets out the conditions, programmes and operating procedures to be implemented in the areas of:

◊ Waste Water
◊ Air Emissions
◊ Noise Emissions
◊ Hazardous And Non-Hazardous Waste

One of the important requirements set out in the license is the implementation of an Environmental Management System (EMS) which will assess all operations and review all practicable options for the use of cleaner technology, cleaner production and the minimisation of waste.

Management Of The Activity

The ISO 14001 Environmental Management System (EMS) which is an internationally recognised standard was the vehicle adopted to manage and control the overall environmental performance of the company. Additionally customers within the Jet Engine Overhaul industry now recognise the importance of environmental management control and accreditation to an International Standard is becoming increasingly necessary.

Environmental Policy

In an Environmental Policy Statement the following principles have been adopted:

◊ To document and evaluate the environmental impact of our activities.
◊ To review objectives and targets aimed at continual improvement of environmental performance by utilising cleaner technologies and process substitution where possible.
◊ To put in place structures to monitor and minimise our environmental impacts.
◊ To conform to all statutory requirements set out in our IPC License.
◊ To promote Environmental Awareness among all our employees.
◊ To ensure this Environmental Policy is available to the public.

Environmental Aspects

A Register Of Environmental Aspects which identifies all activities that interact with the environment was compiled. An activity is considered an environmental aspect if it can interact with the environment and the company has an influence over the activity. The Register is regularly reviewed and updated when a new process or activity is considered.

Significance Rating

The significance of an environmental aspect was based on simple risk methodology and the method of calculation was used to establish a significance rating for each aspect.
The significance rating is calculated as follows:

C = F x L x S

C = Significance Rating
F = Frequency of Occurrence of the aspect and a numerical value between one (i.e. rare) and 10 (i.e. regular/consistent) is assigned.
L = Loss of control and a value between one and ten is assigned where one indicates control loss is unlikely and ten indicates control loss is highly likely.
S = Severity of consequences and is assessed using the following criteria:

(1) Legislative and Regulatory Compliance
(2) Community/Employee Sensitivity
(3) Impact on Air, Land, Water
(4) Cost benefit reasons e.g. insurance liability
(5) Potential for resource depletion
(6) Accident and Emergency

The criteria (1) to (6) is scored between one and five, dependent upon the risk:

e.g. one indicates no risk and five indicates intolerable risk.

Using the subject criteria the top five environmental impacts in order of significance were:

◊ Emissions to Atmosphere
◊ Environmental Noise
◊ Hazardous Materials
◊ Non-Hazardous Waste
◊ Hazardous Waste

Objectives And Targets

The Register of Aspects identified five main objectives which have become the main focus in terms of implementing cleaner technologies, cleaner production and waste minimisation. These objectives have resulted in the following targets now being implemented:

◊ Eliminate use of Trichloroethylene by July 1st 2001.
◊ Eliminate use of Solvents in Bearing Cleaning by July 1st 2001.
◊ Reduce Noise Emissions from the site.
◊ Minimise use of Hazardous Materials by July 1st 2001.
◊ Reduce quantity of Non-Hazardous Waste to landfill by December 2000.
◊ Develop Waste Minimisation Strategies for hazardous waste throughout the production process over the next five years.

Trichloroethylene Replacement

Spray Wash Machines

Vapour degreasing using Trichloroethylene has been the standard process used in the engine overhaul industry over many years. This has been a 'One-Step' process where the resulting parts were:

◊ Clean
◊ Dry
◊ No Surface Residues

Spray wash machines, Figure 1, using a water based alkaline detergent has been adopted as the alternative process to vapour degreasing. The process steps are integrated in one chamber within the machine and in one fully automatic cycle e.g. parts are not moved from tank to tank. The machine is fitted with a cell to convert incoming tap water to de-ionised water for processing.
An oil skimmer and filtration system is also embodied in the machine and the entire process is fully programmable.

Figure 1 - Spray Wash Machine

Dedicated Processes:

The substitute process is located in these areas of the plant where trichloroethylene has been the historical degreasing process e.g:

◊ Degreasing prior to coating e.g. plasma, plating, painting
◊ Degreasing prior to FPI
◊ Degreasing post MPI

◊ General removal of oil and grease from engine parts

The parts requiring degreasing in the high pressure spray wash machines are processed as follows:

◊ Spray wash in water based Alkaline detergent at a concentration of 3% to 5% x 4 - 5 minutes
◊ Re-Circulate chemical to process tank x 2 minutes
◊ Hot Rinse (De-Ionised Water) at 80°C x 3 - 4 minutes
◊ Water removal by vacuum if required
◊ Hot Air Dry (120°C) x 5 - 6 minutes
◊ Total cycle time is approx. 15 minutes

The rinsewater will be discharged to drain under controlled conditions based on chemical analysis and parts thru-put. Contaminated degreasing solutions will be dumped to drain or routed for waste disposal in accordance with the requirements of our IPC licence.

Removal Of Plating Wax

The removal of residual wax which remains on jet engine components after de-waxing in hot water has been traditionally carried out using vapour degreasing in trichloroethylene.

A semi-aqueous process for removing plating wax using the n-Propyl Bromide free product will be installed in the plating shop. The new process line will embody hot rinsing stages before and after a chemical de-wax and also an alkaline rinse aid. A schematic of the new de-wax line is shown in Figure 2.

