

# **Montreal Protocol**



## **Process Agents Task Force**

### **Case Study #26**

**Use of CTC in the manufacture of Cyclodime**

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# CS-26 Use of CTC in the manufacture of Cyclodime

## CS-26.1 Process description

Cyclodime is a synthesis intermediate used for the manufacture of polymers raw materials. The synthesis route which is used for the manufacture of Cyclodime is a proprietary process developed by ELF ATOCHEM during the 70's and well optimized thanks to many improvements done during the last 25 years. The polymers produced are used for technical applications (such as hydraulic systems) in the aerospace, aeronautics, automotive and appliance industries

This process consists of 2 steps :

- Synthesis of crude Cyclodime by a photochemical route
- Purification by thermal treatment to obtain the product.

### Step 1 : Synthesis

Raw materials are dissolved in CTC and then reacted under to a powerful light radiation in order to produce the crude Cyclodime by a photochemical reaction in CTC as solvent.

The use of CTC is essential in this process, because this compound is very stable due to its chemical structure and it is the only solvent which is not decomposed under these conditions. Evaluation of other solvents under process conditions has led to the resulting polymer raw material being unsatisfactory for the production of the final polymers.

The crude Cyclodime is then separated from CTC by decantation and CTC is recycled upstream and consequently re-used permanently.

### Step 2 : Treatment

The crude Cyclodime is then heated at a high temperature for finishing and purification. Traces of CTC contained in the Cyclodime are completely removed by vaporization, collected and directed to a closed treatment unit.

## **CS-26.2      Collection and treatment of the gaseous vents.**

The synthesis unit does not generate any liquid CTC emissions, because all the installation is leakproof and all the liquid CTC is recycled.

All gaseous streams are collected and directed to a closed treatment unit. This unit consists of 2 parts :

- a condensation / absorption system to recover most of the CTC as a liquid which is recycled,
- a thermal conversion system at very high temperature (1200°C) to destroy the last traces of gaseous CTC. In this systems CTC is converted to aqueous HCl which is recycled to the photo-chemical reactor as a catalyst.

Fugitive emissions are not possible due to leakproof equipment and construction.

## **CS-26.3      Consumption of CTC**

- The CTC consumption is due to a minor hydrolysis at the thermal treatment step of the Cyclodime and at the destruction of traces of gaseous CTC at the thermal conversion stage.
- The CTC consumption varies from 400 to 1000 MT/year depending the production volumes of Cyclodime. This consumption corresponds to the conversion of CTC to aqueous HCl which is recycled at the photochemical step.
- The overall mass balance gives a CTC loss smaller than 0,1% versus its consumption.

# MANUFACTURE OF CYCLODIME



