Application of the TFTEI Cost Methodology
Newest developments
ERICCa – TFTEI Emissions Control Cost Assessment Tools

TFTEI technical secretariat
Nadine Allemand (CITEPA), Simon Gloeser-Chahoud (KIT)

Workshop to Promote the Ratification of Technical Protocols of the UNECE Air Convention with Focus on Countries in the EECCA Region
14 to 16 May 2019, Berlin, Germany

Agenda

- Estimation of costs of VOC reduction techniques for:
  - The car manufacturing industry
  - The packaging printing industry
- ERICCa_VOC
- Current tasks
  - Cement industry
  - Aluminium industry

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Size of the plant considered

Plants	Solvent Consumption > 200t/a

A reference paint shop line with high production capacity and medium sized body to be coated.

Installation:

Type of vehicle: passenger car (M1-vehicle)

Body size: electrophoretic coating area: 97 m² per unit

Production capacity: 60 jobs per hour (jph), and 200 000 units per year

Pollutant considered: VOC

VOC emission: g/m²

The coating process of passenger cars

Plants

Solvent Consumption > 200t/a

The different coating steps are as follows (in brackets: common abbreviations):

1. [PT] Pretreatment (cleaning and corrosion protection)
2. [EC] Electrophoretic coating (E-coat (corrosion protection)
3. [SD] Sealing and damping
4. [PR] Primer (smoothing, spreading, stone chip protection, UV protection)
5. [BC] Base coat (colour, colour effects, appearance)
6. [CC] Clear coat (shine, appearance, scratch and chemical resistance)
8. [RE] Finish and paint reworking
7. [CP] Cavity preservation (corrosion protection)

Plants considered for coating of passenger cars

Plants — Solvent Consumption > 200t/a

5 families of paint shops studied :

- ✓ SB: entirely solvent-based coating,
- ✓ WB: water-based coats in primer and base coat stage (CC always solvent based)
- ✓ SB-MIX: either primer or base coats are solvent based ,
- ✓ Integrated process (IP): primerless paint shop

	1 ***SB***	**2A** ***SB-MIX***	**2B** ***SB-MIX***	**3** ***WB***	**4** ***Integrated process***
Primer	SB	WB	SB	WB	-
Base coat	SB	SB	WB	WB	WB
Clear coat	SB	SB	SB	SB	SB

VOC emission reduction techniques

Technologies

Different combinations of primary and secondary options to reduce VOC emissions considered:

1. Primary measures corresponding to the reduction of VOC emissions at the source (reduction of solvent consumption, improved collection of solvent and transfer efficiencies),
2. Secondary measures to treat waste gases containing VOC (end of pipe techniques),
3. Change for a new paint shop (which allows to employ water based paint systems and advanced paint application and waste gas treatment techniques).

Cross media effects detailed as well

Coating of passenger cars – costs

Output data

- **Cost efficiency**

From annual costs and reductions of VOC emissions associated with the reduction measure (primary or secondary), cost efficiency ratio calculated from the following formula:

Cost efficiency ratio (€/g/m2) = annual cost (€)/annual reduction of VOC emissions (g/m2)

- The cost efficiency also expressed in €/car body and €/t VOV non emitted

Costs of VOC emission reduction

Costs

Costs estimated for many combination including new paint shops with cost efficiency analysis. Exemple of results:

	Cost effectiveness (€/t VOC avoided)
100% automation of application of primer, base coat, clear coat	38 634 [11 590 – 67 435]
Optimisation of colour change technology (base coat)	9 272 [2 529 – 86 100]
Innovative application technology (e.g bell-bell)	5 216 [3 245 - 7 727]
100% Automation of interior coating, with rotational bell atomisation and low los colour changers (base coat, clear coat)	27 947 [6 226 – 145 814]
Replacement of pneumatic guns application with robots by electrostatic bells (base coat)	14 234

Coating of passenger cars

Report

http://tftei.citepa.org/images/files/costs_reduction_techniques_large_users_solvents/TFTEI-VOC-car-industry-final.pdf

Report largely used as reference and sources of data to complement the chapter on car manufacturing in the draft BREF STS (issued by EU JRC IPTS)

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Packaging Printing Sector - Specifics

Plants	Solvent Consumption > 200t/a
Technologies	Printing: *Flexography, Rotogravure* Laminating Coating (Cleaning Agents)
Primary Measures	**Substitution:** Water-based inks, UV curing inks, solvent-based inks with lower solvent content **Better capture rate and management of solvents**
Secondary Measures	**Oxidation:** Recuperative (with or without catalyst) Regenerative **Adsorption and Solvent Recovery**
Report	Report finalized with hardly any industry collaboration, focus of KIT on development of ERICCa_VOC