The chemical de-wax product is expensive and methods of extending the life of the process will be investigated. Some shops dump the process on an annual basis but this will depend on thru-put and shops experience.

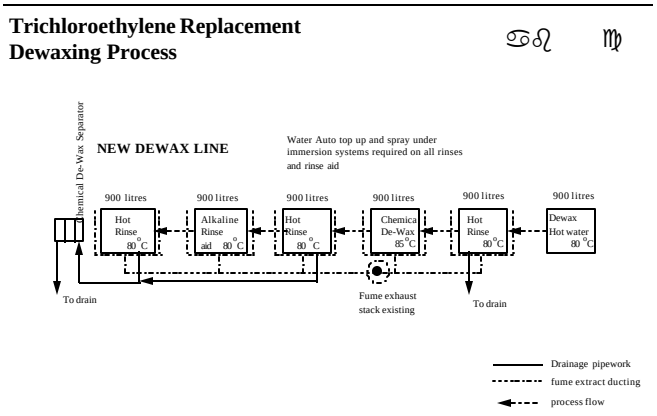

Figure 2 - Trichloroethylene Replacement Dewaxing Plating Process

Solvent Replacement

Bearing Cleaning

The elimination of solvents in the cleaning of engine bearings was identified as a key objective in the Register of Aspects particularly with respect to Air Emissions.

An Aqueous based cleaning process has been adopted as the alternative process to solvent cleaning. The bearings will be processed in a semi automatic system using a water based alkaline cleaner followed by cold rinsing dewatering and preservation. (Fig 3)

A facility for ultrasonic cleaning will be installed in the process solution if necessary.

Mechanical agitation will be provided at each processing stage. The bearings will be inspected in the presence of the dewatering oil and preserved in preservation oil for long term storage if required.

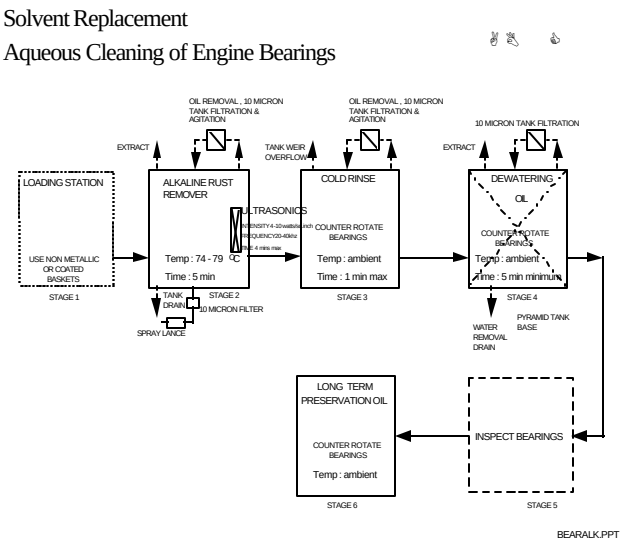

Figure 3 - Solvent Replacement Aqueous Cleaning of Engine Bearings

WASTE MINIMISATION

Non-Hazardous Waste

Strategies have been developed within the company to minimise non-hazardous waste streams historically routed to landfill. Recyling programmes are now in place for the following waste streams:

◊ Waste paper is collected, weighed, shredded and baled for recycling to paper mills.

◊ Waste cardboard is either re-used or if non-useable is recycled.

◊ Waste timber e.g. pallets or boxes is collected, shredded and recycled.

Non-Hazardous Process Waste:

◊ Aluminium Oxide is recycled and re-used for surfacing grinding wheels.

◊ Plasma Dust - Nickel is extracted from the metal dust and is re-used commercially.

◊ Steel Shot - Routed to steel mills for scrap.

WASTE MINIMISATION

Hazardous Waste

Hazardous waste is primarily generated from the following waste streams:

◊ Alkaline and Acid solutions from chemical cleaning processes.

◊ Acid and Alkaline solutions (Cleaners and Strippers) from Electroplating processes.

◊ Chlorinated and non-chlorinated solvents from cleaning and inspection processes.

◊ Empty chemical packaging.

◊ Time expired consumables.

The following programmes are being examined to reduce waste and reduce our dependence on waste disposal contractors:

◊ Extend the life of cleaning process solutions using filtration techniques (Tanks are currently dumped annually).

◊ Upgrade our Effluent treatment capability.

◊ Return empty packaging to suppliers.

Reduce quantity of time expired waste consumables by adopting the following measures:

◊ Re-Qualification for further life extension.

◊ Tighter control of inventory stock.

◊ Review of purchasing policy.

Environmental Management Controls

◊ Procedures in place to cover all aspects of the Environmental Management System.

◊ Scheduled Internal Auditing to establish compliance with EMS.

◊ Corrective Actions to record and rectify non-compliances.

◊ Management Review to evaluate status and adequacy of the management system.

◊ Six monthly surveillance visits by the external accreditation body.

Benefits From ISO14001 Certification

◊ Continual improvement of environmental performance.

◊ Assure customers of commitment to Environmental Awareness.

◊ Reduce incidents that result in liability.

◊ Reduce consumption of materials and energy.

◊ Obtain more competitive insurance costs.

◊ Improve cost control.