Joint Action on Tobacco Control (JATC)

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Work Package 8- Laboratory verification, collaboration and analyses

Laboratory survey report

WP8 D8.2

Prepared by IRFMN

June 2020

Version	Date of creation	Title	Handling
1	03/07/2019	WP8 laboratory survey results _04-07-2019.pptx	Sent out WP8 Partners for consultation
2	11/09/2019	Work Package 8- Laboratory verification, collaboration and analyses Laboratory survey report WP8 Pre D8.2	Sent out WP8 Partners for consultation
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5	6/3/2020	WP8 D8.2 final TC with partners on Recommendations	4/3/2020 Recommendations sent to WP8 Partners

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Table of contents

3. Background

Laboratory measurements are essential for effective application of various provisions of Directive 2014/40/EU of the European Parliament and of the Council of 3 April 2014 (referred as Tobacco Products Directive, TPD, in following text). In particular, according to Article 4, the competent authorities (CA) of all the European Union (EU) Member States (MS) "shall communicate to the European Commission a list of approved laboratories, specifying the criteria used for approval and the methods of monitoring applied, and shall update that list whenever any change is made". The independent laboratories should verify the tar, nicotine and carbon monoxide (TNCO) emission levels of cigarettes (using ISO standards). The TPD requires that these laboratories are independent. Therefore, they "shall not be owned or controlled directly or indirectly by the tobacco industry" and "the verification process should be protected from tobacco industry influence".

In order to map the current status quo of EU MS laboratories performing analyses on tobacco and e-cigarettes, and therefore to better understand the laboratory capacity and requirements, the availability of specific operating procedures or protocols and the independency of laboratories from the tobacco industry, we prepared a structured questionnaire to be filled by various laboratories.

4. Methodology

A simplified questionnaire was designed to collect from various Laboratories in Europe information on the current state-of-the-art of the verification processes, including laboratory information and verification activities.

The specific aim of this survey is to collect information on:

- the presence, activities, capacity, analysis requirements, protocols and independence from the tobacco industry of laboratories within EU;
- protocols for testing the ingredients and emissions of cigarettes and electronic cigarettes.

The survey was conducted through SurveyMonkey platform among laboratories identified by GoToLab contact list and/or EU-CEG. The full questionnaire is reported in Annex I.

A summary table on analysis on cigarettes and e-cigarettes is reported in Annex II and Annex III.

5. Results

We received 28 response records 17 countries. The laboratories that responded are divided into:

- 20 laboratories perform analysis on cigarettes;
- 21 laboratories perform analysis on e-cigarettes, herbal products and novel tobacco products.

5.1 Laboratory specifications

The first specific section of the questionnaire includes 19 questions and contained general questions about the laboratory (year of construction and laboratory surface, staff members, internal verification systems, number of instruments and laboratory independence). The main results of this section have been summarized in the graphs below.

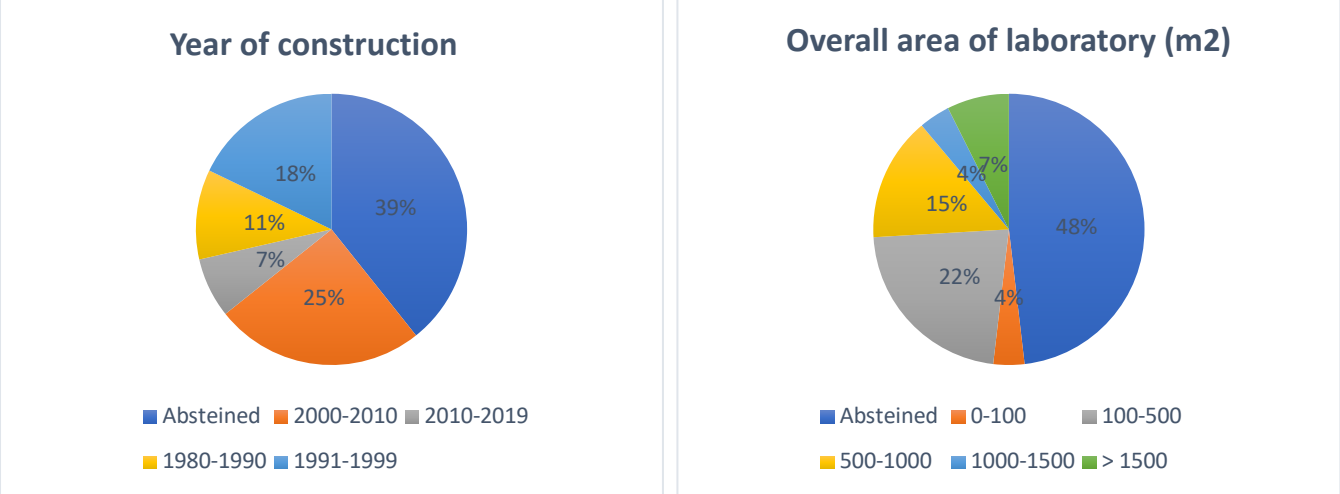


Figure 1 Results, expressed in percentage, to the questions concerning the year of construction / renovation (left) of the laboratory, the overall area dedicated (right)

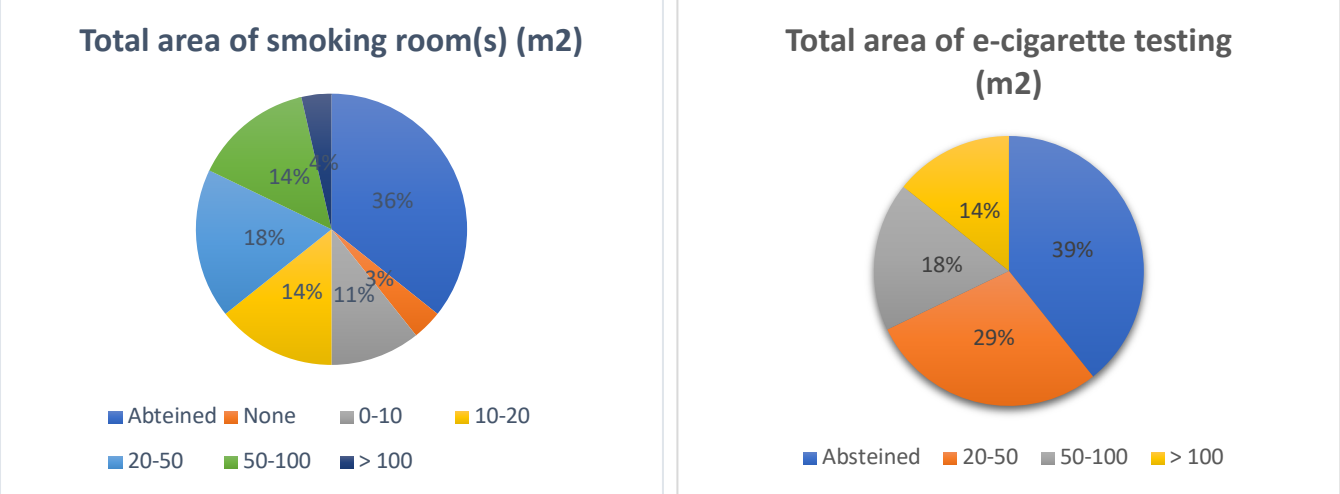


Figure 2 Results, expressed in percentage, to the questions concerning the total area of laboratory dedicated to smoking room(s) (left) and e-cigarette testing (right).

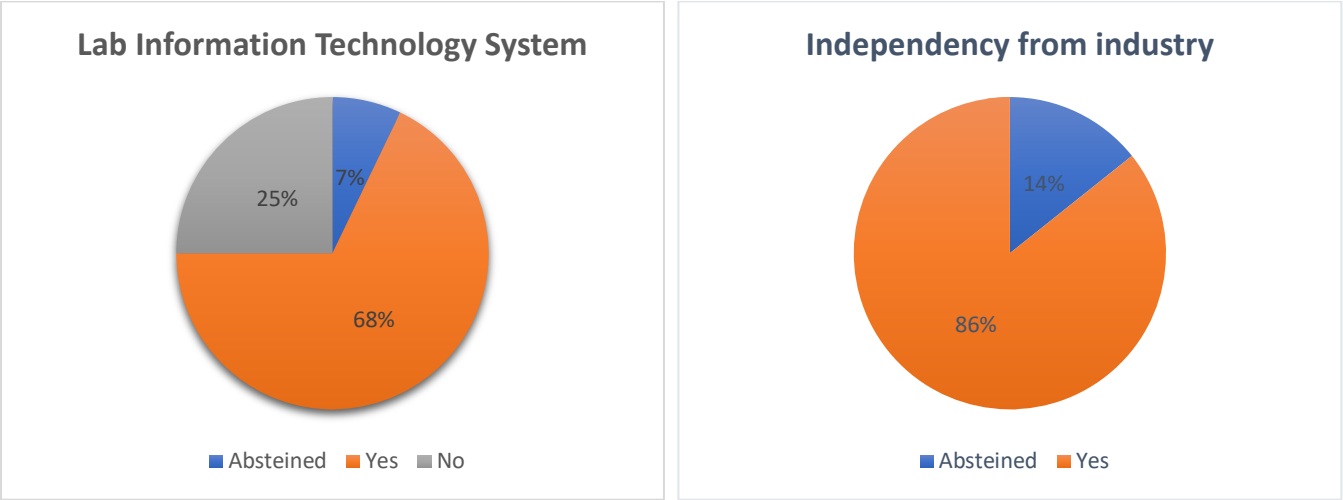


Figure 3 Results, expressed in percentage, to the questions concerning the Laboratory Information Technology System (left) and independency from industry of laboratories (right).

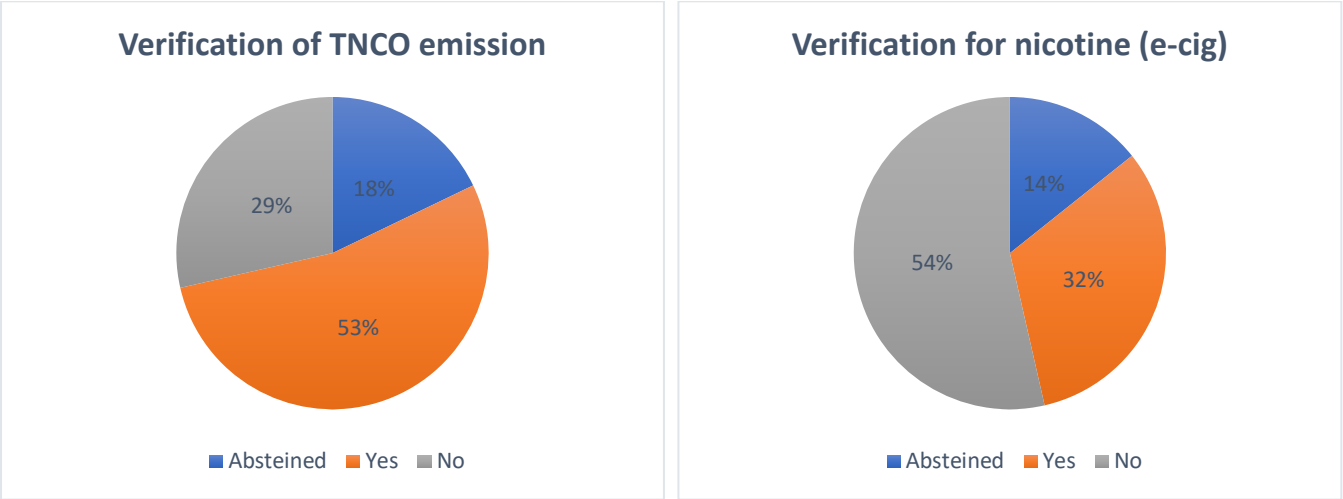


Figure 4 Results, expressed in percentage, to the questions concerning the annually-based verification programs for TNCO in cigarettes (left) and for nicotine in e-cigarettes (right).

Composition of laboratory staff

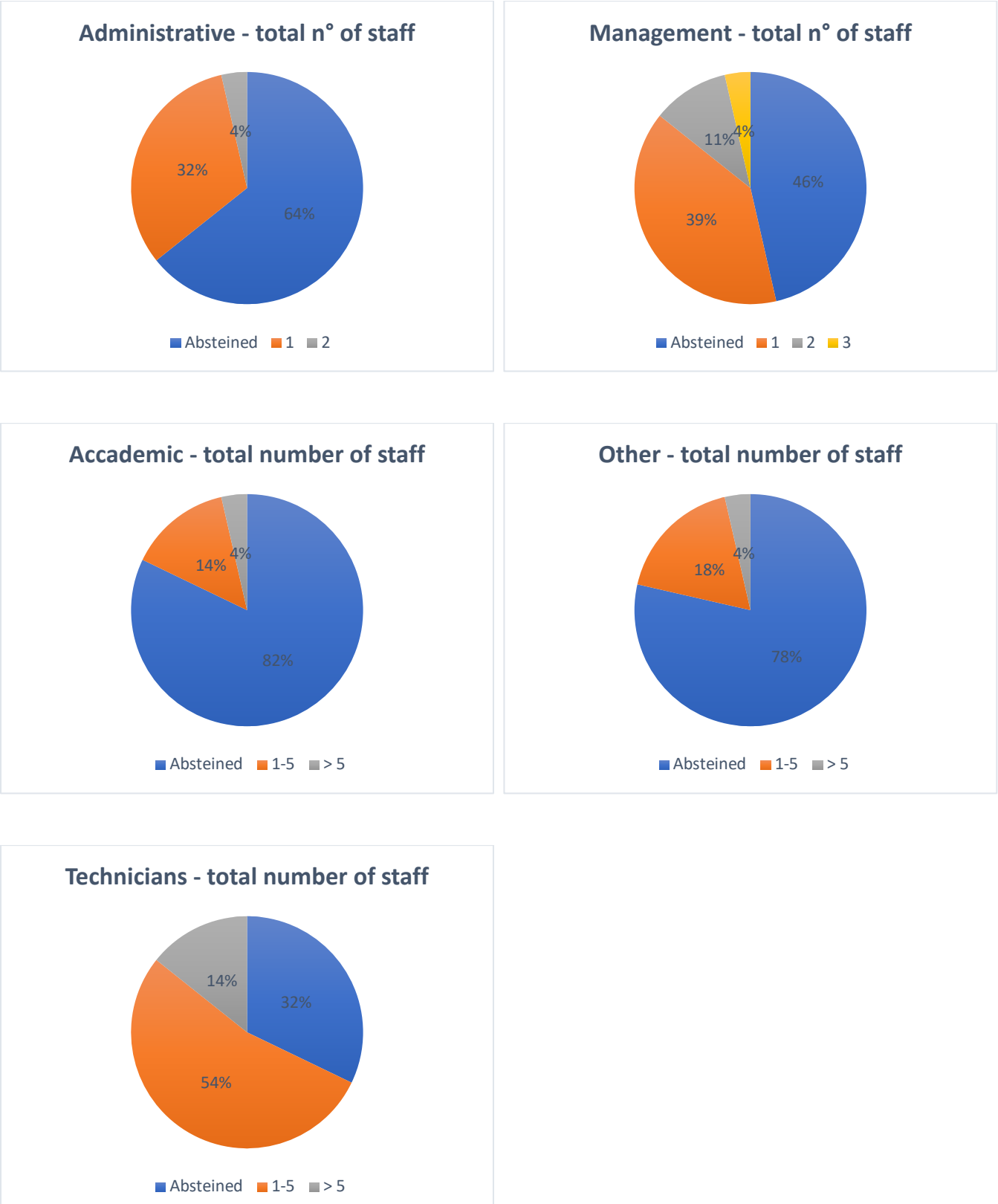


Figure 5 Results, expressed in percentage, to the questions about the composition of laboratory staff divided into different classes of workers: administrative, management, academic, technicians and other.

