BUS COATING

SYNOPSIS SHEET

Prepared in the framework of EGTEI

1. Activity description and EGTEI contribution - summary

This sector covers the coating of busses as part of production and assembly. This activity emits VOC originating from the spray booths, the drying ovens and the application equipment's cleaning steps.

No information on VOC emissions is available at a European level.

The coating of busses **is addressed by the European Directive 1999/13/EC** (SED) [1] related to the reduction of NMVOC emissions from the use of solvents in some industrial activities. In order to be able to better represent the impact of this Directive in term of emission reduction and costs, **this sector has been considered as an individual activity by EGTEI [2]**. The background document was carried out in close cooperation with the European Automobile Manufacturer Association (ACEA) [3] which has delivered specific data for this sector to EGTEI.

In the previous RAINS version [4], the coating of busses was not studied as a separate sector. It was considered together with the coating of cars, trucks and truck cabins. Presently, the new RAINS version [5] does not take into account updated EGTEI data. These sectors are very little in terms of VOC emissions and usually already well equipped. Thus, the coating of all vehicles is still considered together.

In EGTEI, the representative unit used is the number of vehicles coated annually (busses/year). Only one reference installation (RI) has been defined with ACEA to simplify the work of national experts.

Aggregated measures defined correspond to the substitution of coatings consumed and to the use of thermal oxidiser. Measures 01 and 02 allow large installations respecting the SED requirements.

EGTEI provides default emission factors (EF) with abatement efficiencies, investments, variable and fixed operating costs (OC) as well as additional unit costs (€/t NMVOC abated and €/activity unit) for the three abatement measures defined.

Unit costs vary from 13.5 to 23.5 k€/t of VOC abated (or 950 to 2,100 €/bus). National experts have only to provide the activity level trend from 2000 to 2020 as well as the application and applicability rates of each abatement technique.

This sector has not been specifically introduced in RAINS but the completion of ECODAT will facilitate the bilateral discussions to describe how this sector has to be effectively taken into account with the manufacture of cars with CIAM.

2. European regulation

As mentioned above, the European Directive 99/13/EC [1] applies to this sector (annex IIA, part II).

The Directive applies to installations with a solvent consumption above 15 t per year. Emission limit values defined in the Directive are presented in table 2.1. All obligations are not described in this chapter.

Table 2.1: Emission limit values

Activity (type of vehicle)	Production threshold [number of vehicles]	Total emission limit values	
	Annual production	New installations	Existing installations
Bus coating	> 2,000	150 g / m^2	225 g / m^2
	≤ 2,000	210 g / m^2	290 g / m^2

The compliance date for existing installations is 2007. Following the transcription of the directive in Member States, this date can be different from country to country. For example, in France, the compliance date is October 30th, 2005.

3. Methodology developed within EGTEI to represent the sector

3.1 Definition of the reference installation

Only one installation has been defined according to the number of buses produced.

Table 3.1.1: Reference installation

Reference Installation Code RIC	Description	Technical characteristics
01	Medium Installation: output: > 2,000 units / year	Solvent input: 290.4 t/y Average surface per vehicle: 380 m²

The activity is defined as the number of buses produced per year. As there is only one reference installation, it is relatively simple to find data in every country.

3.2 Definition of emission abatement techniques

No distinction is made between primary and secondary measure. Measures are defined as a mix of techniques enabling to reach the Directive requirements [1] and to go further.

Measure 00 represents the reference case: only conventional solvent-based products are used.

Measure 01: this intermediate measure corresponds to the use of water-based primer and high solid enamel.

Measure 02: this final measure corresponds to the use of waterborne enamel. As this is in most cases hard to modify an existing installation in order to adopt water-based enamel (basically for lack of space), the unique alternative is to build a new installation in a new building.

