

WINDING WIRE COATING

SYNOPSIS SHEET

Prepared in the framework of EGTEI

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1. Activity description and EGTEI contribution - summary

This sector covers the industrial application of paints onto enamelled wires. In the production of enamelled wire, a thin film of polymer is applied to the wire in a number of layers. The polymer is applied from a solution in organic solvents and the solvent content varies according to the wire diameter- round wires from 0.015 - 6.0 mm and rectangular section up to 80 mm². The solvent content of the solution varies from 60 to 80%.

This activity emits VOC. In the enamelling oven, the solvents are evaporated from the wire and the solvent laden air passed over a catalyst (with efficiency between 90 and 97% depending on the age of the enamelling machine) and the energy released from the combustion of the solvents for use in the process. This recovered heat accounts for approximately 50% of the heat used in the process and allows maximum destruction of VOC.

At a EU25 level for the year 2000 (according to the RAINS model: version CP_CLE_Aug04(Nov04)), NMVOC emissions were 5.4 kt representing 0.05% of total NMVOC emissions. Total activity being, 420 kt of winding wire coated, average emission factor is about 12.3 kg NMVOC/t of wire coated meaning that emissions from this sector are already partly treated in EU25 (unabated emission factor being 17 kg/t). These estimations could be modified in a near future due to information delivered by national experts during the bilateral consultation in 2005.

Winding wire coating 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 terms of emission reduction and costs, **this sector has been considered as an individual activity by EGTEI [2]**. In the previous version of the RAINS model [3], the coating of winding wires was not studied as a separate sector. It was considered as part of "Industrial Use of Paints in Other Industrial Use of Paints" (sector gathering both ship building industry, manufacture of plastic and metal articles, wood products industry and other applications of paints). **EGTEI has been able to develop an approach to represent this sector and estimate costs of reduction techniques**. The methodology was developed in close cooperation with the European association of manufacturers of insulated wires and cables (EUROPACABLE) [4]. Presently, RAINS has been modified and integrates EGTEI proposals. **Data provided by EGTEI (emission factors and costs) have been implemented in the new RAINS version [5]** for the modelling work carried out in the scope of the CAFÉ programme and the revision of the Gothenburg Protocol and national emission ceiling Directive.

The representative unit used is the amount of winding wires coated annually (kt/year). Only one reference installation (RI) has been defined with EUROPACABLE to simplify the work of national experts.

Aggregated measures defined correspond to the reduction of solvent content in enamel, the decrease of fugitive emissions and the use of more efficient ovens. The combination of all these techniques leads to the respect of the SED requirements.

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

The use of more efficient ovens leads to cost savings as less electricity is consumed.

National experts have only to collect 1 country specific parameter (electricity cost: EGTEI gives a default figure which can be used if no better national data exist) and to provide the trends in activity level from 2000 to 2020 as well as the application and applicability rates of each abatement technique.

As the representation of this sector in RAINS is based on the EGTEI proposal, it is recommended to national experts to complete ECODAT with country specific parameters which are not known from CIAM.

2. European regulation

As mentioned above, the European Directive 99/13/EC [1] applies to this sector (annex IIA, n°9).

The Directive applies to installations with a solvent consumption above 5 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

Solvent consumption threshold [t / y]	Total emissions limits [g VOC / kg wires] (for installations manufacturing wires with a diameter ≤ 0.1 mm)	Total emission limit values [g VOC / kg wires] For all other installations
> 5 t	10	5

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

The reference installation is defined according to its production of winding wire per year.

Table 3.1.1: Reference installation

Reference Installation Code RIC	Description	Technical characteristics
01	<u>Medium Installation:</u> output: 20,000 t / y (between 5,000 to 35,000 t / y)	<u>Solvent input:</u> 340 t/year

3.2 Definition of emission abatement techniques

3.2.1 Primary measures

In the production of enamelled wire, a film of wax is applied to the surface before it is wound onto a delivery reel. Traditionally the wax is applied from a dilute solution in organic solvent (0.5-2%).