Number of the smoking / vaping machines used

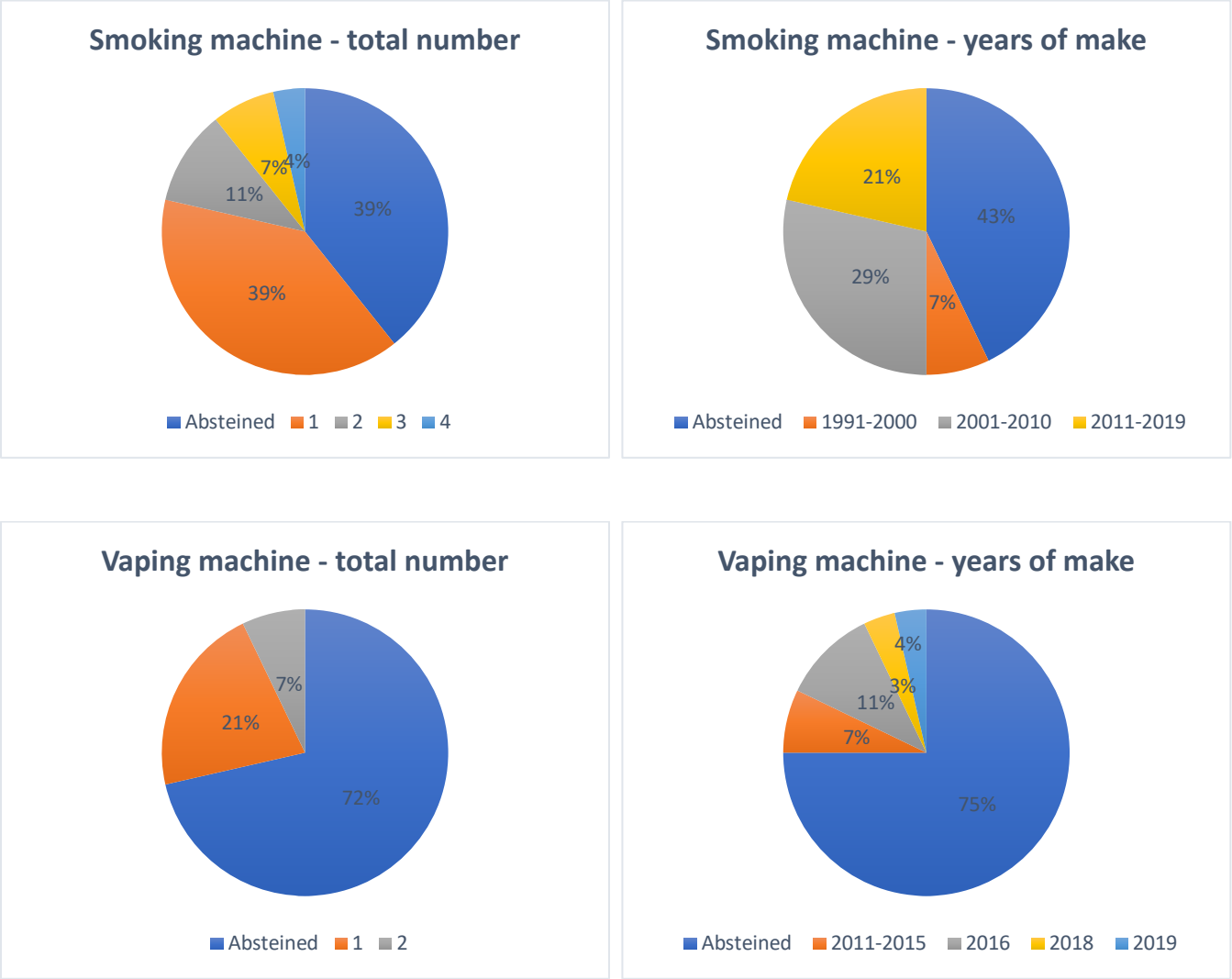


Figure 6 Results, expressed in percentage, to the questions concerning the number of smoking and vaping machine (left part) and the years of make of the smoking and vaping machine (right part)

5.2 Analysis carried out on cigarettes

This section includes 90 questions and focused on the analysis of compounds contained in cigarettes. Each compound examined was subjected to the same questions: methods used, state of the method (validated, accredited or in progress) and number of analyses carried out in one year. The compounds examined for cigarettes include: TNCO, nitrogen oxides, VOCs, tobacco N-nitrosamines, carbonyl compounds, metals, ammonia in tobacco filler, humectants, additives and cigarette ventilation. The answers to the questions are divided by substance analysed and presented showing the position of the laboratories that answered the questionnaire on the map and with the graphical representation of the answers.

5.2.1 TNCO

About this category of analytes, we received responses from 16 laboratories from 14 countries.

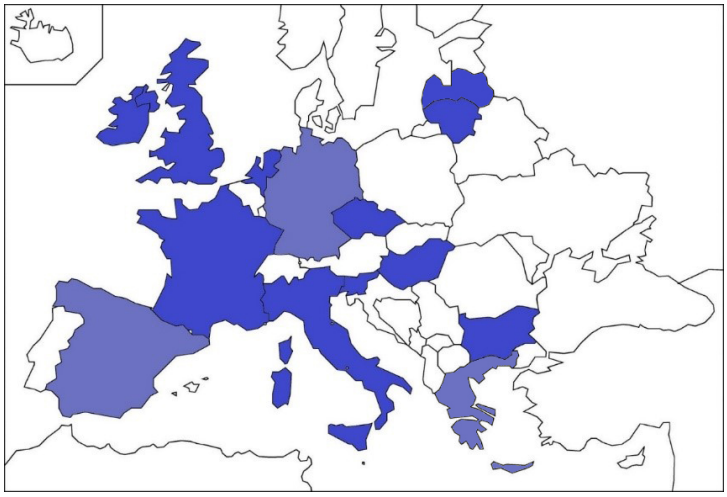


Figure 7 The map represents the distribution of the laboratories that deal with TNCO analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.

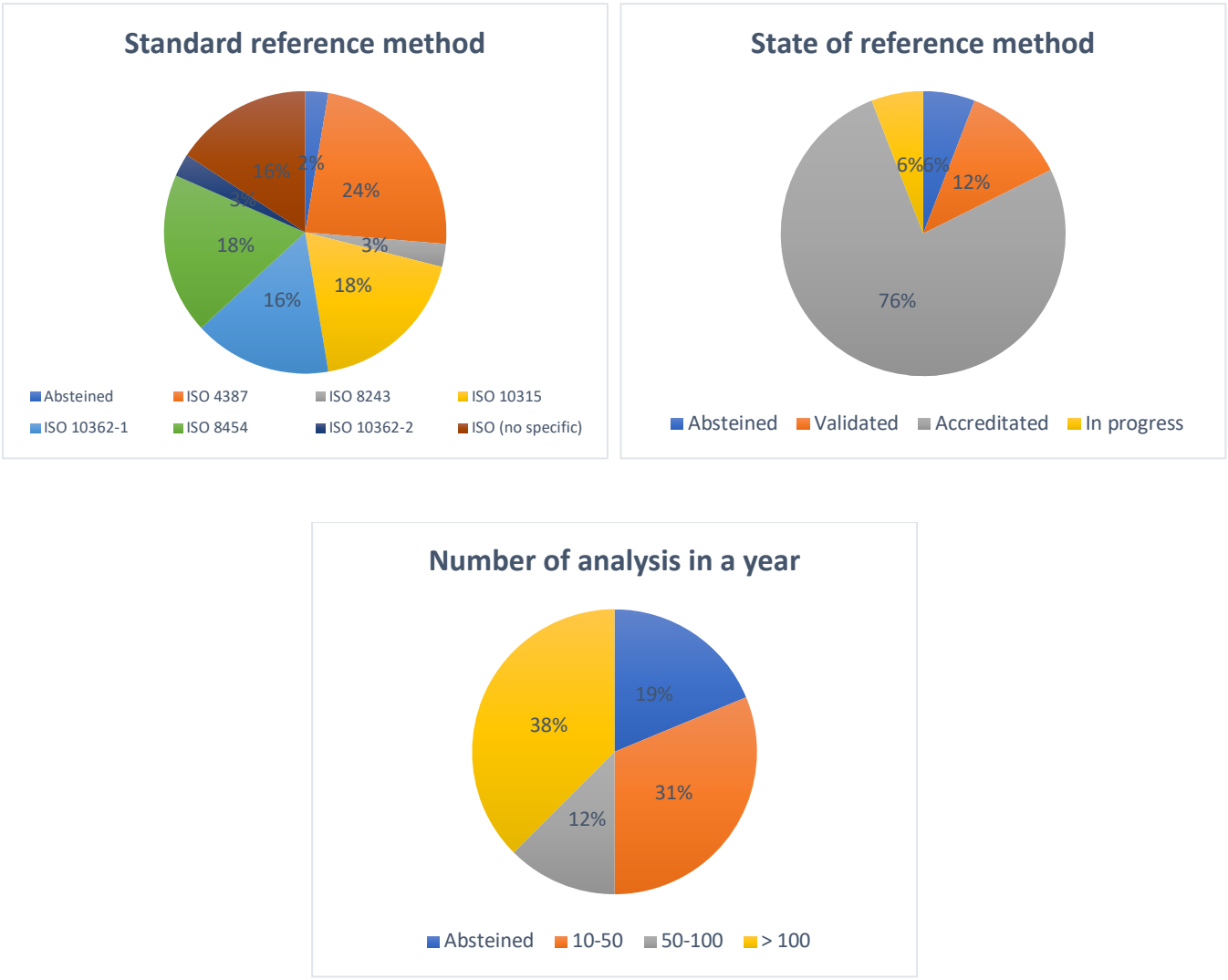


Figure 8 Results, expressed in percentage, of questions about the standard reference method for TNCO, its state of method and the number of analysis done by the laboratories for TNCO.

5.2.2 Nitrogen oxides

About this category of analytes, we received response record from 1 laboratory from 1 country. Only a laboratory with an ISO method (accredited) analyse this class of compounds with 50 analysis in a year.

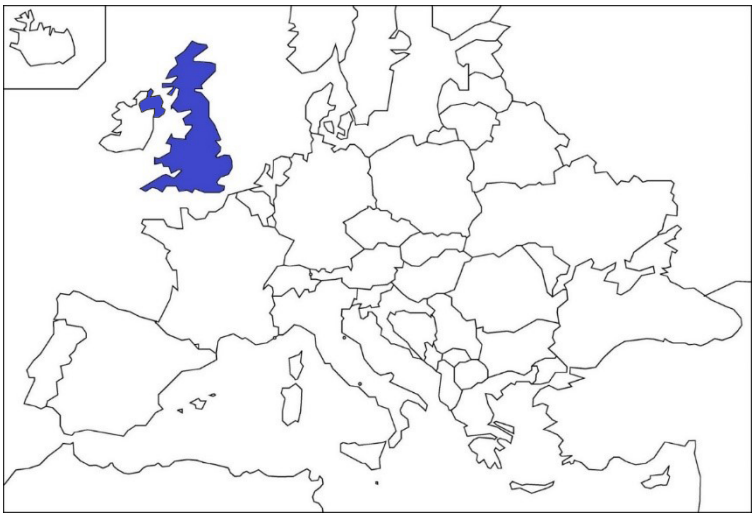


Figure 9 The map represents the distribution of the laboratories that deal with Nitrogen oxides analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.

5.2.3 VOCs

About this category of analytes, we received responses from 4 laboratories from 4 countries.

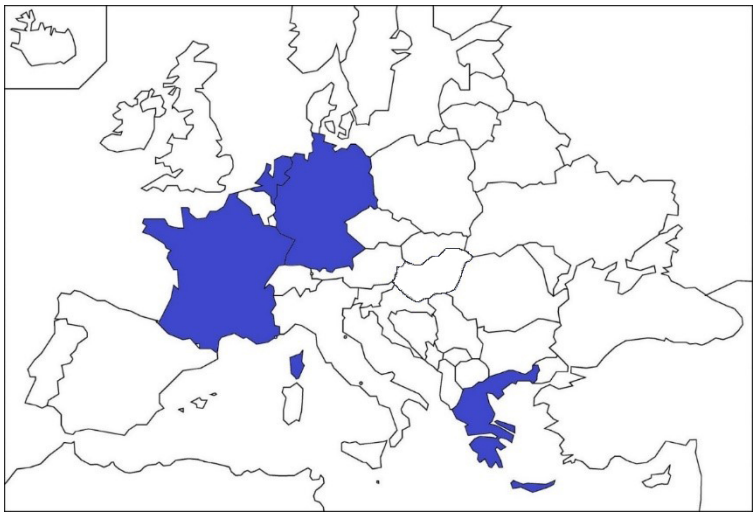


Figure 10 The map represents the distribution of the laboratories that deal with VOCs analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.

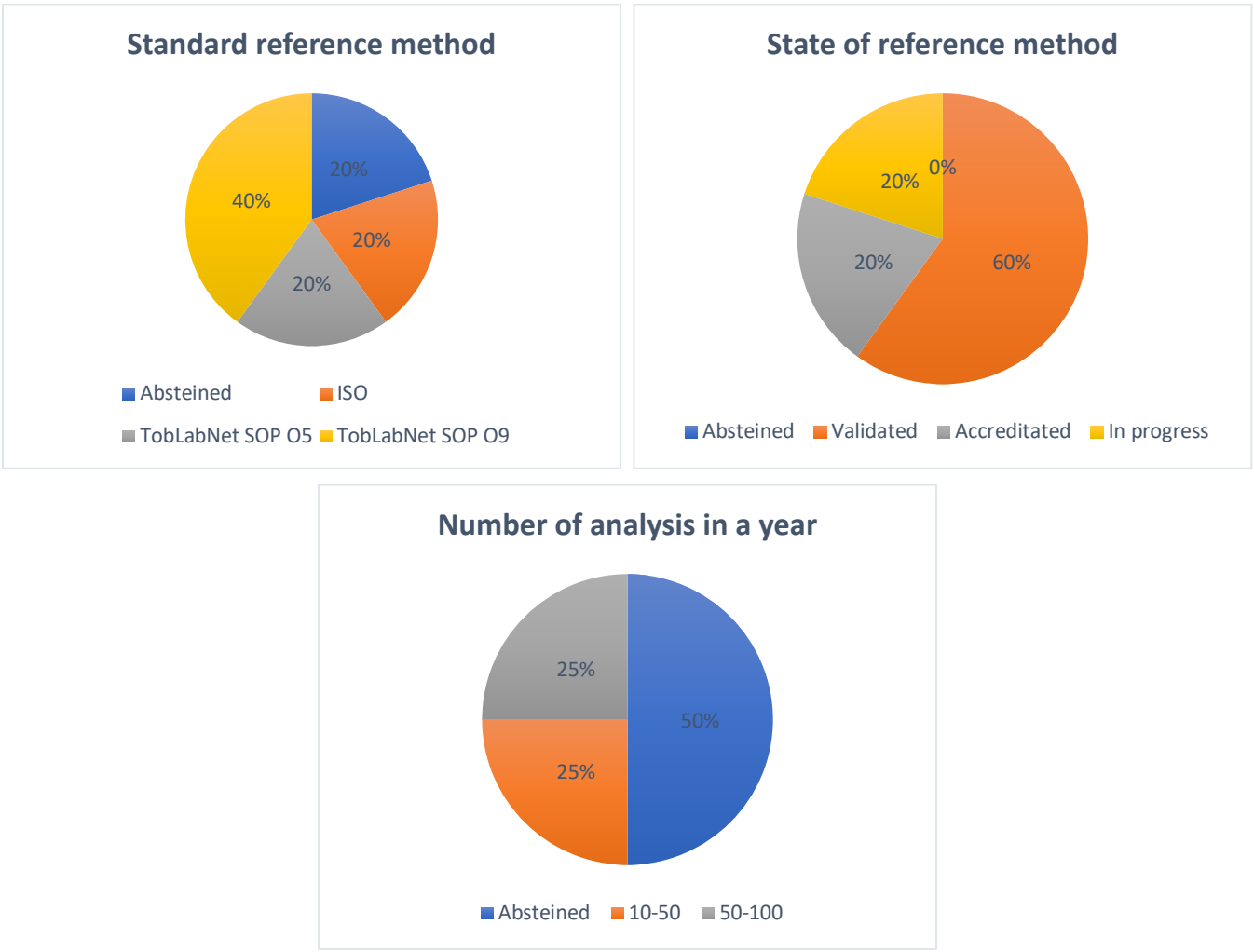


Figure 11 Results, expressed in percentage, of questions about the standard reference method for VOCs, the state of method and the number of analysis done by the laboratories for VOCs.

5.2.4 Tobacco N-nitrosamines

About this category of analytes, we received responses from 4 laboratories from 4 countries.

