Case study

Shoe manufacture
Legal Requirements
Installation of Annex VII, part 2, No 14 of IE Directive

Annex VII part 1, No 6:

Footwear manufacture:

Any activity of producing complete footwear or parts

Solvent Consumption Threshold: > 5 tons/year

Remark:

Cleaning of equipment is considered to the activity in each case, here No. 14 footwear manufacture
Overview

Annex VII Part 2 No 14:
Footwear manufacture
Solvent consumption threshold: 
> 5 tons/year

IE (IPPC) Directive Annex I, No. 6.7:
Surface treatment using organic solvents; solvent consumption threshold > 150 kg/h or
> 200 tons/year
1. Step: Check IPPC installation:
Installation under the scope of IE (IPPC) Directive Annex 1 No 6.7 because of amount of solvent consumption (> 150 kg/h or > 200 tons/year)?

[Here total solvent consumption over all organic solvent activities is generally less than given thresholds]


Footwear manufacture if complete pairs of shoes are produced
Otherwise: adhesive coating No 16]

3. Step: Do the activities fall under the scope of IE Directive Chapter 5 (former VOC Directive) because of exceeding solvent consumption threshold?

[No 14 Footwear manufacture: yes, if solvent consumption is „> 5 tons/year“
No 16 adhesive coating: yes if solvent consumption is „> 5 tons/year“]
Requirements according to Annex VII, part 2, No 14 – Footwear manufacture:

• CMR substances (Art. 58):
  a) Substitution as far as possible by less harmful substances/mixtures within the shortest possible time.
  b) In case of emission mass flow $\geq 10$ g/h:
      emission limit for waste gases $2$ mg/Nm$^3$

• The discharge of such VOCs shall be controlled as emissions from an installation under contained conditions as far as technically and economically feasible to safeguard public health and the environment.

Check of Safety Data Sheets necessary and/or confirmation of supplier
Requirements according to Annex VII, part 2, No 14 – Footwear manufacture:

- Emission limit values for halogenated VOC with hazard statements H341 or H351: In Germany: additionally No 5.2.5 Class I TA Luft
  In case of emission mass flow ≥100 g/h:
  emission limit for waste gases 20 mg/Nm³

- The discharge of such VOCs shall be controlled as emissions from an installation under contained conditions as far as technically and economically feasible to safeguard public health and the environment.

Check of Safety Data Sheets necessary and/or confirmation of supplier
Requirements according Annex VII Part 2 No 14 Footwear manufacture

<table>
<thead>
<tr>
<th>Threshold [t/year]</th>
<th>Total emission limit value</th>
<th>Special provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5</td>
<td>25 g per pair</td>
<td>Total emission limit value is expressed in grams of solvent emitted per pair of complete footwear produced.</td>
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Total emissions of an installation (Art. 2 No 12 1999/13/EC; Art. 57 No 4 IE Directive):
sum of fugitive emissions and emissions in waste gases

Here for footwear manufacture: VOC emissions over all processing steps (including cleaning, adhesive coating, printing etc.)

In case of waste gas cleaning: the part of emitted substances after the waste cleaning has to be added too!

Total emission limit value is equivalent to an installation specific reduction scheme referring to Annex IIB No 1 of VOC Directive (IE Directive: Annex VII part 5 No 1). A specific reduction scheme in sense of Annex IIB No 1 is therefore not necessary.
Verification of compliance to total emission limit value by annual solvent mass balance (elaborated by operator)

Because of dependence of total emission limit value of solvent input -> total emission limit value = floating value to be determined for each year!
Total emission limit value:

Total emission limit value = 25 g C per pair complete footwear

1. Step: Determination of total emissions by solvent mass balance

Total Emission E = Fugitive Emission F + Emission in waste gas (captured) O1 = I1 – O5 – O6 - O7 – O8

Note:

Fugitive Emission F = I1 – O1 (emissions of captured waste gases) – O5 (solvent destroyed by waste gas cleaning) – O6 (solvent in waste) – O7 (organic solvent in sold products) – O8 (solvents for reuse but not counted as input)
3. Step: Comparison of determined total emissions with emission limit value:

Here in footwear manufacture: Generally no waste gas abatement technique used

-> O5 = 0

For simplification:

O7 = 0 (no VOC in sold products anymore)

O8 = 0 (no recycling of solvents at site of installations – Note: solvent recycled external has to be considered as O6 (waste)

Total emission = I1 – O6

Calculation of emission factor referring to pairs of shoes = (I1 – O6)/(total produced pair of shoes in time period)
Compliance to requirements of Annex IIA No 14 VOC Directive (Annex VII Part 2 No. 17 IE4 Directive) is given:

Determined total emission per complete pair of shoes ≤ total emission limit value of 25 g per pair shoes

Example:
Estimated total VOC total emissions per complete pair of shoes:
1 125 000 g VOC/40 000 pairs of shoes = 28 g per pairs of complete shoes

Compliance to EU VOC Directive would not be given – a more detailed analysis would be required!

Note:
This is only an estimation – for a detailed analysis all VOC weight contents over all VOC solvent containing agents used in manufacturing of shoes must be considered
BAT - Possibilities for emission reduction:

• Use of solvent free adhesives e.g.
  Cementation of sole and insole with hot melts or PUR dispersions

• Use of adhesive free soling techniques e.g. injection moulding, sewing techniques

• Reduce quantities of adhesives and cleaning agents (e.g. reduction of material consumption by use of automatic processes)

• Process changes can avoid the need for adhesives (e.g. injection moulding techniques)
  E.g. pre-treatment of phylon by UV/ozone technique makes the use of VOC free primer and adhesives for bonding possible

• In case of heavy duty footwear: Installation of end-of pipe techniques like thermal oxidiser with heat recovery, biofiltration

  Generally thanks to improved surface preparation and modern chemical technologies solvent-free adhesives can now be reliably used throughout all traditional footwear production processes.
If compliance with the Emission Limit value of 25 g VOC/pair of shoes is not given -

Possible measures:

• Use of water-based glues
• Use of high solid glues
• Use of water-based cleaners

Recommendation STE:

Contact supplier to develop a strategy for compliance with emission limit value of 25 g VOC/pair of shoes!

There are materials with less VOC content available!
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