Table 3.2.1: Definition of aggregated measures

Measure code MC	Description of the measure
00	80 % two layer – 20 % one layer • Solvent-based products
01	80 % two layer – 20 % one layer • MC 00 + water-based primer and high solid enamel • Improvement of the cleaning stages • Improved solvent recovery / solvent consumption reduction • Incineration on electrophoresis oven, primer and enamel
02	80 % two layer – 20 % one layer • MC 01 + water-based enamel • Improvement of the cleaning stages • Improved solvent recovery / solvent consumption reduction • Incineration on electrophoresis oven, primer and enamel

4. Country specific data to be collected

Very few country specific data have to be collected to represent this sector. Costs have been developed at a European level on field observations. So no economic parameter is necessary.

Information concerning activity levels from 2000 to 2020 as well as the description of the control strategy is required (these data can be directly entered in the database ECODAT). A full definition of the work to be done by national experts is provided in the general EGTEI methodology [6].

The national expert can also modify the default unabated emission factor proposed by EGTEI to represent the reference situation of the coating of bus for all Parties in a range of ± 10%. If the modification is higher than 10%, then appropriate explanations have to be provided.

Table 4.1: Unabated emission factor [kg of VOC / bus coated]

Default emission factor	User specific emission factor
145.2	To be completed by national expert

5. Default emission factors and cost data defined with the EGTEI methodology

Table 5.1 gives an overview of all data provided by EGTEI: default emission factors (EF) with abatement efficiencies, variable operating costs (OC) as well as additional unit costs per t NMVOC abated and per unit of activity.

Table 5.1: Default emission factors (EF), abatement efficiencies and costs for each combination

RIC MC	NMVOC EF [kg NMVOC/ vehicle]	Abatement efficiency [%]	Investment [k€]	Variable Operating Costs [k€ / year]	Fixed Operating Costs [k€ / year]	Unit cost [€/t NMVOC abated]	Unit cost [€/ vehicle]
01 00	145.2	0.0	0	0	0	-	0
01 01	74.9	48.4	12,000	530	240	13,559	953
01 02	55.1	62.0	40,000	830	240	23,474	2,115

Costs incurred by the use of waterborne enamel are much higher because usually, a new installation has to be built because of a lack of space.

Investments correspond to the cost of new application lines, booths and the use of secondary measures when it is appropriate. Variable operating costs are derived from the use of alternative coatings and secondary measures as defined in table 3.2.1. Fixed operating costs are only taken into account for secondary measures and represent 5% of thermal oxidation investments (for maintenance and insurance). As no economic data are available, it is assumed that fixed operating costs are the same for all primary measures.

Additional unit costs are obtained by dividing the additional annual cost of the measure considered by the amount of VOC abated (compared to the reference case MC 00).

6. Relevance of EGTEI information for Integrated Assessment Modelling (IAM)

In the previous RAINS version [4], the coating of busses was considered with the coating of cars. According to ACEA, techniques used in the manufacture of cars are not suitable for the coating of busses. That is why this sector has been treated separately within EGTEI.

EGTEI provides now an approach to consider this sector and to test the impact of the current legislation.

Data provided in the EGTEI approach (emission factors and costs) have not been implemented in the new version of the RAINS model [5] for the modelling work because VOC emissions are very little and already well treated. This sector will still be considered together with the manufacture of cars, trucks and truck cabins. The unabated emission factor is country specific and has to be defined by the national expert (it depends on the shares of the different types of vehicles coated). Abatement techniques and costs are defined according to the EGTEI document concerning the manufacture of cars [7].

It is still interesting for national experts to do this exercise for this sector so they can define their country specific unabated emission factor for the manufacture of all types of vehicles and they can also estimate more precisely their VOC emissions from 2000 to 2020.

7. Perspective for the future

In the future, any new technology which could be developed should be considered by EGTEI in the background document to continuously improve the representation of the sector.