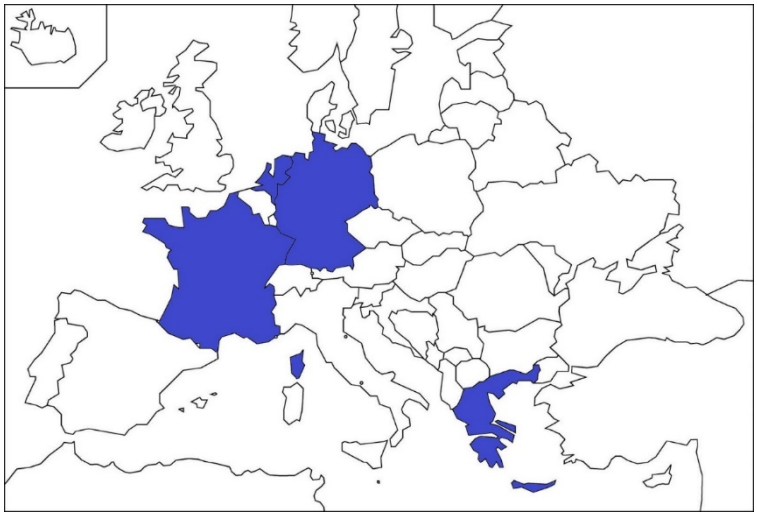
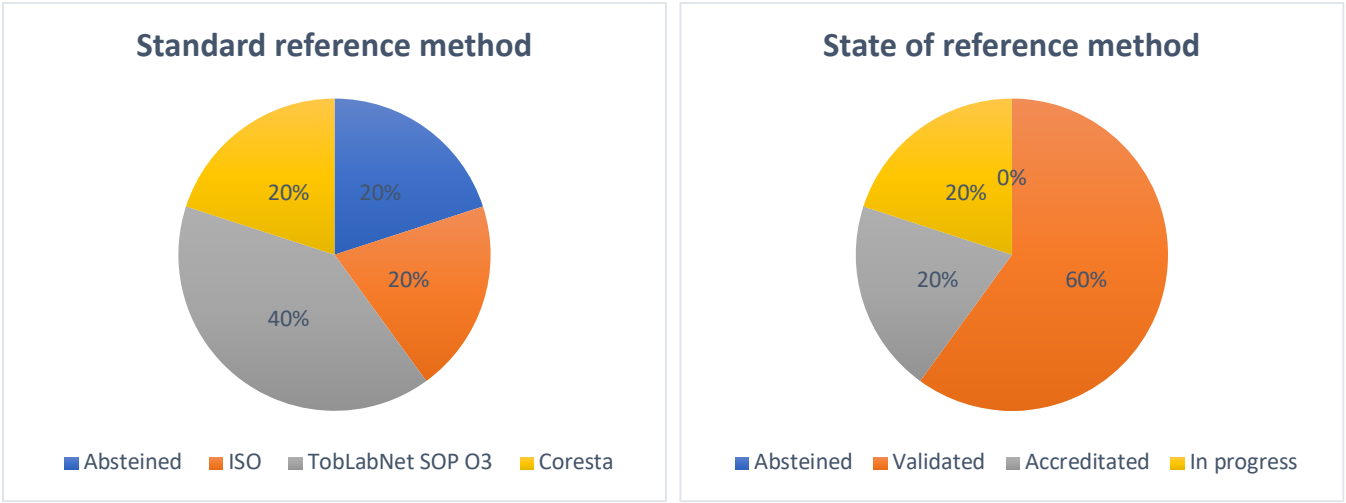


Figure 12 The map represents the distribution of the laboratories that deal with Tobacco N-nitrosamines analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



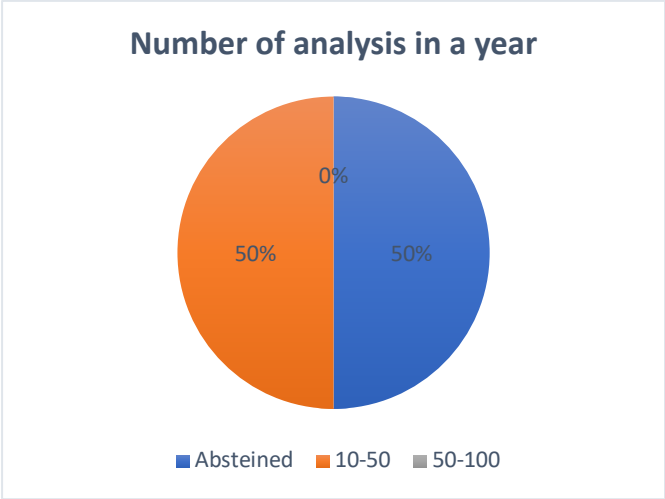


Figure 13 Results, expressed in percentage, of questions about the standard reference method for Tobacco N-nitrosamines, the state of methods and the number of analysis done by the laboratories for Tobacco N-nitrosamines.

5.2.5 Carbonyl compounds

About this category of analytes, we received responses from 6 laboratories from 6 countries.

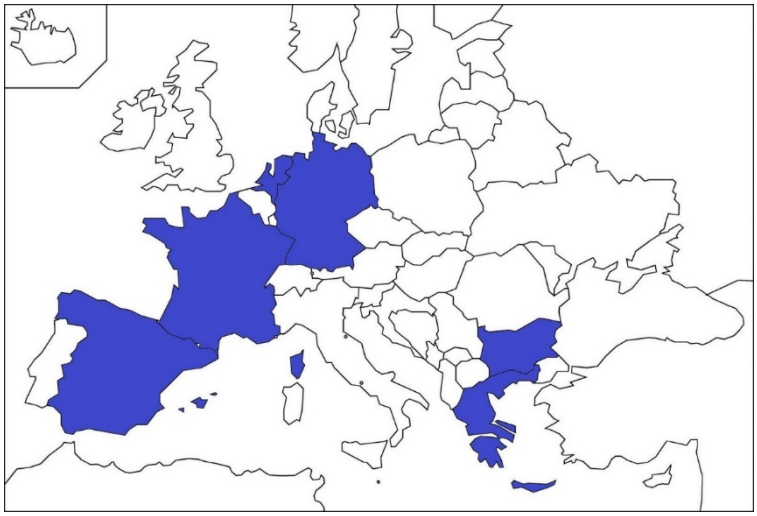
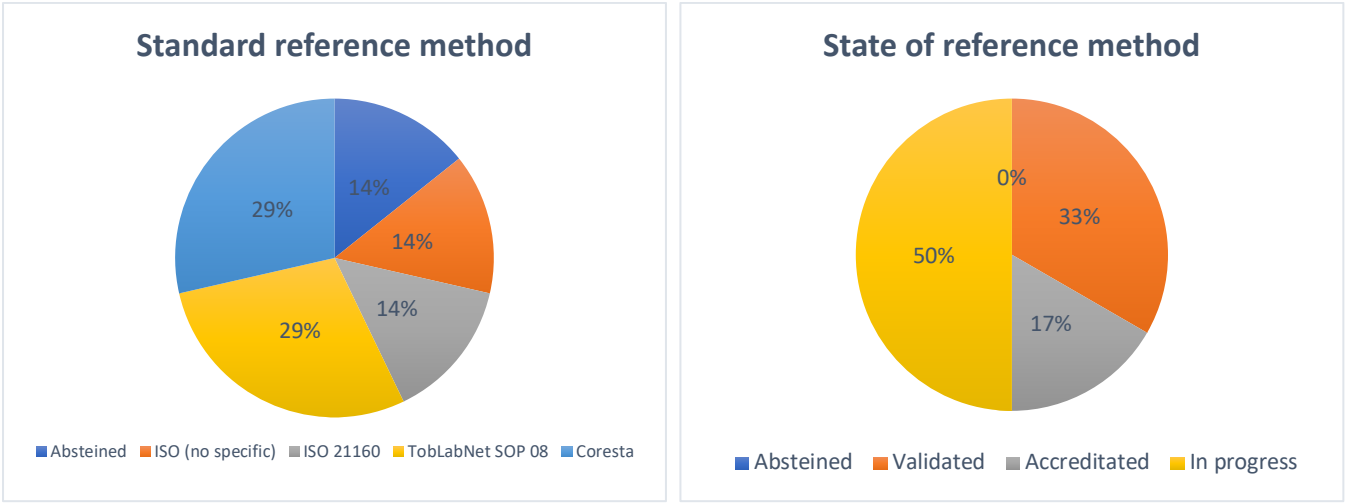


Figure 14 The map represents the distribution of the laboratories that deal with carbonyl compounds analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



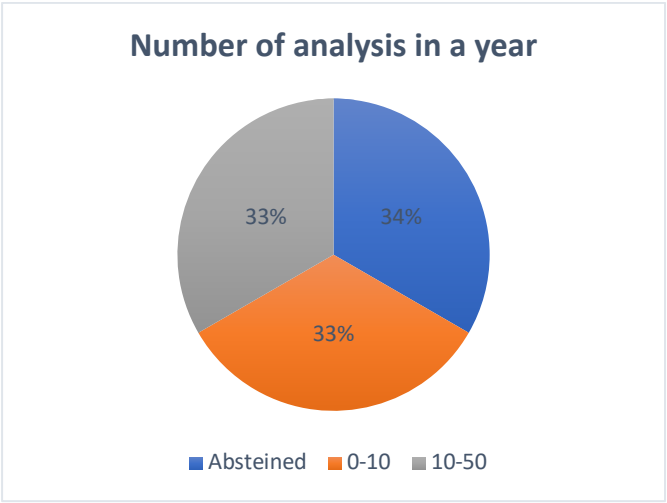


Figure 15 Results, expressed in percentage, of questions about the standard reference method for carbonyl compounds, the state of method and the number of analysis done in a year by the laboratories for carbonyl compounds.

5.2.6 Metals

About this category of analytes, we received responses from 3 laboratories from 3 countries.

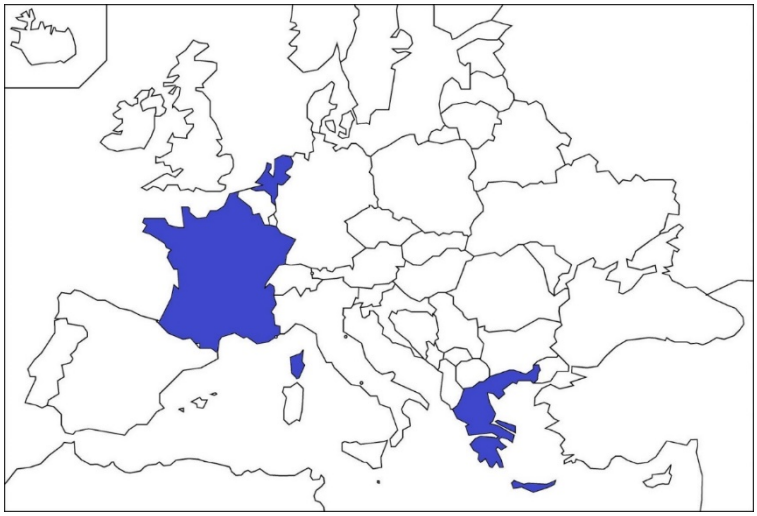
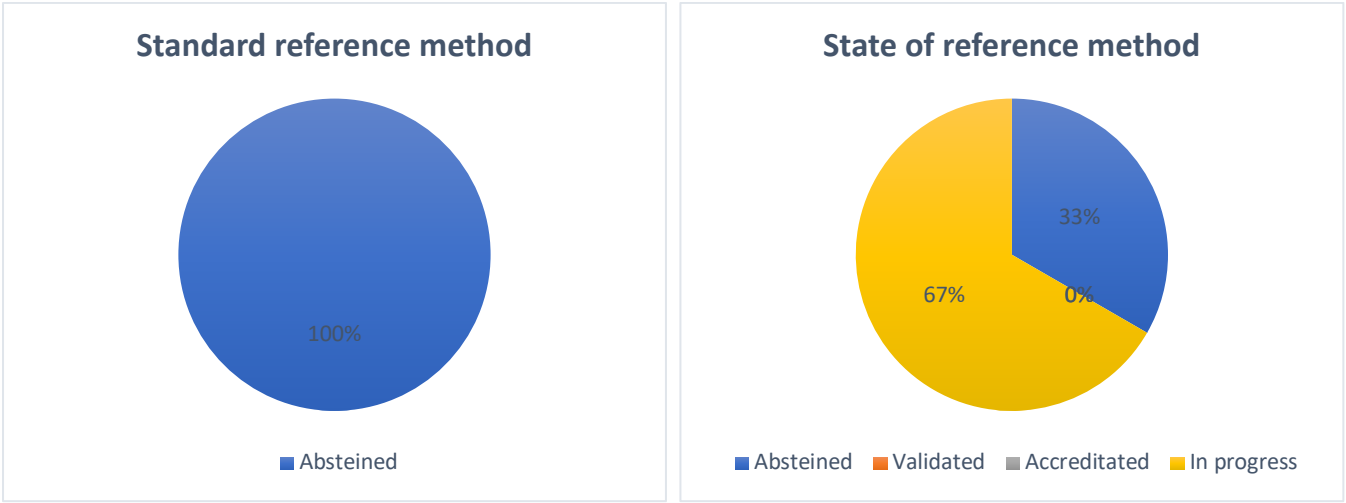


Figure 16 The map represents the distribution of the laboratories that deal with metals analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



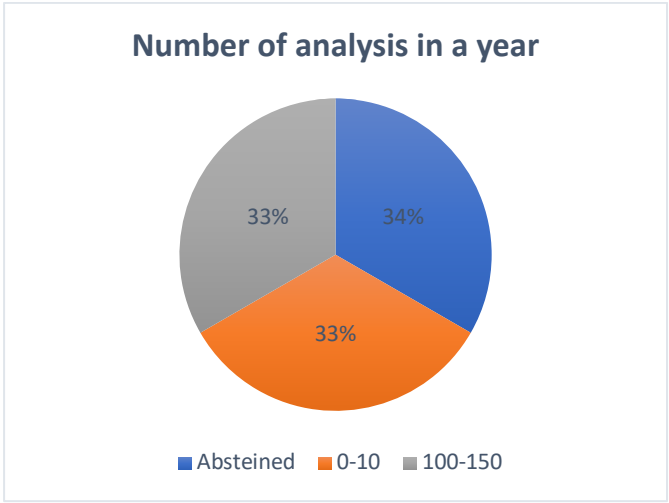
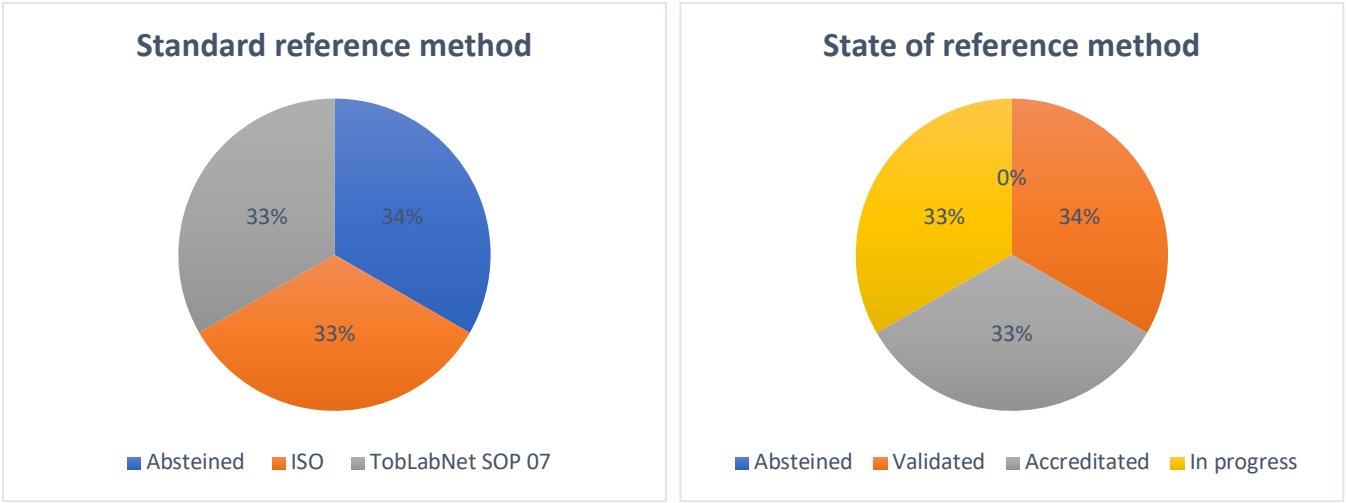


Figure 17 Results, expressed in percentage, of questions about the standard reference method for Metals, the state of method and the number of analysis done in a year by the laboratories for Metals.

5.2.7 Ammonia in tobacco filler

About this category of analytes, we received responses from 3 laboratories from 2 countries.

Figure 18 The map represents the distribution of the laboratories that deal with Ammonia in tobacco filler analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



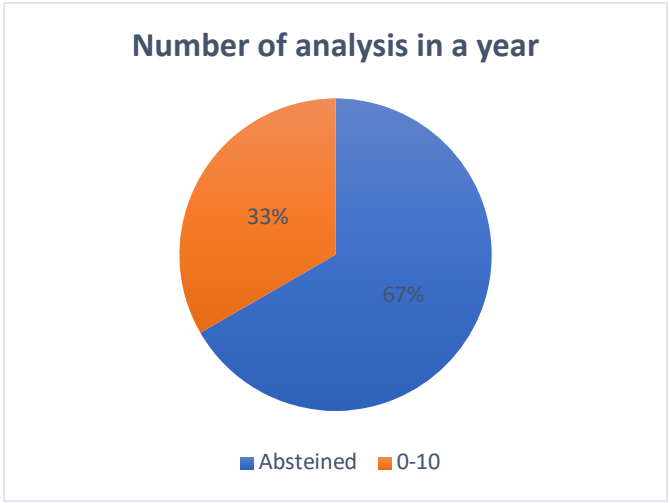


Figure 19 Results, expressed in percentage, of questions about the standard reference method for Ammonia in tobacco filler, the state of method and the number of analysis done in a year by the laboratories for Ammonia in tobacco filler.

