Reduction in Organic Solvent Emissions at a Lighting Fittings and Fixture Manufacturing Industry	Sweden	1990	Full scale

ELECTRICAL MACHINERY AND APPARATUS # 4

Background

Thorn Jornkonst manufactures lighting fittings and fixtures for use both indoors and outdoors. The company was incorporated into Thorn EMI, with headquarters in England, in 1988. Production amounts to 600,000 units for indoor use and 150,000 units for outdoor use. The total number of employees is 400 people and the turnover in 1993 was US$ 38.4 million.

The environmental authorities in 1986/87 reviewed the facility. Following this, several requirements were placed on Thorn Jornkonst to reduce the emissions of organic solvents. The previously installed cleaning equipment with thermal combustion should be taken into use. In addition to these demands, the company had the ambition to reduce the emission from the painting with 30% by increasing the amount of powder painting.

By this time, the Landskrona project management introduced the new approach that environment problems should be attacked at the source instead of taking measures on the symptoms with expensive end-of-pipe technology. In this case the primary aim was to question the existing need of degreasing and to do this, some questions were framed:

- What has to be removed from the items being produced?
- Which are the pollution sources?
- Is it possible to reduce the number of pollution sources?
- Does the existing degreasing correspond to the real need for degreasing, that is, does any unnecessary degreasing take place?

The first measure that was taken was to analyze the handling routines for the materials processed in the degreasing plant. It was then discovered that a considerable degreasing took place even though it was not actually needed. A saving of 40-50% of the consumption of trichlorethylene could be made without any interference in the process itself. The reduction also lead to less emissions of pollution to the air. A wider analysis of the need for degreasing pointed to the deep drawing of aluminum details as a large pollution source because of the use of petroleum based drawing oils.

Cleaner Production Principle

Material substitution; Process/ product modification

Cleaner Production Application

The metal working comprises different forms of cutting, punching and pressing. The majority of the metal details was degreased with trichlorethylene. Aluminum details

for outdoor use were treated by chromating followed by phosphatizing while details made of sheet steel were pretreated only by phosphatizing. The painting took place in two automatic lines-one with organic solvent based paints and one with powder paints. Some smaller series of fittings were manually painted in spraying chambers.

Material substitution: The deep drawing of aluminum details was a large pollution source because of petroleum based drawing oils. The drawing oils were replaced with environmentally sound and biologically degradable products. These oils could more easily be removed from the goods and made it possible to end the degreasing with trichlorethylene. As a result the company scrapped the old degreasing plant and began using a more environmentally sound alkalic degreasing process.

Process modification: Installation of a new electrostatic powder painting line with high capacity. Products which are manufactured in short series with special colors are, as before, manually painted with solvent-based paints and corresponds to 5% of the total lacquering. The change of painting technology also included an overhaul of the phosphatizing methods. The earlier zinc phosphatizing for outdoor fittings was replaced with iron phosphatizing which is used for the rest of the products. The zinc component in the waste water could then be reduced. Changes have also been accomplished in the chromating process used as pretreatment for the painting of fitting details in aluminum for outdoor use. A change-over to other alloys made it possible for the company to reject the chromating process and yet retain an acceptable quality level for its products.

The existing drawing oils were replaced with environmentally sound and biologically degradable products and a change-over to vegetable drawing oils which could more easily be removed from the goods and made it possible to end the degreasing with trichlorethylene and replace it with a more environmentally sound alkalic degreasing process. An electrostatic powder painting line with high capacity replaced the solvent based painting line. The earlier zinc phosphatizing for outdoor fittings was replaced with iron phosphatizing. The zinc component in the waste water could then be reduced. A change-over to other alloys in the chromating process made it possible for the company to reject the process and yet retain an acceptable quality level for its products at the same time as a saving of 5,000 m^3 of water a year could be done.

Environmental and Economic Benefits

The benefits include,

- no discharge of organic solvents to the atmosphere,
- major reduction of the amount of hazardous waste,
- an improved working environment and
- no inflammable products or fire resistant storage yard
- a change-over to other alloys in the chromating process made it possible to save 5,000 m^3 of water a year.
- the company also contributed to the development of improved quality of powder paints.

Material Category	Quantity Before	Quantity After
Waste Generation	N/A	
Degreasing:	N/A	
emission of trichlorethylene	11 tons	0
water discharge	0	process water to internal waste water treatment plant
hazardous chemical waste	trichlorethylene sludge 5 ton	oil-bearing sludge 1-2 ton
Painting:		
Emission of organic solvents	65 ton	7 ton
Hazardous chemical waste:		
Solvents residues	10 m^3	2 m^3
Paint residues	47 tons	0.2 tons
Powder residues	<0.5 tons	3 tons

The investment cost for the powder painting line was US$ 388,000 (1990).

Operational and maintenance costs (in US$, 1990) are summarized below:

Running and capital costs	Degreasing with trichlor ethylene	Alkalic degreasing
Chemicals	3,400b	3400
Water	negligible	13,500
Energy	6,700	18,600
Labor force(a)	75,900	75,900
Cleaning equipment	33,700(c)	2,500
Capital	16,900	(d)

TOTAL	136,600	113,900

a. labor need of 2 persons at both plants
b. reduced consumption by tri recycling
c. running and capital costs
d. the plant is depreciated

Solvent based painting

Paint + solvent	388,000
Cleaning (labor cost 6 persons x 1 day/month x 11)	16,900
Hazardous waste (transport + destruction)	42,200
Pump station (working cost)	30,400
Cleaning equipment (cost of support combustion)	38,800
Labor need (4 painters)	202,400
Total	718,600

Powder painting

Paint	202,400
labor need (2 painters)	101,200
Total	**303,600**

The calculation yields US$ 421,700 (1990) lower running costs each year for the powder painting line compared to the solvent-based painting line meaning a payback time of less than one year. The changes in the chromating process save US$ 128,200 a year giving an immediate payback time.

Constraints

None reported.

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Review Status

This case study was translated from Swedish and submitted by the Swedish Foundation of TEM to UNEP IE. It was edited by UNEP IE in July 1995.

Subsequently the case study has undergone a technical review by Dr Prasad Modak at Environmental Management Centre, Mumbai, India, in September 1998.