8. Bibliography

[1] Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.
[2] EGTEI background document. http://www.citepa.org/forums/egtei/buses_coating_150703.pdf
[3] Automobile Manufacturers Association (ACEA). http://www.acea.be/ASB/ASBv1_1.nsf
[4] KLIMONT; M. AMANN; J. COFALA. Estimating costs for Controlling Emissions of Volatile Organic Compounds (VOC) from Stationary Sources in Europe. Interim Report IR-00-51. IIASA. August 1. 2000. http://www.iiasa.ac.at/~rains/voc_review/voc_ir-00-51.pdf
[5] Review of data used in RAINS-VOC model
http://www.iiasa.ac.at/web-apps/tap/RainsWeb/
[6] EGTEI methodology http://citepa.org/forums/egtei/egtei_index.htm
[7] EGTEI background document.
http://citepa.org/forums/egtei/car_coating_300603%2Bcorrection_021203.pdf
[8] CITEPA: National reference centre for emission inventories
[9] Rapport d'inventaire national au format UNECE/NFR et NEC
Rapport d'étude du CITEPA - Décembre 2003

ANNEXE: Example of data collection and use of EGTEI data – Case of France

A. Country specific data collection and scenario CLE developed

The French national expert has been able to complete ECODAT for the production of busses with the help of CITEPA [8].

All collected data have been provided to CIAM for the bilateral consultation France – CIAM in March 2004. As mentioned before, this sector is not considered separately in RAINS. This exercise will help estimating VOC emissions from the aggregated sector corresponding to the coating of vehicles.

Activity level

Activity level in 2000 is derived from the annual industrial reports. Very few installations exist in France so this treatment is easily done. The activity forecast from 2000 to 2020 comes from data provided by the French national expert. It is based on the production trend (in volume) from 1995 to 2001 available in the French statistics. This corresponds to an annual increase of 1.97% of the production from 2000 to 2020.

Table A.1: Activity levels from 2000 to 2020 (bus / year)

RIC	2000	2005	2010	2015	2020
01	3,141	3,463	3,818	4,209	4,640

Current legislation control scenario (CLE)

In the current legislation control scenario (CLE), the application rates of the different abatement techniques depend on the regulation implemented and on the dates of compliance.

In 2000, the activity share is estimated so that VOC emissions calculated with EGTEI emission factors are consistent with VOC emissions derived from the annual industrial reports in the scope of the French emission inventory (carried out for the French ministry of Ecology) [9].

For the years 2005 to 2020, it is assumed that installations will comply with the Directive requirements by implementing the measure MC 01.

The application rates and applicability factors for the CLE scenario are presented in table A.2.

Table A.2: Definition of the CLE scenario

RIC MC	Application rate in 2000 [%]	Application rate in 2005 [%]	Appl. [%]	Application rate in 2010 [%]	Appl. [%]	Application rate in 2015 [%]	Appl. [%]	Application rate in 2020 [%]	Appl. [%]
01 00	67	0	100	0	100	0	100	0	100
01 01	33	100	100	100	100	100	100	100	100
01 02	0	0	100	0	100	0	100	0	100
Total RIC 01	**100**	**100**		**100**		**100**		**100**	

B. Trends in emissions and total costs of the CLE scenario

Data shown in the table below are directly provided by ECODAT and based on input parameters defined in chapter A.

Table B.1 presents NMVOC emissions from 2000 to 2020 and total annual costs of emissions reduction for the CLE scenario.

Table B.1: Trends in emissions and total annual costs of emission reductions in the CLE scenario

	2000	2005	2010	2015	2020
NMVOC emissions	**t NMVOC**	**t NMVOC**	**t NMVOC**	**t NMVOC**	**t NMVOC**
CLE scenario	383	259	286	315	348
Annual total costs	**k€/year**	**k€/year**	**k€/year**	**k€/year**	**k€/year**
CLE scenario	1,000	3,300	3,600	4,000	4,400

Emissions shown in table B.1 for the year 2000 according to the CLE scenario have been calculated with EGTEI emission factors. They are consistent with VOC emissions deduced from the industrial reports.