5.2.8 Humectants

About this category of analytes, we received responses from 6 laboratories from 5 countries.

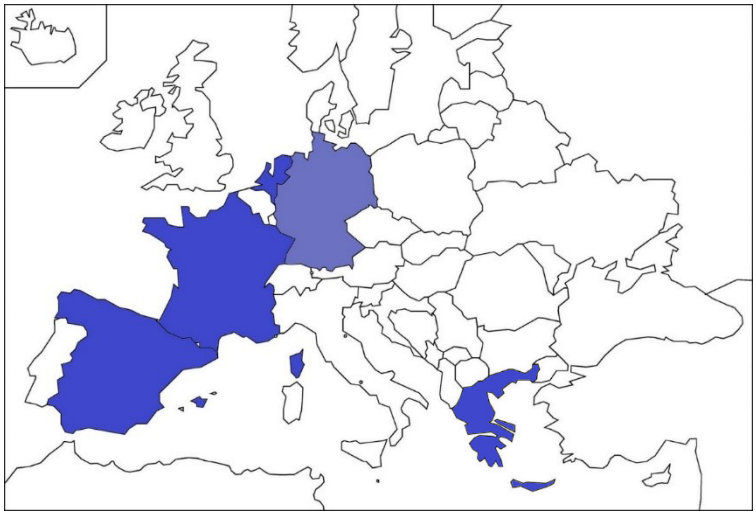
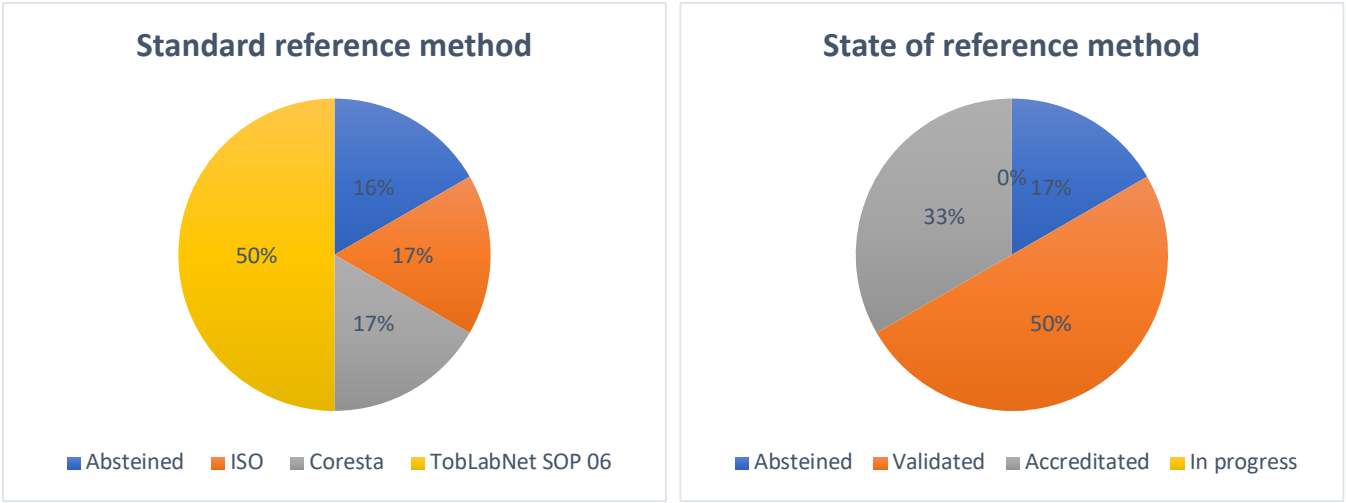


Figure 20 The map represents the distribution of the laboratories that deal with Humectants analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



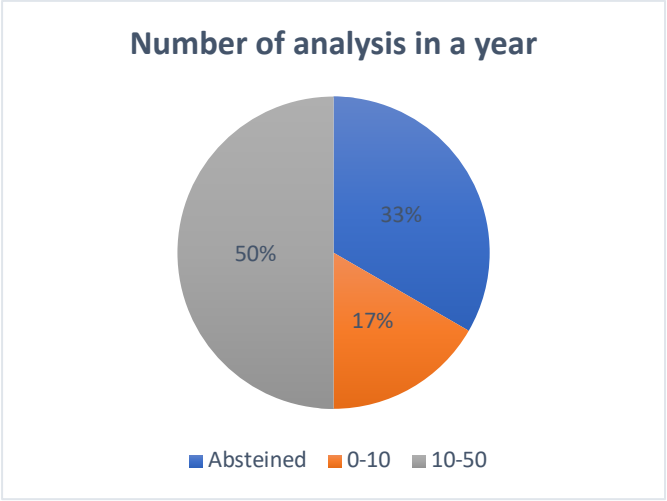


Figure 21 Results, expressed in percentage, of questions about the standard reference method for Humectants, the state of method and the number of analysis done in a year by the laboratories for Humectants.

5.2.9 Cigarette ventilation

About this category of analytes, we received responses from 3 laboratories from 2 countries.

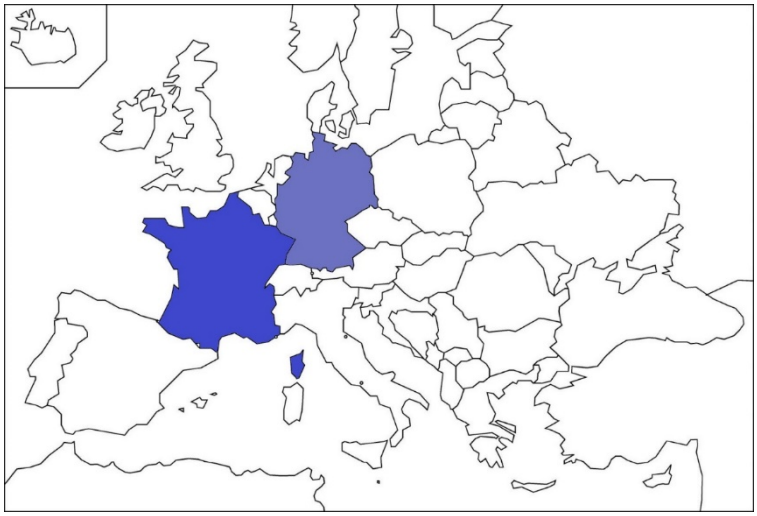
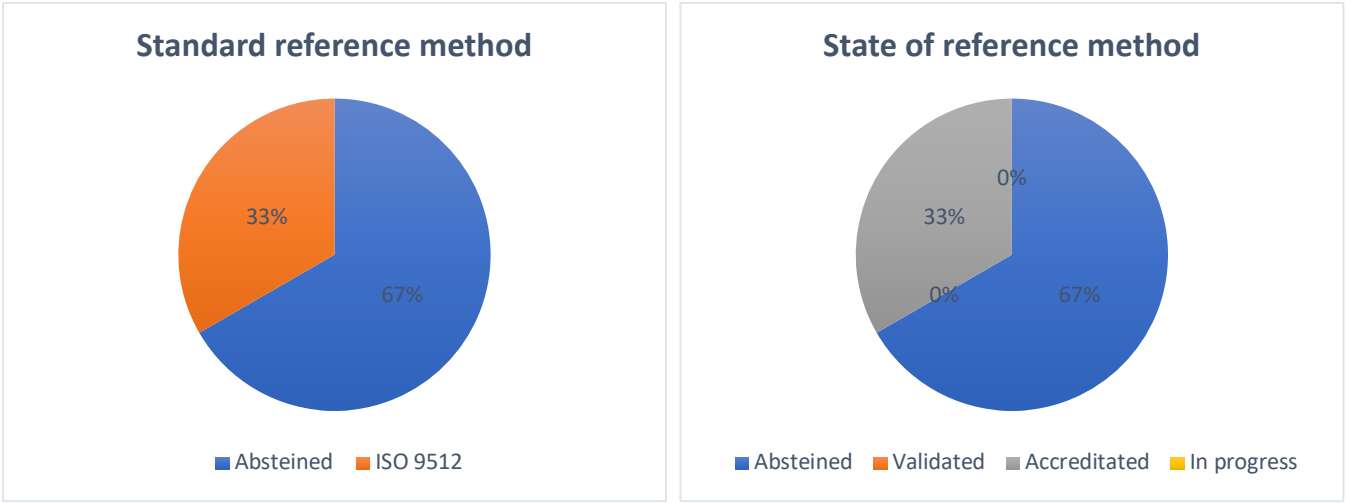


Figure 22 The map represents the distribution of the laboratories that deal with Cigarette ventilation analysis: in dark blue the states with a single laboratory while in light blue the states with two laboratories.



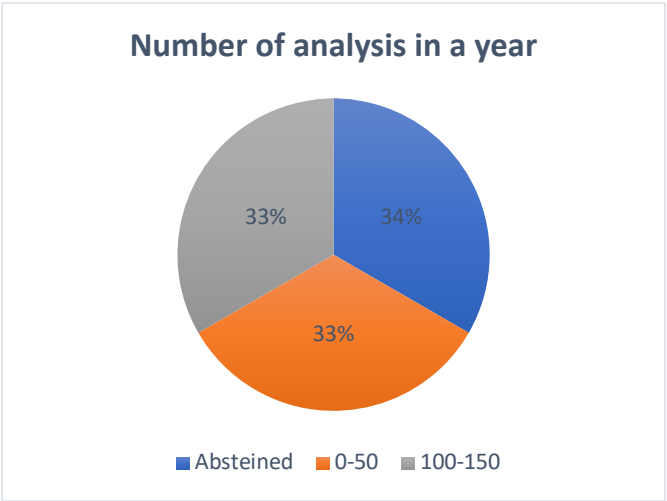


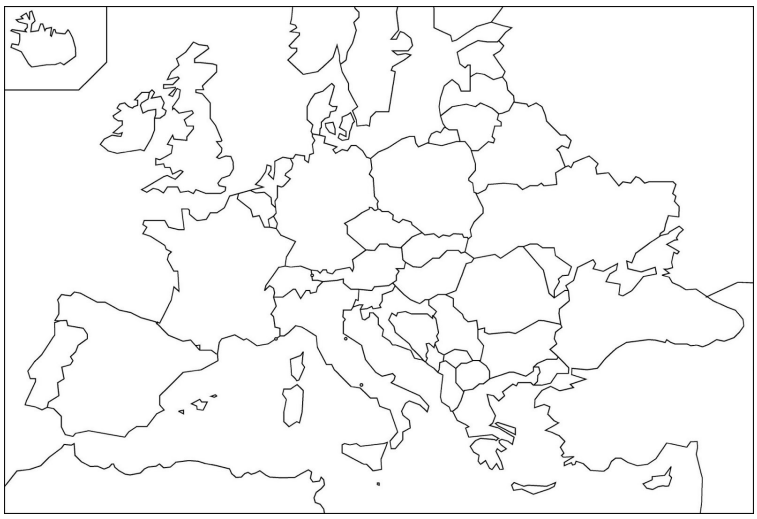
Figure 23 Results, expressed in percentage, of questions about the standard reference method for Cigarette ventilation, the state of method and the number of analysis done in a year by the laboratories for Cigarette ventilation.

5.3 Analysis carried out on e-cigarettes, herbal products and novel tobacco products

This section includes about 90 questions and focused on the analysis of compounds contained in e-cigarettes, herbal products and novel tobacco products. Each compound examined was subjected to the same questions: methods used, state of the method (validated, accredited or in progress) and number of analyses carried out in one year. The compounds examined for cigarettes include: nicotine, flavours, vitamins, stimulant additives, substances with CMR properties, glycols, carbonyl compounds, metals. The answers to the questions are divided by substance analysed and presented showing the position of the laboratories that answered the questionnaire on the map and with the graphical representation of the answers.

5.3.1 Vitamins

About this category of analytes, we received no response from any country.



5.3.2 Nicotine

About this category of analytes, we received responses from 16 laboratories from 11 countries.

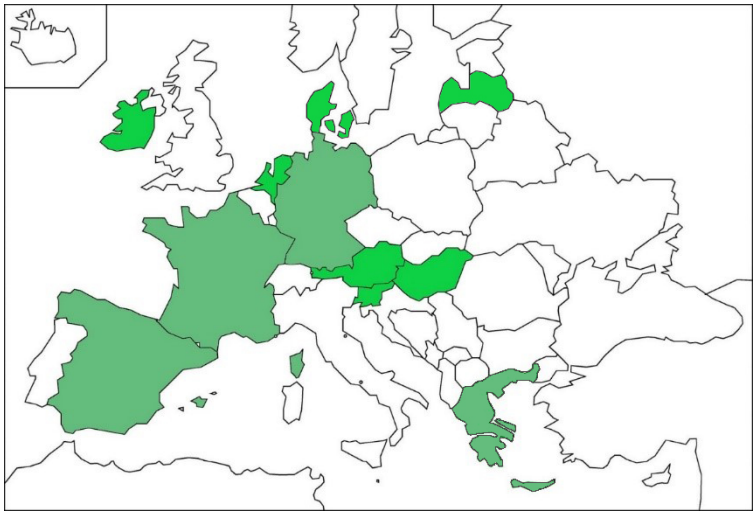
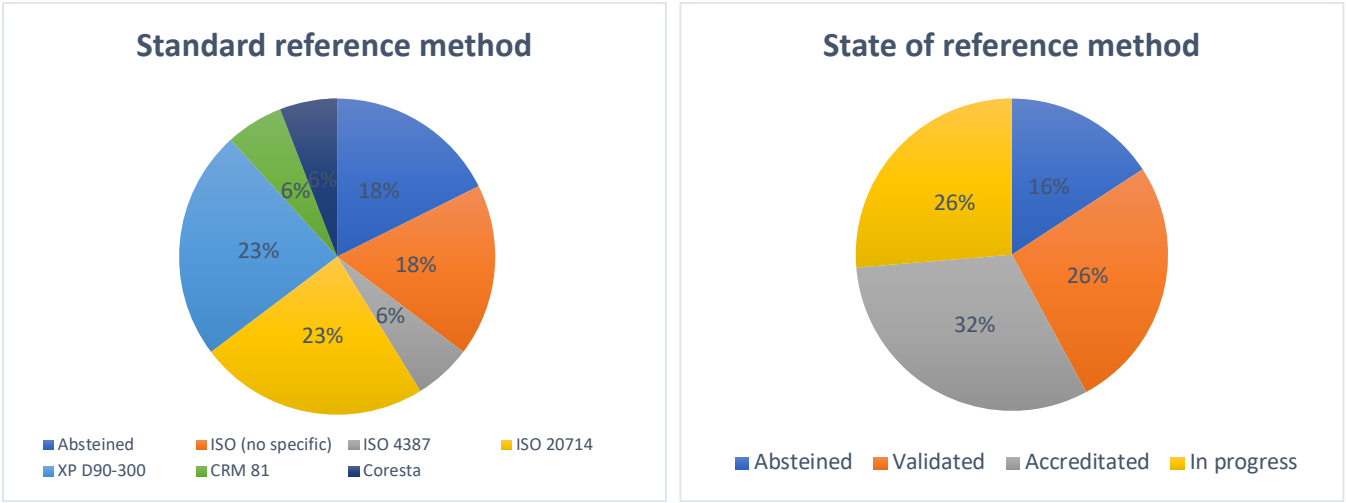


Figure 24 The map represents the distribution of the laboratories that deal with Nicotine analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



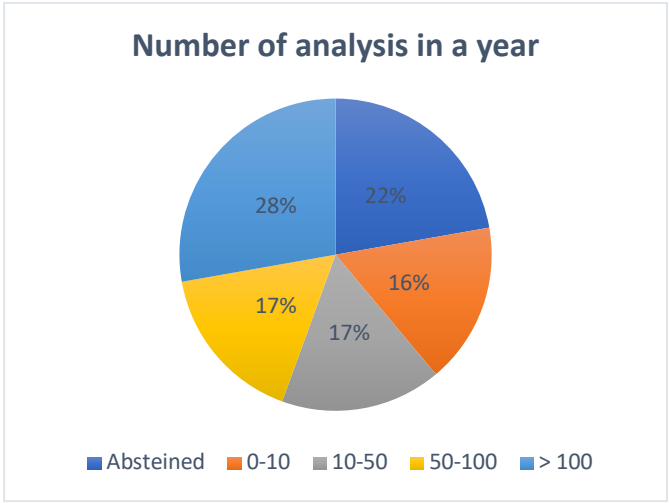


Figure 25 Results, expressed in percentage, of questions about the standard reference method for Nicotine, the state of method and the number of analysis done in a year by the laboratories for Nicotine.

5.3.3 Flavours

About this class of compounds, we received responses from 8 laboratories from 7 countries.