There are now two methods available for applying solid wax to the wire surface. One method uses wax coated string in contact with the surface and the other is by applying a molten wax to the surface of the wire.

The advantage is the elimination of fugitive emissions.

Disadvantages are:

- ü High cost with no pay-back: a typical site has approximately 200 lines,
- ü Some technical problems,
- ü Restrictions: this can not be used on very fine wires.

Table 3.2.1.1: Average share of solvent emissions from wax compared to total emissions

	Description
"Conventional application system"	Use of solvent based wax Solvent from wax as % of total solvent: ~7

3.2.2 Secondary measures

Two different situations are defined:

- ü Ovens from 1990 with an abatement efficiency of 90%,
- ü Modern ovens with an abatement efficiency of 97%. According to [4], all ovens in 2010 will be "modern" ones in EU15 (no information is available at a EU25 level).

3.2.3 Aggregated measures

Measures defined are a mix of primary and secondary ones. They are described below.

Table 3.2.3.1: Aggregated measures

Aggregated measure code (MC)	Description
00	Solvent content in the enamel: 70% Abatement efficiency of the oven [%]: 90
01	Solvent content in the enamel: 62% Reduced emissions from the wax application process Reduced fugitive emissions Abatement efficiency of the oven [%]: 97

4. Country specific data to be collected

Very few data are requested for this sector.

Country specific economical parameters are used to calculate variable operating costs. Only the cost of electricity is required for this activity. A default cost is proposed by EGTEI in table 4.1.

Table 4.1: Country specific costs

Parameter	Default cost provided by EGTEI	Country specific cost
Electricity [€/kWh] (net of taxes)	0.0686	To be provided by national experts

Default cost has been used to calculate variable and unit costs presented in table 5.1.

Information concerning activity level from 2000 to 2020 as well as the description of the control strategy is also necessary (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].

National experts can also modify the default unabated emission factor proposed by EGTEI to represent the reference situation of the winding wire coating for all Parties, in a range of $\pm 10\%$. If the modification is higher than 10%, then appropriate explanations are required.

Table 4.2: Unabated emission factor [g / kg of wire produced]

Default emission factor	User specific emission factor
17	To be provided 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.

Additional investment for a more efficient oven is not considered in this document. When ovens are replaced, the only choice is to buy a more efficient one. The only difference considered concerns the energy savings (1.5 kWh/kg of wire for measure MC00 and 1 kWh/kg of wire for MC01).

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

RIC MC	NMVOC EF [g NMVOC/ kg wire]	Abatement efficiency [%]	Investment [k€]	Variable Operating Costs [k€/ year]	Unit cost [€/t NMVOC abated]	Unit cost [€/t wire]
01 00	17	0.0	0	0	-	0
01 01	4	76.5	0	-638	- 2,638	-34

Additional unit costs are obtained by dividing the additional annual cost of measure MC01 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 [3], winding wire coating was not studied as a separate sector. It was considered as part of "Industrial Use of Paints in Other Industrial Use of Paints" (sector gathering both ship building industry, manufacture of plastic and metal articles, wood products industry and other applications of paints). Thus, emission factors, abatement techniques and costs considered were not specific to this sector and it was very difficult to define a reduction scenario.

EGTEI provides now a specific approach to consider this sector and to test the impact of the current legislation. It is also possible with this methodology to determine the maximum achievable reduction scenario.

Emission factors defined in the EGTEI document [2] are now integrated in RAINS. National experts can easily use ECODAT to provide CIAM with information to prepare the bilateral consultations.

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. More detailed information at a country level is also necessary: in France for example, this sector is considered together with the use of coatings in the general industry as no statistics is available on the activity level. This issue has been discussed with [4] but only aggregated data at a EU15 level have been provided to EGTEI until now.

8. Bibliography

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