Packaging Printing Sector - Specifics

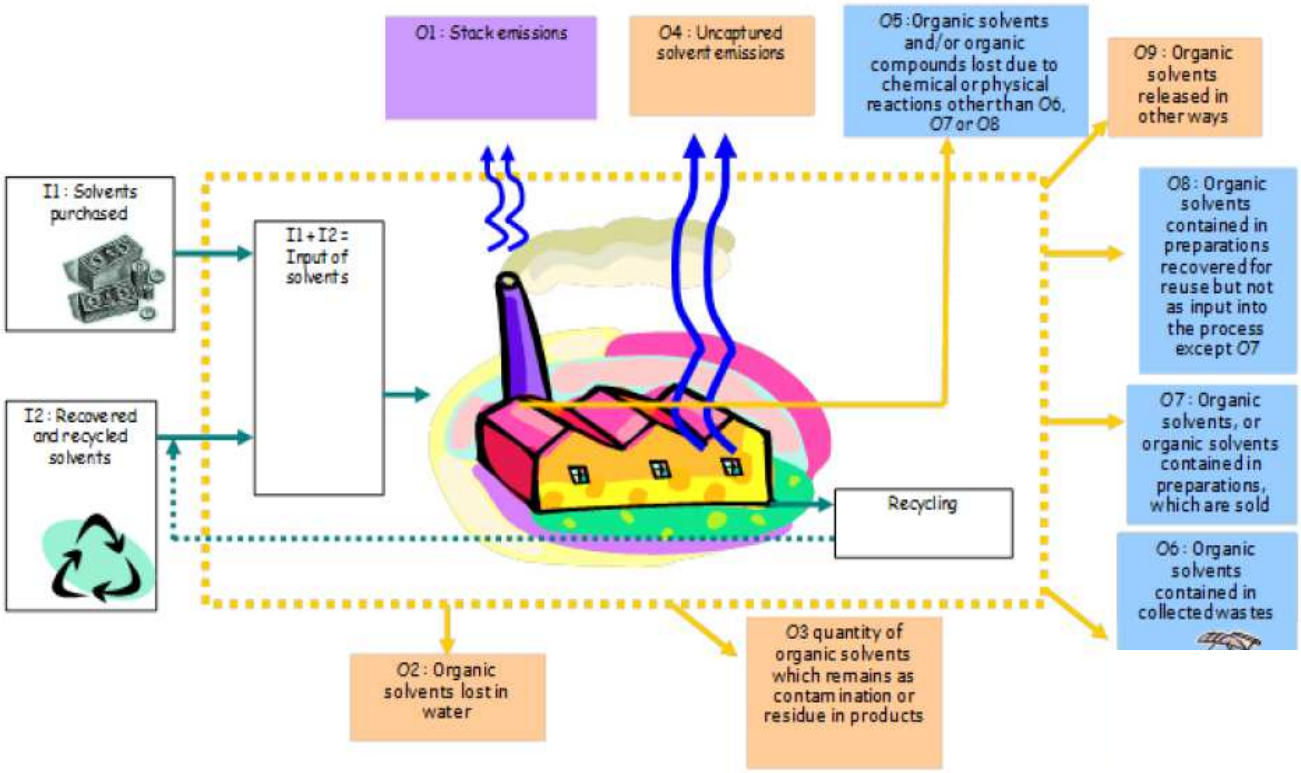
Flue Gas

Typical VOC concentrations: > 1g/m³
=> **Usually no preconcentration necessary**

Solvent Management Plan

Important flows:

- **I1**
- **(I2)**
- **O1**
- **O4**
- **O6**
- **O8**



Packaging Printing Sector - Specifics

Reduction techniques

- The technical feasibility of recycling solvents is influenced by the number of solvents in use
- The installed equipment is also influencing the usage of solvents (in case of solvent recovery installation, single-solvent is favored whenever possible)
- Oxidation process are largely used for emission reduction

Cross-Media Effects

- Oxidators may cause other emissions (NO_X, CO_2, etc.)
- The use of water-based or low-solvent inks may negatively influence the operating conditions of secondary measures
- Water-based inks can cause ground water emissions

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ERICCa_VOC
Summary, Outlook and Open Tasks

Implementation of ERICCa_VOC

- Implementation completed with comments from TFTEI technical secretariat and industry
- MS-Excel tool without VBA support
  ⇒ Ensures compatibility
  ⇒ Facilitates future adaptations
- Tool can be downloaded from the website: http://tftei.citepa.org/en/work-in-progress/costs-of-reduction-techniques-for-large-users-of-solvents

Functions

- Cost calculation for primary and secondary VOC abatement measures (2°: oxidation and adsorption)
- Integrated contemplation or individual calculation of measures (e.g. only oxidation) possible
- Consideration of the solvent management plan is possible

Documentation

- Technical document

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Cement production

Request	• Update the TFTEI reports made in 2003 and in 2011 for the revision of the Gothenburg Protocol
Techniques considered	⇒ Primary mesures ⇒ Sedondary : Selective Non Catalytic Reduction (SNCR) and selective Catalystic Reuction (SCR)
Pollutants	• SO_2 • Dust • NO_X • HM • Dioxines
Costs	• Cooperation with industry to collect investments for SNCR and SCR (CEMBUREAU)
Organization	• The work on cement is executed by CITEPA (Nadine Allemand and Etienne Feutren)

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Report on Emissions of the Aluminium Industry

Request

- Provide a sector specific document with techno-economic information on the abatement of emissions to air from the aluminium industry

Industry overview

- Primary and secondary production
  - ⇒ Focus on primary
  - ⇒ Emissions of secondary production depend primarily on the fuel in use for smelting
- Processes:
  - Alumina production
  - Anodes production
  - Aluminium production

Pollutants

- **SO_2**
- **PAHs** (polycyclic aromatic hydrocarbons)
- **Fluorides**
- **Dust**
- NO_X
- HM

Report on Emissions of the Aluminium Industry

Activities

- Meeting with representatives of Eurometaux and European Aluminium
- Literature survey

First insights

- BREF is a vast and up-to-date body of knowledge
- Report focus on summarizing/editing the most important BREF information, complemented with other references and information

Organization

- The work on Aluminium is executed by KIT-DFIU (Simon Chahoud)

Thank you very much for your attention! Questions?

TFTEI Technical Secretariat

CITEPA

Karlsruher Institut für Technologie