(Excluding chemical or sensory analysis, performed within EUREST-FLAVOURS that are not reported here)

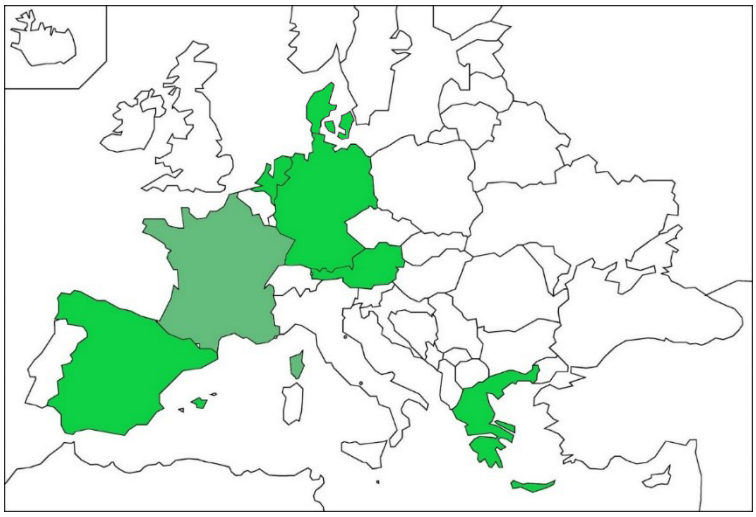
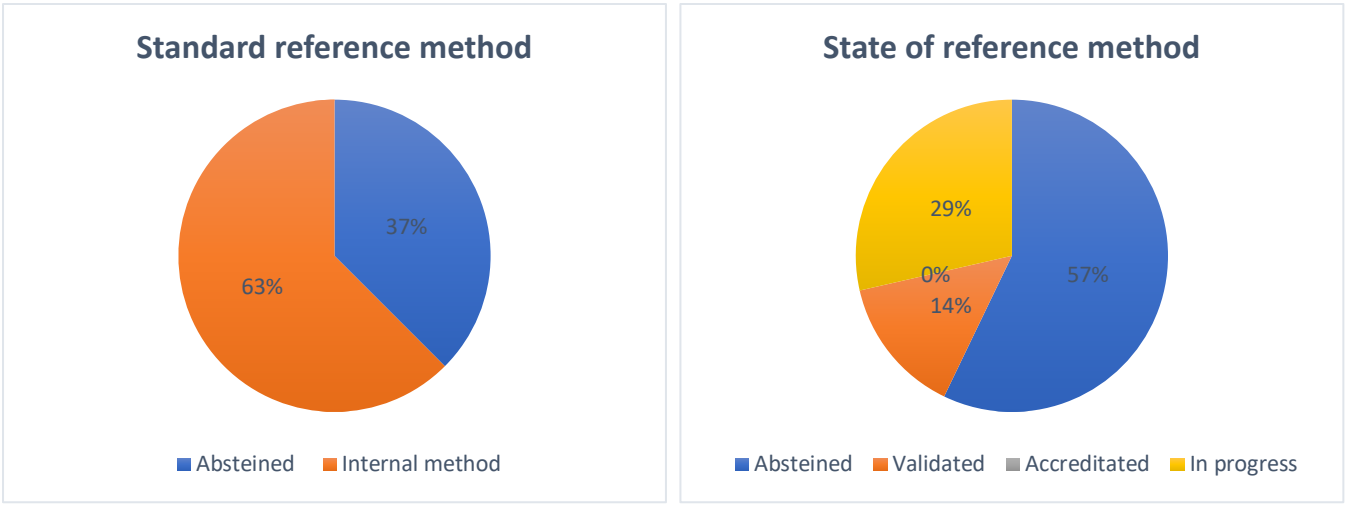


Figure 26 The map represents the distribution of the laboratories that deal with Flavours analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



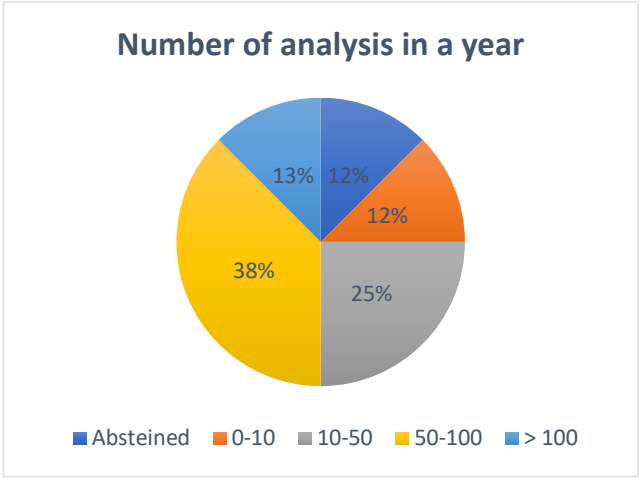


Figure 27 Results, expressed in percentage, of questions about the standard reference method for Flavours, the state of method and the number of analysis done in a year by the laboratories for Flavours.

5.3.4 Stimulant additives

About this class of compounds, we received responses from 3 laboratories from 3 countries.

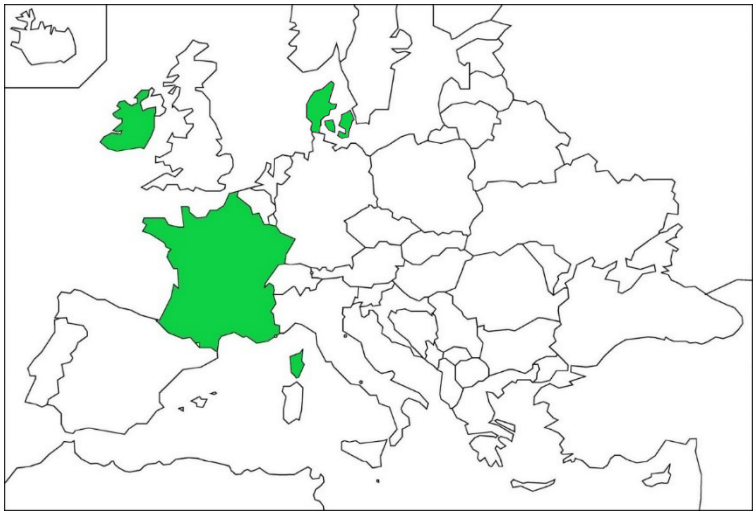
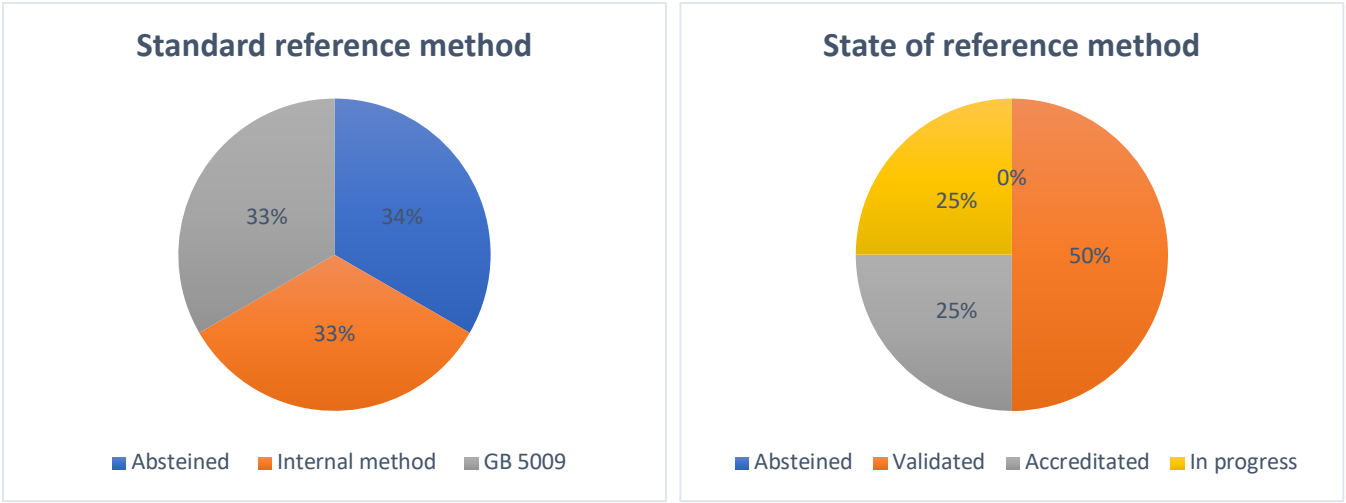


Figure 28 The map represents the distribution of the laboratories that deal with Stimulant additives analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



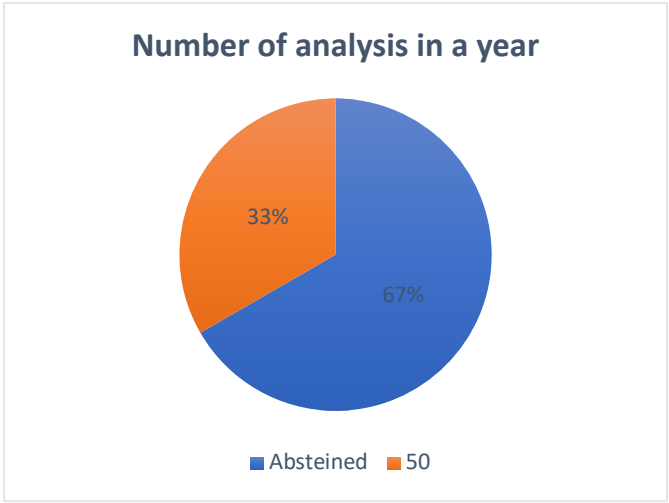


Figure 29 Results, expressed in percentage, of questions about the standard reference method for Stimulant additives, the state of method and the number of analysis done in a year by the laboratories for Stimulant additives.

5.3.5 Substances with CMR properties

About this class of compounds, we received responses from 3 laboratories from 3 countries.

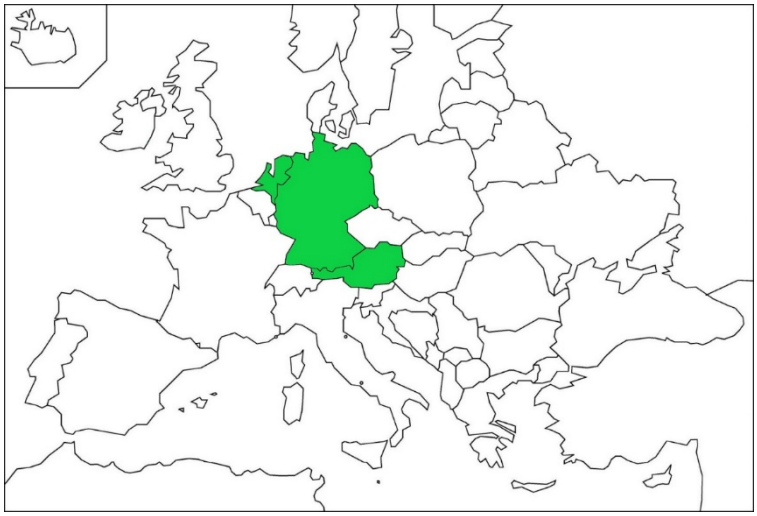
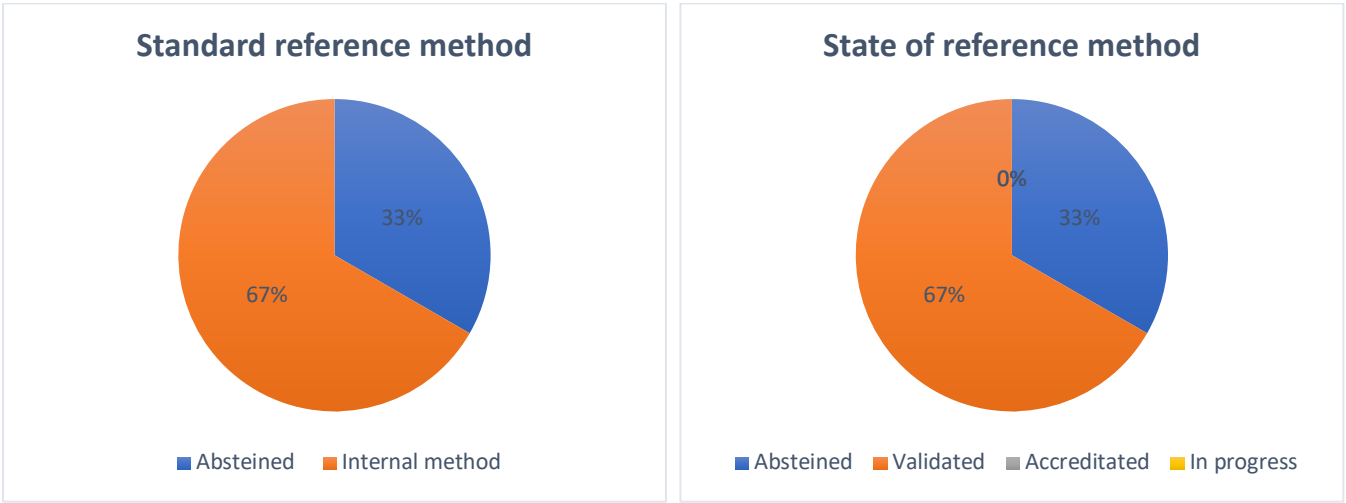


Figure 30 The map represents the distribution of the laboratories that deal with Substances with CMR properties analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



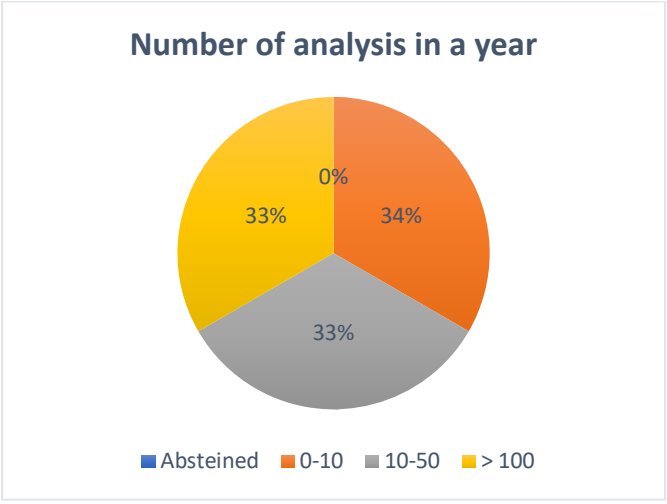


Figure 31 Results, expressed in percentage, of questions about the standard reference method for Substances with CMR properties, the state of method and the number of analysis done in a year by the laboratories for Substances with CMR properties.

5.3.6 Glycols

About this class of compounds, we received responses from 10 laboratories from 7 countries.

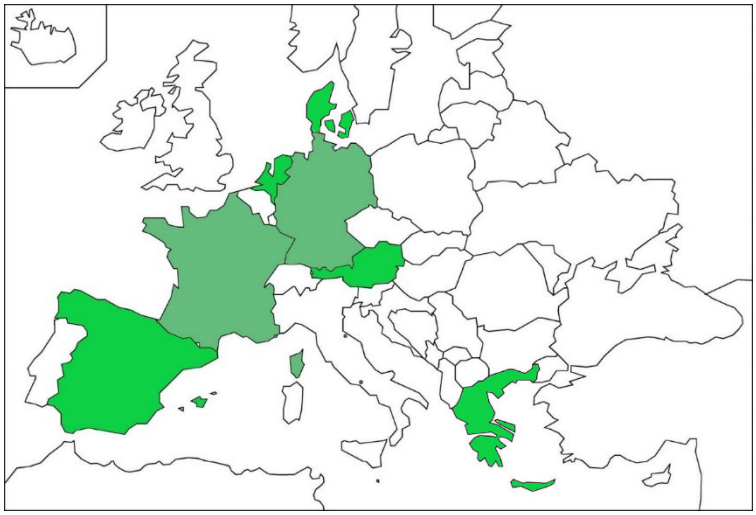
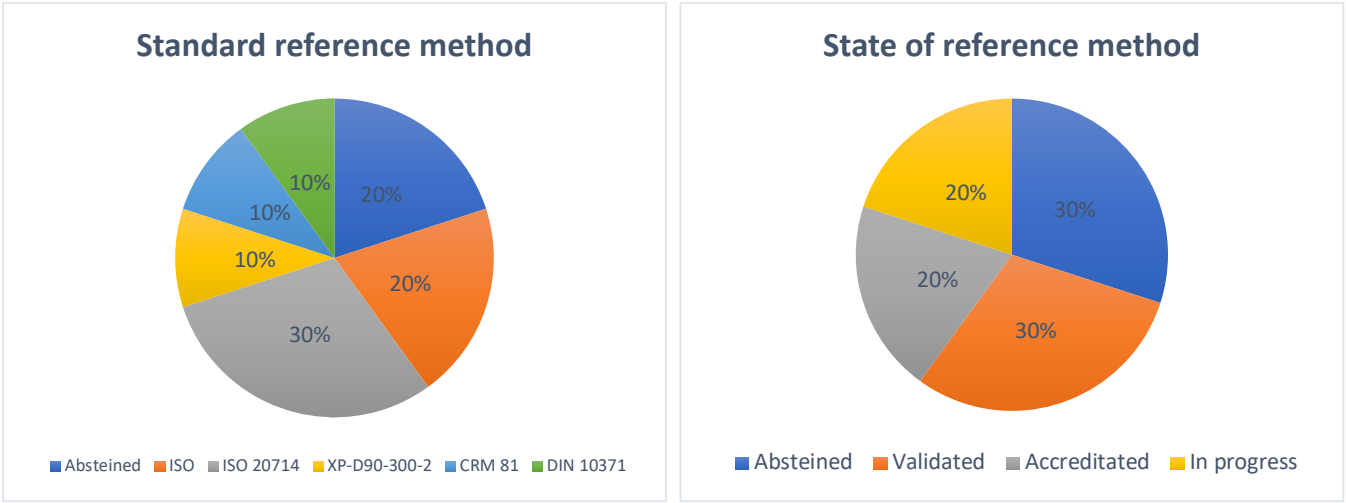


Figure 32 The map represents the distribution of the laboratories that deal with Glycols analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



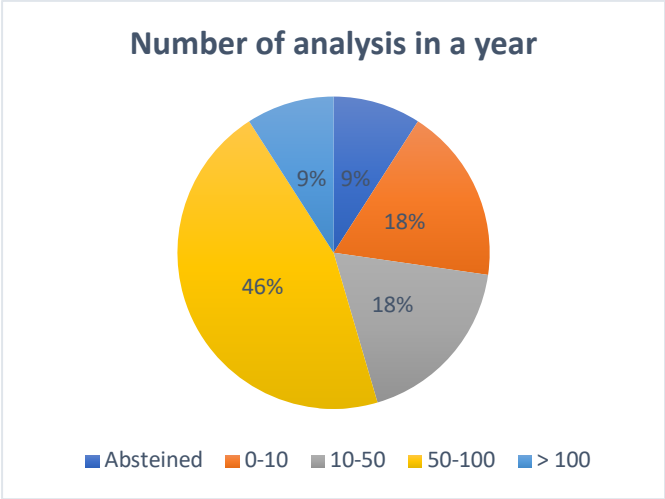


Figure 33 Results, expressed in percentage, of questions about the standard reference method for Glycols, its state and the number of analysis done in a year by the laboratories for Glycols.

5.3.7 Carbonyl compounds

About this class of compounds, we received responses from 7 laboratories from 5 countries.

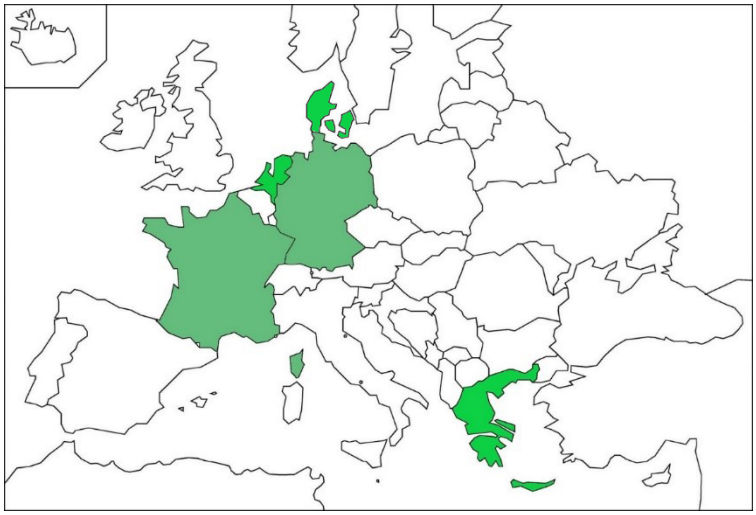
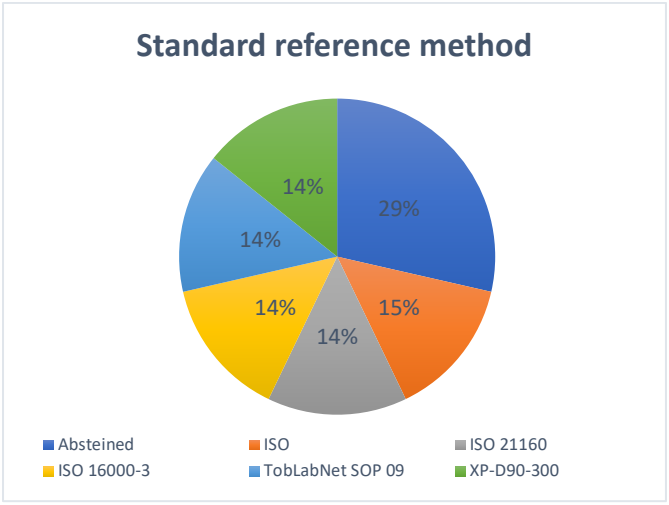
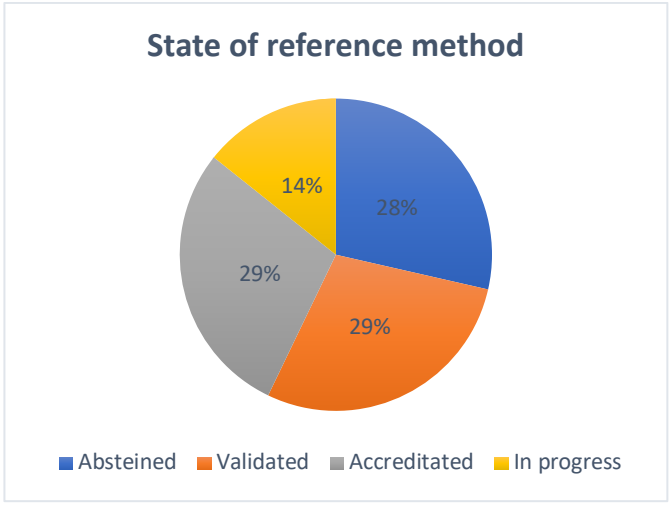


Figure 34 The map represents the distribution of the laboratories that deal with Carbonyl compounds analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.





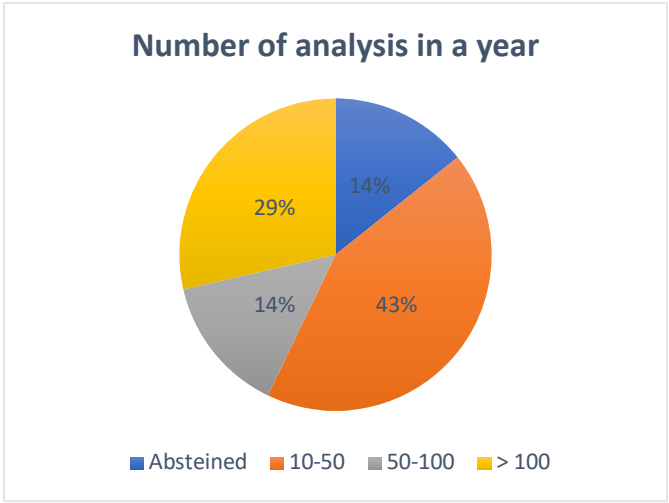


Figure 35 Results, expressed in percentage, of questions about the standard reference method for carbonyl compounds, its state and the number of analysis done in a year by the laboratories for carbonyl compounds

5.3.8 Metals

About this class of compounds, we received responses from 7 laboratories from 6 countries.

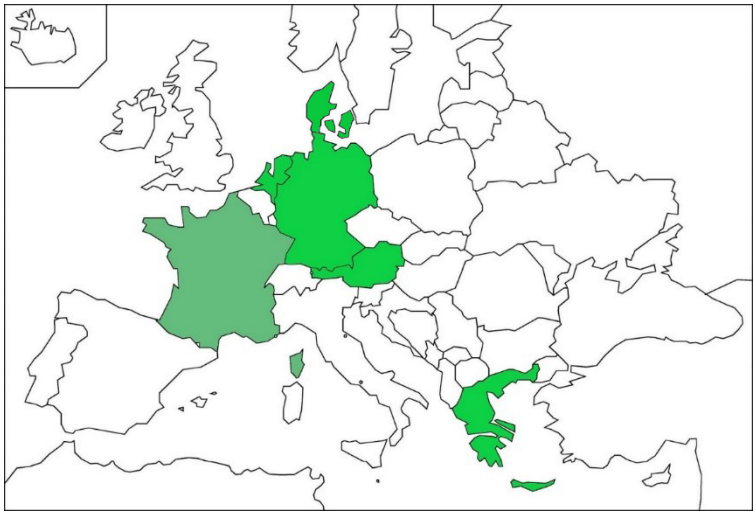
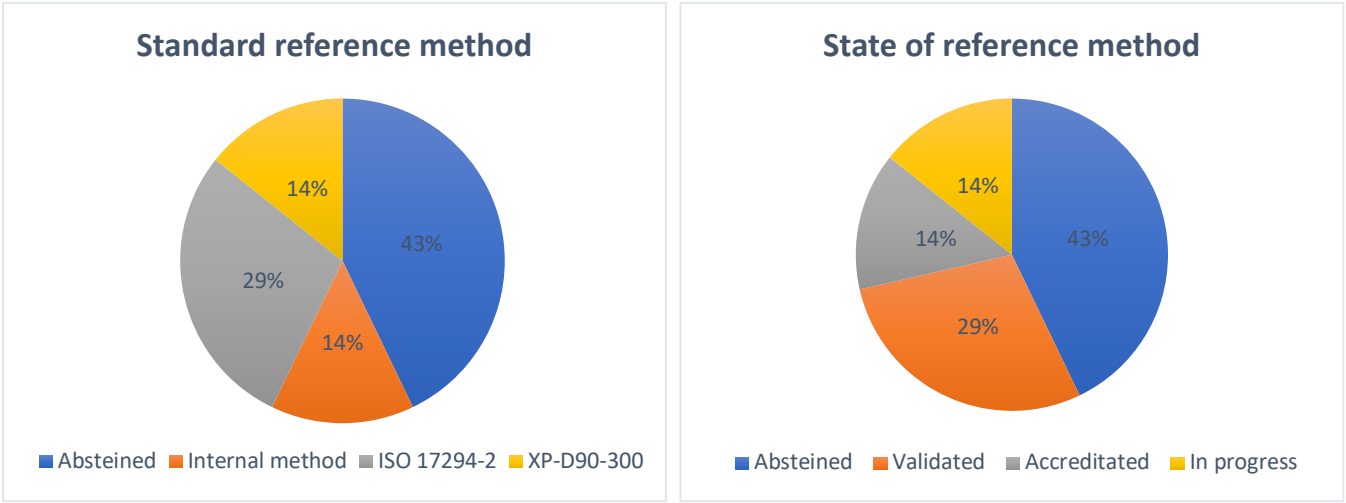


Figure 36 The map represents the distribution of the laboratories that deal with Metals analysis: in light green the states with a single laboratory while in dark green the states with more laboratories.



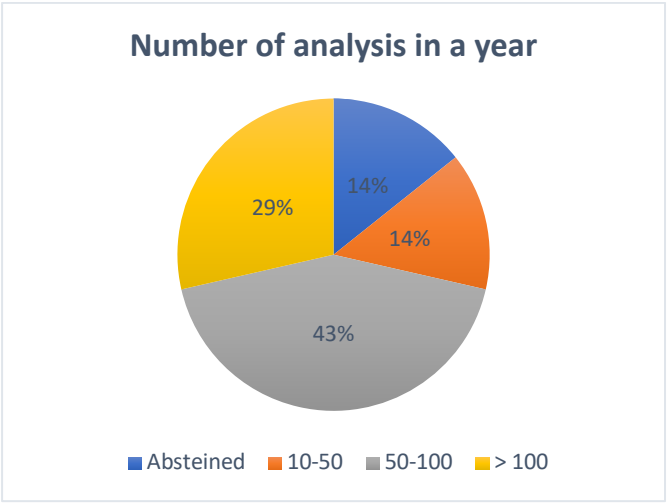
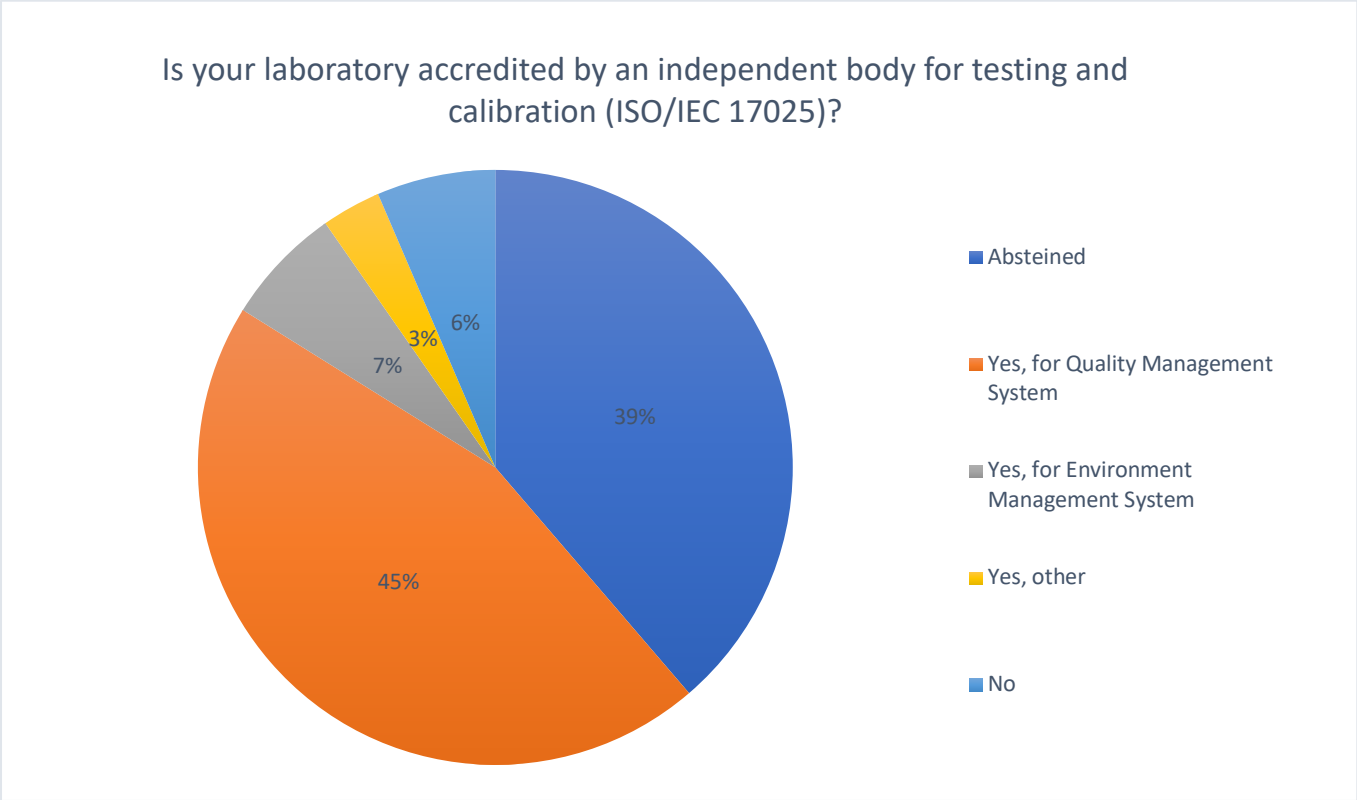


Figure 37 Results, expressed in percentage, of questions about the standard reference method for Metals, its state and the number of analysis done in a year by the laboratories for Metals.

5.4 Certifications of laboratory

The last two questions in the questionnaire aimed to provide information on certification systems of the laboratories.



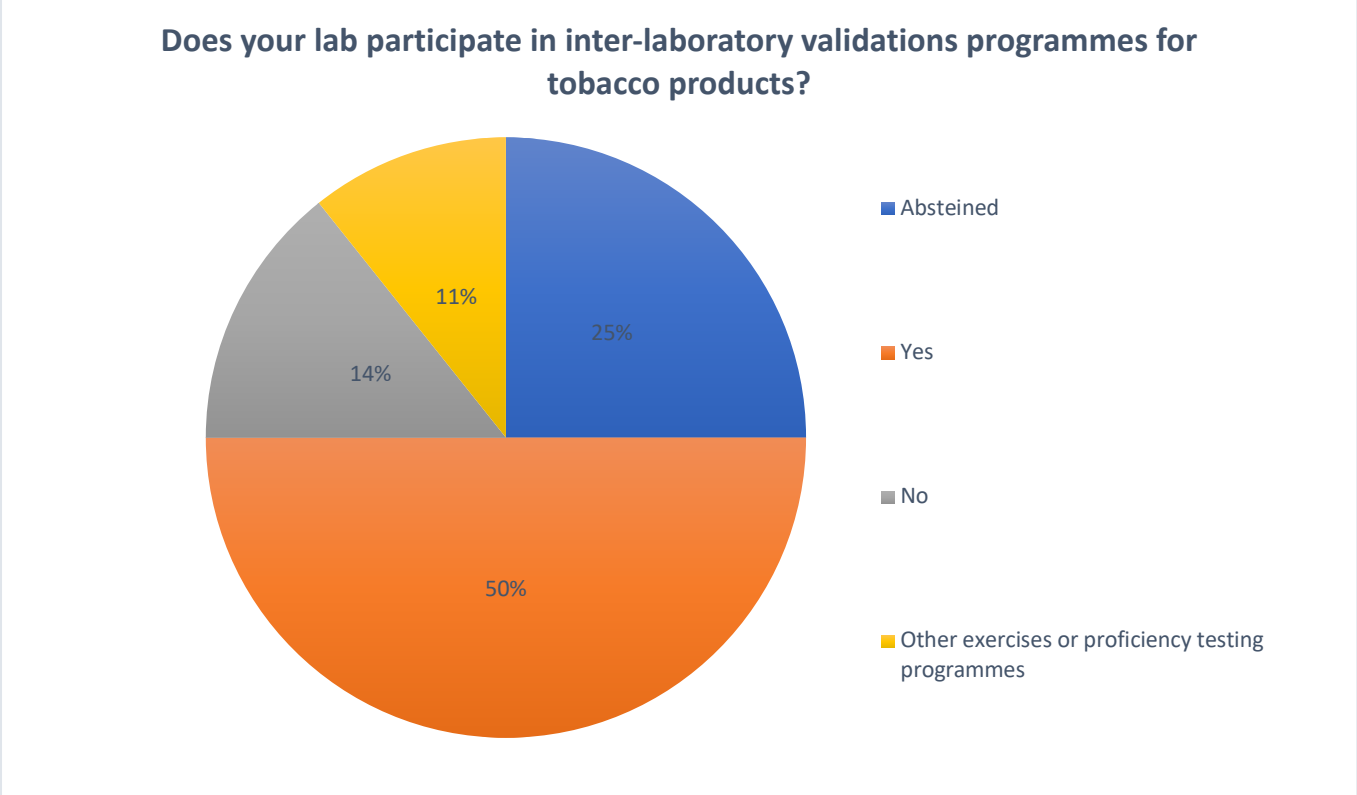


Figure 38 Results, expressed in percentage, of question about the certification of laboratories.

6. Conclusions based on the questionnaire

Laboratories

Laboratories that participated to the survey declared all independency from industry. The majority seems to be larger than 100 m^2 and have annual programs for verification (53% for TNCO, 32% for nicotine on e-liquids). About staff qualification, the technical employees are mainly technicians with 14 years of experience, while management/administration is mainly served by one person that is well experienced (average of 15 years of experience). The laboratories mainly use information technology systems.

Instrumentation

A list of detailed equipment is reported in annex 1. In general, there is coherence, among parameters, of instrumentation used especially for cigarettes methods, while for e-cigarettes laboratories tend to choose different approaches. Nicotine for example is analysed either by GC, GC-MS and HPLC-DAD, while for other parameters, like aldehydes, instrumentation is more uniform (HPLC-DAD). About excess capabilities, the number of instruments (n) available per single parameter (p) measured is mainly n=1 (p=33), while duplicate of instrumentation are present in less cases with n=2 (p=24), and only few parameters are guaranteed by n=3 (p=4) and n=4 (p=3) instruments.

6.1 Cigarettes

EU distribution of laboratories for testing

Results indicates that 20 laboratories perform analysis on cigarettes, based in 14 different MS

Type of parameters tested

The most diffused parameter verified is TNCO as 16 laboratories in 14 MS verify these parameters, followed by aldehydes (6 labs in 6 MS), humectants (6 labs in 5 MS), VOC (4 labs in 4 MS) and N-nitrosamines (4 labs in 4 MS)

Number of parameters tested

Germany, The Netherlands and France are the most active MS, with verification on 11, 8 and 7 different compounds or classes of compounds respectively. Analytes measured in all other MS are 5 compounds or classes of compounds or less.

Analytical methods

Regarding TNCO all laboratories follow ISO methods, most of them being accredited (76%), while other laboratories are either validated or in progress. For other commonly measured parameters, aldehydes 14% are ISO, 29% follow standard Coresta or TobLabNet; VOC methods are 20% ISO 60% follow standard TobLabNet; N-nitrosamines methods are 20% ISO 40% follow standard TobLabNet. Also these parameters are verified with methods that are either accredited, validated or with an on-going process.

Number of analysis performed per year

TNCO: 38% of laboratories declared > 100 analyses (350 as an average), 31% in the range of 10-50, generally being one order of magnitude higher of other commonly measured parameters, aldehydes and N-nitrosamines.

Metals, ammonia in tobacco filler, humectants, cigarette ventilation and nitrogen oxides

These parameters are verified in a very limited number of countries. Humectants and nitrogen oxides (this being verified only in England) are the parameter verified following mostly validated or accredited standard methods.

Other additives contained in cigarettes and roll-your-own tobacco subject to enhanced reporting obligations

Measured in Austria, France, The Netherlands, Spain and Germany, the laboratories declared 41 analyses per year, as an average.

6.2 e-cigarettes and NTPs

EU distribution of laboratories for verification

Results indicates that 21 laboratories perform analysis on e-cigarettes, herbal products and novel tobacco in 9 MS

Type of parameters

The most diffused parameter verified is nicotine as 16 laboratories in 11 MS verify this parameter, followed by propylene glycol (10 labs in 7 MS), flavours (8 labs in 7 MS) and aldehydes and metals (7 labs in 6 MS)

Number of parameters

France, Germany, Denmark are the most active MS, with verification on 7 different compounds or classes of compounds, followed by Austria and The Netherlands with 6 and Greece with 4 different compounds or classes of compounds. Analytes measured in all other MS are 2 compounds or classes of compounds or less.

Analytical methods

Regarding nicotine 82% of laboratories follow ISO or other standard methods, some of them being accredited (32%), while other laboratories are either validated or in progress. For other commonly measured parameters, propylene glycol 50% are ISO, 63% follow XP D90-330 or TobLabNet standard; flavours methods are 63% internal methods; aldehydes methods are 43% ISO, 28% follow standard XP D90-330 or TobLabNet; methods for metals are 29% ISO, 14% follow standard XP D90-330. Also these parameters are verified with methods that are either accredited, validated or with an on-going process.

Number of analysis performed per year

Nicotine: 28% of laboratories declared > 100 analyses, 17% in the range of 50-100, other commonly measured parameters are less than 50 per year, slightly more for VOC.

Vitamins, stimulant additives and CMR substances and other compounds

These parameters are verified in a very limited number of countries, all with internal or non specified methods. CMR compounds and metals are verified in relatively large set of samples, others are not. Vitamins are not verified in any MS

7. General conclusions

Laboratories appear to be equipped with standardized instruments, where applicable. Few laboratories have also state-of-the-art instrumentation, like GC/MS-MS or HPLC/MS-MS.

Laboratories that perform verification of parameters listed in Art. 3 of the TPD, within EU member states, are present in a relatively limited number of countries. Moreover, the number of parameters measured is limited to TNCO for cigarettes and nicotine for e-cigarettes and NTP, while levels of other compounds are analysed in a very limited number of MS.

For cigarettes TNCO and e-cig/NTP nicotine parameters, methods used follow international standards with laboratories procedures that are accredited or validated. For other parameters in e-cig and HNB products this is not the general case, being a large number of test performed with in-house or not specified methods.

There is a lack of standard methods and ISO is working on this for some of them. The most important needs are the methods on e-cigarettes, in general, mainly for testing emissions and for constant level delivery.

The publication of TPD and the ingredients limitations for tobacco products (art.7) requires that testing laboratories will need more expensive instrumentation to fulfil all requirements. The cost of verification analyses will increase if MS wants to have an internal verification program. The costs will be more and more important parameter for the laboratories since these are not systematically covered by a clear approach on MS about fee retribution (see WP8 D 8.1) and this aspect urgently needs a common resolution.

8. Recommendations for laboratory protocols and technical requirements

Cigarettes analysis

A Recommendation Form has been prepared and shared among WP8 partners and results have been collected and reported here.

ISO methods for measuring emissions are under revision and final recommendations on equipment and protocols should follow final publications these methods. The case of The Netherlands [1], about cigarettes ventilation and use of Canadian Intense (CI) method, is emblematic. In case of a review of the TPD, TNCO methods should consider validated and agreed analytical methods from other international organizations. Methods independent from industry are preferred, when available.

Under the current Directive the main recommendation is about the number of MS accredited laboratories and distribution across EU. MS that do not have accredited laboratories, within CA or as an external contract laboratory, should charge manufacturers and importers with fees to develop and implement verification programs.

VOCs and carbonyl compounds analysis measurements should be strongly recommended. In this respect equipment should be updated as state of the art instrumentation, like GC-MS (better GC-MS/MS) and HPLC-MS are needed. VOCs should be selected from WHO list of priority toxicants[2]. TSNAs should be considered in future products regulations.

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	GENERAL RECOMMENDATIONS **Cigarettes analysis**														
G1	**LIMITATION TO ISO METHODS** ISO methods for measuring emissions are under revision and final recommendations on equipment and protocols should follow final publications these methods. The case of The Netherlands about cigarettes ventilation and use of Canadian Intense (CI) method, is emblematic. In case of a review of the TPD, TNCO methods should consider standard methods from other international organizations.	TPD [Art. 4. 1]	10 x Yes 1 x No	5Y	1Y	5Y	5Y	5Y	3Y	5Y	5Y	5Y	N	2Y	4.1
G2	**ANALYTES OTHER THAN TNCO** Regarding CMR properties of the tobacco product TPD [ART.7.13]: VOCs, aldehydes and TSNAs measurements should be strongly recommended.	TPD [ART.7.13]	10 x Yes 1 x No	5Y	5Y	3Y	5Y	5Y	5Y	4Y	5Y	5Y	N	4Y	4.6

ENDS and Novel Tobacco Products (or Heated Tobacco Products, HTPs)

A Recommendation Form has been prepared and shared among WP8 partners and results have been collected and reported here.

Nicotine and PG concentrations in liquids are the only parameters verified with standard procedures by CA accredited laboratories. No ISO methods are available for emissions testing. Currently, standard methods are under development, with a strong industry participation, for emissions testing for standard e-liquids, vaping machine, parameters and topography.

The market is under a fast evolution both for devices and components. E- cigarettes and vaping topographies are evolving; several mouth-to-lung vapers evolved in direct-to-lung vaping with different, and unknown, toxicity aspects. More and more products are facing the market, while new ingredients, like nicotine salts and non-tobacco nicotine, either synthetic or extracted from non-tobacco plants, are facing the market.

Toxicity knowledge is rapidly evolving, especially for the acute exposures[3], posing new milestones for verification needs.

Under the current Directive verification of these tobacco products is limited to tobacco nicotine. MS should develop, implement and enforce verification programs for ingredients that "do not pose a risk to human health in heated or unheated form" (Art. 20. 3. Paragraph e) like glycerol, PG in liquids and glycerol, PG, carbonyl compounds (formaldehyde, acetaldehyde, acrolein) and metals in emissions,
It is important to consider that toxicants which are relevant for e-cigarettes are not the same for HTPs. Lists of priority toxicants should be different for the two products (for example VOCs are more relevant for HTPs rather than for e-cigarettes, while carbonyls might be more relevant for e-cigarettes rather than for HTPs). HTPs list of prior toxicants shall be defined in the future.

There are no regulations for nicotine content and emissions analysis. Consequently, to supplement the verification programs suggested, measurements for nicotine contents and emissions regulations should be recommended for both e-cigarettes and HTPs.

MS should develop, implement and enforce verification programs for nicotine emissions to verify consistent delivery (Art. 20. 3. Paragraph f).

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	GENERAL RECOMMENDATIONS **Electronic Cigarettes and Novel Tobacco Products (HTPs) analysis**														
G3	**NICOTINE EMISSIONS** MS should develop, implement and enforce verification programs for nicotine emissions using both AFNOR, CEN draft or peer-reviewed independent publications	TPD [ART.19.1] [ART. 20.3.f]	10 x Yes 1 x No	5Y	5Y	4Y	5Y	5Y	Y	5Y	5Y	5Y	N	4Y	4.8
G4	**ANALYTES OTHER THAN NICOTINE** CMR properties of the tobacco product TPD [ART.7.13] VOCs, aldehydes and TSNAs measurements should be <u>strongly recommended.</u>	TPD [ART.7.13] [ART. 20.3.e]	9 x Yes 1 x No	5Y	3Y	1	5Y	5Y	5Y	4Y	4Y	5Y	N	4Y	4.1
G4-b	**ANALYTES OTHER THAN NICOTINE** CMR properties of the tobacco product TPD [ART.7.13] VOCs, aldehydes and TSNAs measurements should be <u>regulated.</u>	TPD [ART.7.13] [ART. 20.3.e]	5 x Yes 4 x No		2Y	1	5Y	5Y	5Y	N	1N	5Y	N	1N	3.1

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	LABORATORY VERIFICATION COLLABORATION AND ANALYSIS **WP8 PRELIMINARY PROPOSALS**														
L1	**VERIFICATION cigarettes** Each MS should identify, accredit, approve and use at least one independent testing laboratory, internal or external, for each tobacco product and electronic cigarette.	Lab Survey TNCO in 12 MS out of 28	8 x Yes 2 x No	5Y	5Y	Y	5Y	5Y	N	5Y	5Y	Y		1N	4,4
L2	**VERIFICATION cigarettes** Testing laboratories should have an indoor air quality monitoring program	WP8 internal meeting	5 x Yes 5 x No	5Y		N	3.5 Y	5Y	N	N	1N	Y	N	2Y	3.3
L3	**VERIFICATION e-cig liquid** CA Approved laboratories should also measure propylene glycol and glycerol in liquids for electronic nicotine delivery devices following ISO 20714:2019 Draft This is needed in order to verify EU-CEG declaration		8 x Yes 0 x No	5Y	3Y	1		5Y	5Y	5Y	5Y	Y		4Y	4.1
L4	**VERIFICATION e-cig emissions** Measurements in Art.4 paragraph 1 should include also emissions from e-cigarettes for carbonyl contents like acroleine formaldehyde and acetaldehyde. While the final CEN TC437 methods are not available, analyses should be performed following AFNOR methods or peer-reviewed independent publications	[ART. 20.3.e]	10 x Yes 1 x No	3Y	3Y	5Y	5Y	5Y	5Y	4Y	3Y	Y	N	4Y	4.1

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	It is well known that heating of PG and glycerol will produce toxic compounds. To fulfill TPD requirements “except for nicotine, only ingredients are used in the nicotine-containing liquid that do not pose a risk to human health in heated or unheated form”;														
L4-b	**VERIFICATION e-cig emissions** MS should develop, implement and enforce verification programs for emissions from e-cigarettes for carbonyl contents like acroleine formaldehyde and acetaldehyde. While the final CEN TC437 methods are not available, analyses should be performed following AFNOR methods or peer-reviewed independent publications It is well known that heating of PG and glycerol will produce toxic compounds. To fulfill TPD requirements “except for nicotine, only ingredients are used in the nicotine-containing liquid that do not pose a risk to human health in heated or unheated form”;	[ART. 20.3.e]	10 x Yes 0 x No	3Y	4Y	3Y	5Y	5Y	Y	3Y	3Y		Y	4Y	3.0
L5	**VERIFICATION** Direct to Lung (DTL) topography should be used in addition to Mouth to Lung (MTL) topography when emissions (G3, L4) are measured	WP8 internal meeting	7 x Yes 4 x No	5Y	N	2Y	4Y	5Y	N	4Y	1N	Y	N	4Y	3.6
L4	**ANALYSIS: ACCREDITATION**	Lab Survey	8 x Yes 2 x No	1Y	5Y	5Y		5Y	3Y	N	5Y	Y	Y	2N	3.7

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	"TNCO analysis on tobacco and related products in CA approved laboratories should be ISO 17025 accredited or an accreditation process should be in progress"														
L5	**ANALYSIS: METHOD DEVELOPMENT** Methods for e-cigarettes HTP and waterpipe tobacco products are under development for emissions by ISO commissions. Methods could also be designed by independent laboratories through a collaboration	Lab Survey	8 x Yes 1 x No	5Y	4Y			5Y	4Y	3N	4Y	Y	Y	3Y	4.0

ID	Recommendation (IRFMN proposal)	Inspiration	Inherent to WP8?	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	TOT
	GENERAL RECOMMENDATIONS **Electronic Cigarettes and Novel Tobacco Products (HTPs) analysis**														
G3	**NICOTINE EMISSIONS** MS should develop, implement and enforce verification programs for nicotine emissions using both AFNOR, CEN draft or peer-reviewed independent publications	TPD [ART.19.1] [ART. 20.3.f]	8 x Yes 1 x No	5Y	5Y	4Y	5Y	5Y	Y	5Y			N	4Y	4.7
G4	**ANALYTES OTHER THAN NICOTINE** CMR properties of the tobacco product TPD [ART.7.13] VOCs, aldehydes and TSNAs measurements should be <u>strongly recommended.</u>	TPD [ART.7.13] [ART. 20.3.e]	7 x Yes 1 x No	5Y	3Y	1	5Y	5Y	5Y	4Y			N	4Y	4.0
G4-b	**ANALYTES OTHER THAN NICOTINE** CMR properties of the tobacco product TPD [ART.7.13] VOCs, aldehydes and TSNAs measurements should be <u>regulated.</u>	TPD [ART.7.13] [ART. 20.3.e]	4 x Yes 3 x No		2Y	1	5Y	5Y	5Y	N			N	1N	3.2

On the basis of the Recommendation Form results, assuming the same arbitrary threshold used for previous recommendation of:

- at least 7 opinions that the recommendation is inherent to WP8
- an importance score of at least 4

the following specific recommendations are proposed:

1. **VERIFICATION cigarettes.** Each MS should identify, accredit, approve and use at least one independent testing laboratory, internal or external, for each tobacco product and electronic cigarette. Testing needs to be executed within the EU.

Cigarettes analysis

2. **LIMITATION TO ISO METHODS.** In case of a review of the TPD, TNCO methods should consider validated and agreed analytical methods from other international organizations.

3. **ANALYTES OTHER THAN TNC.** Regarding CMR properties of the tobacco product TPD [ART.7.13]: VOCs and carbonyls measurements should be strongly recommended.

Electronic Cigarettes and Novel Tobacco Products (HTPs) analysis

4. **NICOTINE EMISSIONS.** MS should develop, implement and enforce verification programs for nicotine emissions using validated and agreed analytical methods from international organizations or, if not available, using peer-reviewed independent publications. Methods independent from industry are preferred, when available.

5. **ANALYTES OTHER THAN NICOTINE.** CMR properties of the tobacco product TPD [ART.7.13]. VOCs and carbonyls measurements should be strongly recommended. Other compounds will be defined in the future.

6. **VERIFICATION e-cig liquid.** CA Approved laboratories should also measure propylene glycol and glycerol in liquids for electronic nicotine delivery devices following ISO 20714:2019 Draft This is needed in order to verify EU-CEG declaration.

7. **VERIFICATION e-cig emissions.** Measurements in Art.4 paragraph 1 should include also emissions from e-cigarettes for carbonyl contents. While the final CEN TC437 methods are not available, analyses should be performed using validated and agreed analytical methods from international organizations or, if not available, using peer-reviewed independent publications. Methods independent from industry are preferred, when available.

9. Annex I - The questionnaire presented to the MS laboratories

Confidential Data, used to check for overlaps of respondents:

Family name of participant: _____

Laboratory: _____

Address: _____

1. Please describe your laboratory

Member State	Free text
City	Free text
Year of construction of the laboratory or years since last renovation	AAAA
Overall area of laboratory	m^2
Total area of smoking room(s)	m^2
Total area of instrument room(s)	m^2
Laboratory Information Technology System	Y/N
Amount of time dedicated to tobacco analysis	%
Amount of overall income coming from tobacco industry	%
Amount of time dedicated to e-cigarette analysis	%
Amount of overall income coming from e-cigarette industry	%

2. Please describe the staff currently working in your laboratory

	Total number of staff	Years of experience (average)
Administrative	n	n
Management	n	n
Technicians	n	n
Student/Post doc/Academic	n	n
Other	n	n

3. Does your laboratory develop also methods for new analytes?

□ Yes

□ No

□ Only for e-cigarettes or novel tobacco products

□ other

4. Please list the smoking / vaping machines you use

	Total number of	Years of production
Smoking machine	n	AAAA
Vaping Machine	n	AAAA
Other	n	AAAA

5. **Please list the analyses and methods you have performed on cigarettes in the last three years (April 2016-March 2019)**

	1 Standard reference method (ISO, EN, etc.)	2 Extraction method	3 Analytical Method	4 Analytical instrument	5 Number of instrument(s)	6 Model of instrument	7 Approximate number of analysis in a year
TNCO	Free text	Free text	Free text	Free text	n	Free text	n
Nitrogen Oxides	"	"	"	"	"	"	"
VOCs (phenolic, aromatic amines, 1,3 butadiene, benzene, BaP, …)	"	"	"	"	"	"	"
Tobacco Specific N-Nitrosamines	"	"	"	"	"	"	"
Aldehydes (Formaldehyde, acetaldehyde, acrolein)	"	"	"	"	"	"	"
Metals	"	"	"	"	"	"	"
Ammonia in tobacco filler	"	"	"	"	"	"	"
Humectants in tobacco filler	"	"	"	"	"	"	"
Other additives contained in cigarettes and roll-your-own tobacco subject to enhanced reporting obligations	"	"	"	"	"	"	"
Cigarettes ventilation	"	"	"	"	"	"	"
Other	"	"	"	"	"	"	"

6. Please list the analyses and methods you have performed on e-cigarettes, herbal products and novel tobacco products, in the last three years (April 2016-March 2019

	1 Standard reference method (ISO, EN, etc.)	2 Extraction method	3 Analytical Method	4 Analytical instrument(s)	5 Number of instrument(s)	6 Model of instrument	7 Approximate number of analysis in a year
Nicotine	Free text	Free text	Free text	Free text	n	Free text	n
Flavours	"	"	"	"	"	"	"
Vitamins or other additives used as food supplements	"	"	"	"	"	"	"
Stimulant additives such as caffeine or taurine	"	"	"	"	"	"	"
Substances which have CMR properties	"	"	"	"	"	"	"
Glycols other than propylene glycol	"	"	"	"	"	"	"
Aldehydes (formaldehyde, acetaldehyde, acrolein)	"	"	"	"	"	"	"
Metals	"	"	"	"	"	"	"
Other (please specify)	"	"	"	"	"	"	"

7. Is your organization certified by an independent body?

□ Yes, for Quality Management System

□ Yes, for Environment Management System
□ Yes, for Occupational health and Safety Management System

□ Yes, Other, specify?

□ No

8. Is your laboratory accredited by an independent body for testing and calibration (ISO/IEC 17025)?

□ Yes

□ No

□ In Progress

9. **Does your lab participate in inter-laboratory validations programmes?**

□ Yes

□ No

10. **Is your laboratory available to share analytical data/results of the last 3 years (period 2016-2018)? Data will be kept confidential and used to understand EU member states verification results.**

□ 1 Yes

□ 2 Only in an aggregated form

□ 3 Need permission from CA

□ 4 No

if you answered 1-3 write an e-mail contact _____

Thank you very much for your kind cooperation. Please kindly provide us the contact details (responsible person and his/her email) here. We will reach you by email soon in the future. _____ responsible.person@mail.com _____

10. Annex II - Instrumentation in use in CA approved laboratories as from the survey.

	Analytical instrument	Number of instrument(s)	Model of instrument
TNCO			
Greece	GC	1	Agilent Technologies (HP) 6890 N
Greece	GC FID, GC TCD	-	RORGWALDT RM 20H SM, CLARUS 500
Ireland			
Bulgaria	GC	1	Agilent 7890A
The Netherlands	GC-FID, GC-TCD	2	Shimadzu GC-2010
Germany	GC FID, GC-MSD, NDIR	2	Agilent, Borgwaldt
Hungary	GC, Karl Fischer titrator	2 GC, 1 titrator	Chrompack, Agilent
Germany	As in ISO	-	Agilent
Lithuania	Smoking machine	1	RM 20 “Borgwaldt technik”
Spain	Smoking machine	2	Borgwaldt RM 200 with CO analyser, Borgwaldt RM 20H GC-FID
Czech republic	smoking machine (Borgwaldt RM20), GC (Agilent 7890A), CO analyser (Borgwaldt C21)	smoking machine - 1 pc, GC - 1 pc, CO analyser - 1 pc	smoking machine (Borgwaldt RM 20), GC (Agilent, CO analyser (Borgwaldt)
France	PERKIN ELMER	1	CERULEAN SM450
England	GC	-	HP 6890
Slovenia	GC-FID, KARL-FISCHER TITRATOR, SMOKING MACHINE	2 GC-FID, 1 KARL-FISCHER TITRATOR, 1 SMOKING MACHINE	GC-FID (AGILENT 6890), KARL-FISCHER TITRATOR 795, SMOKING MACHINE (RM20)
Spain	GC-FID/TCD	2	Thermo Quest, Varian 450 GC.
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Nitrogen Oxides			
England		1	
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
VOCs			
The Netherlands	GC-MS	2	Agilent Iontrap 240 / Agilent Quadrupole

Germany	GC-MSD	4	Agilent, AB Sciex
Greece	GC-HPLC		
France	-	-	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Tobacco specific N-nitrosamines			
The Netherlands	LC-MS	1	Sciex QTrap 6500
Germany	LC-MS	1	AB Sciex
Greece	GC-HPLC	-	-
France	-	-	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Aldehydes			
Bulgaria	HPLC UV-VIS	1	Perkin Elmer
The Netherlands	HPLC-DAD	1	Shimadzu LC-20
Germany	HPLC-DAD	1	Agilent
Greece	HPLC	-	-
France	-	-	-
Spain	UPLC-PDA	2	Waters Acquity
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Metals			
France	ICP-MS	1	Brucker
The Netherlands	ICP-MS	1	Thermo iQAP RQ
Greece	XRF	-	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Ammonia in tobacco filler			
Greece	Ionic chromatography	-	-

Spain	Ion chromatography with conductivity detection	1	Waters 1525 B.pump/717 AS/ 432 Conductivity detector
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Humectants in tobacco filler			
The Netherlands	GC-FID	2	Shimadzu GC-2010
Germany	GC-FID	1	Agilent
Germany	GC	2	Agilent
France	-	-	-
Spain	GC-FID	2	Thermo Quest/ Varian 450GC
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Other additives			
Austria	-	2	-
France	GC-MS	1	Agilent with Gerstel Maestro
The Netherlands	GC-MS	2	Agilent - Gerstel / Agilent Ion-trap
Germany	HPLC-DAD, GC-MS	3	Agilent
Spain	GC-FID	2	As before
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Cigarettes ventilation			
France	binocular microscope	1	Olympus
Germany	-	1	Borgwaldt
Germany	-	1	OMI+ (Borgwaldt KC)
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Others			
Austria	HPLC DAD	2	-
The Netherlands	HPLC-ELSD	1	Schambeck ELSD ZAM3000

Germany	-	-	-
Lithuania	GC-FID	2	Shimadzu GC-2010
France	-	-	-

Tabella 1 e-cigarettes

	Analytical instrument	Number of instrument(s)	Model of instrument
Nicotine			
Austria	HPLC DAD	2	-
Ireland	-	-	-
France	GC-MS	3	Shimadzu & Agilent
The Netherlands	GC-FID	2	Shimadzu GC-2010
Germany	GC-FID	1	Agilent
Hungary	GC	2	Chrompack, Agilent
Greece	HPLC - GC		
France	GC-MS	3	
Germany	vaping machine, GC	-	LM4E (Borgwaldt KC), Agilent
Spain	-	-	-
France	-	-	-
Slovenia	GC-FID	2	6890 AGILENT
Spain	GC/FID	2	Thermo Quest
Denmark	GC-FID, GC-MS	2	GC 6980
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Flavours			
Austria	GC MSMS, GC MS	3	-
France	GC-MS	1	Agilent
The Netherlands	GC-MS	1	Agilent Ion-trap
Germany	GC-MS	1	Agilent
Greece	GC/MS	-	-
France	GC-MS/FID	1	Shimadzu QP 2020
Spain	-	-	-

Denmark	GC-MS, GC-HS-MS	2	GC 6980 with HS-unit
Vitamins			
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Stimulant additives			
France	GC-MS and LC	-	-
Irland	-	-	-
Denmark	IC-UV (Taurin), GC-MS (Caffein)	2	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Substances which have CMR properties			
Austria	HPLC, GC MS, GC FID		
The Netherlands	LC-MS	1 / 1	Sciex QTrap 6500
Germany	GC-MS	1	Agilent
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Glycols other than propylene glycol			
Austria	HPLC RID	1	-
France	GC-MS	3	Shimadzu or Agilent
The Netherlands	GC-FID	2	Shimadzu GC-2010
Germany	GC-FID	1	Agilent
France	GC-MS, FC-FID	4	-
Germany	Vaping machine, GC	-	LM4E (Borgwaldt (KC), Agilent
France	-	-	-
Spain	GC/FID	2	Thermo Quest
Denmark	GC-FID (in some case GC-MS)	2	6890

	Analytical instrument	Number of instrument(s)	Model of instrument
Aldehydes			
The Netherlands	HPLC-DAD	1	Shimadzu LC-20
Germany	HPLC-DAD	1	Agilent
Greece	HPLC		
France	HPLC-DAD	2	
Germany	see method	vaping machine, HPLC	LM4E (Borgwaldt (KC), Agilent
France	-	-	-
Denmark	HPLC	3	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Metals			
Austria	ICP MS	-	-
The Netherlands	ICP-MS	1	Thermo iQAP RQ
Greece	XRF	-	-
France	ICP MS	1	-
Germany	electrostatic trap	-	HV1 (Borgwaldt KC)
France	-	-	-
Denmark	ICP	2	-
	Analytical instrument	**Number of instrument(s)**	**Model of instrument**
Others			
Austria	-	-	-
Germany	GC-MS	1	Agilent
France	GC-MS for Diactetyle and Acetyl propionyl. HPLC-DAD for aldehydes (1) + Closed cup equilibrium method for (2)	4	-
Denmark	mechanical testing devices	2	-
Switzerland	-	-	-

11. Annex III - Analysis performed on e-cigarettes and NTP

	TNCO	Nitrogen oxides	VOCs	Tobacco N-nitrosamines	Aldehydes	Metals	Ammonia	Humectants	Other additives	Cigarettes ventilation	Other	n
Austria	-	-	-	-	-	-	-	-	√	-	√	2
Ireland	√	-	-	-	-	-	-	-	-	-	-	1
Bulgaria	√	-	-	-	√	-	-	-	-	-	-	2
France	-	-	-	-	-	√	-	-	√	√	-	3
The Netherlands	√	-	√	√	√	√	-	√	√	-	√	8
Germany	√	-	√	√	√	-	-	√	√	√	-	7
Hungary	√	-	-	-	-	-	-	-	-	-	-	1
Greece	-	-	√	√	√	√	√	-	-	-	-	5
Germany	√	-	-	-	-	-	-	√	-	√	√	4
Lithuania	√	-	-	-	-	-	-	-	-	-	-	1
Spain	√	-	-	-	-	-	-	-	-	-	-	1
Czech republic	√	-	-	-	-	-	-	-	-	-	-	1
France	√	-	√	√	√	-	-	√	-	-	√	5
England	√	√	-	-	-	-	-	-	-	-	-	2
Slovenia	√	-	-	-	-	-	-	-	-	-	-	1
Spain	√	-	-	-	√	-	√	√	√	-	-	5
Greece	√	-	-	-	-	-	-	-	-	-	-	1
Latvia	√	-	-	-	-	-	-	-	-	-	-	1
Greece	√	-	-	-	-	-	√	√	-	-	-	3
n	16	1	4	4	6	3	3	6	5	3	4	

12. Annex IV - Analysis performed on e-cigarettes and NTP

	Nicotine	Flavours	Vitamins	Stimulant additives	Substances CMR properties	Glycols	Aldehydes	Metals	Others	n
Austria	√	√	-	-	√	√	-	√	√	6
Ireland	√	-	-	-	-	-	-	-	-	1
France	√	√	-	-	-	√	-	-	-	3
The Netherlands	√	√	-	-	√	√	√	√	-	6
Germany	√	√	-	-	√	√	√	-	√	6
Hungary	√	-	-	-	-	-	-	-	-	1
Greece	√	√	-	-	-	-	√	√		4
France	√	√	-	-	-	√	√	√	√	6
Germany	√	-	-	-	-	√	√	√	-	4
Spain	√	√	-	-	-	-	-	-	-	2
France	√	-	-	√	-	√	√	√	-	5
Ireland	-	-	-	√	-	-	-	-	-	1
Slovenia	√	-	-	-	-	-	-	-	-	2
Spain	√	-	-	-	-	√	-	-	-	2
Denmark	√	√	-	√	-	√	√	√	√	7
Switzerland	-	-	-	-	-	-	-	-	√	1
Latvia	√	-	-	-	-	-	-	-	-	1
Greece	√	-	-	-	-	√	-	-	-	2
n	16	7	0	3	3	10	7	7	5	

Abbreviations

C: conclusion (it refers to the number of the conclusion(s) of WP8 survey, see ANNEX 1)

CA: Competent Authority

MS: Member States

TPD: Tobacco Products Directive

WHO: World Health Organization

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