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# Setting up of an efficient system to monitor the quality of fuels on the market

**TAIEX/ ECRAN Workshop on Climate Legislation in relation to Transport (cars and vans, labelling, renewables and fuel quality)**
Wednesday, April 14th, Tirana, Albania

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Problem setting

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## Introduction

- The fuel production and delivery chain is a complex system
- Fuel quality can deteriorate due to intentional or unintentional causes
- Fuel Quality Monitoring (FQM) can prevent or minimize risks

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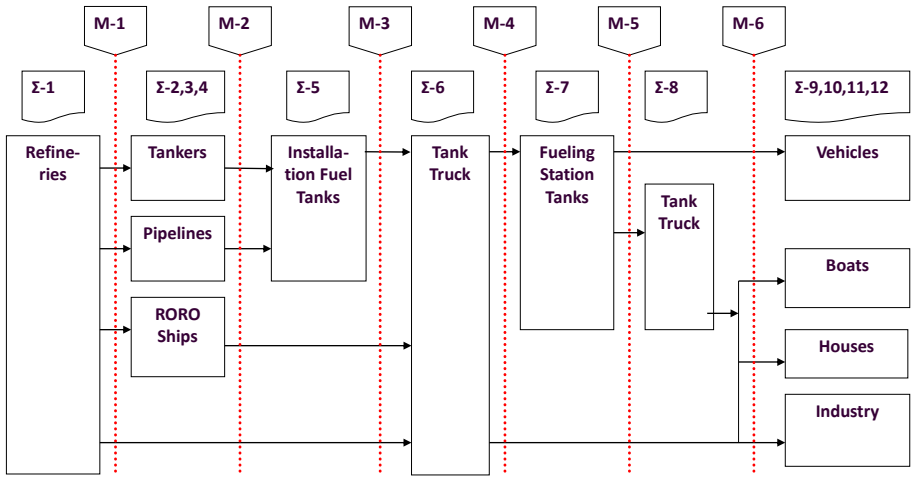
## Schematic of the Downstream Supply Chair

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## Unintentional Fuel Failures

- Fuel deterioration due to bad storage or handling
- Unintentional fuel mixing in the delivery network
- Presence of water or emulsions (unintentionally added at the delivery or storage network)
- Traces of rust
- Bacteria infection of storage tanks

→ In general, due to bad practices and lack of efficient Quality Assurance procedures in the supply chain

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## Intentional Fuel Failures (fuel smuggling)

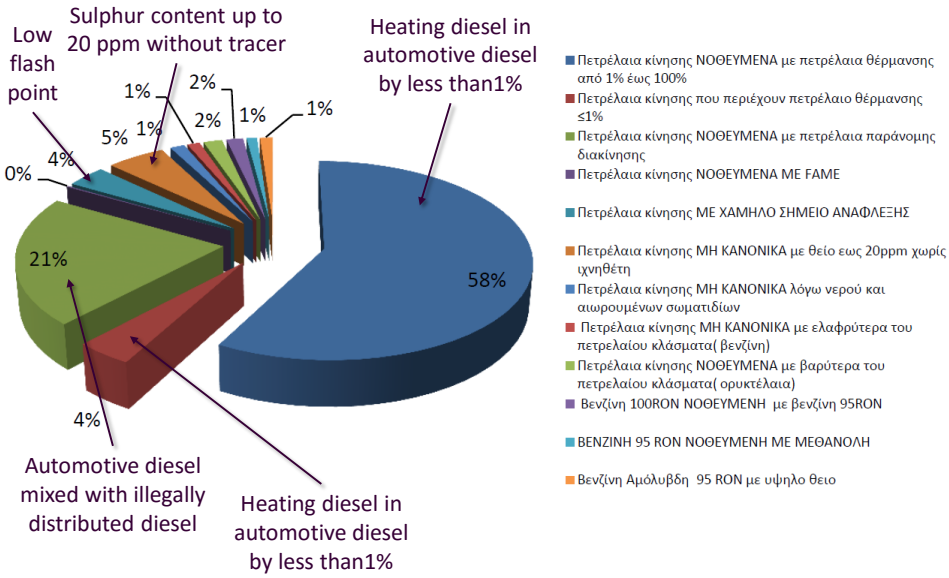
- Fake exports – illegal imports
- Fake fuelling (e.g. use of marine fuels for other purposes)
- Mixing of fuels of higher quality and price with fuels of lower quality and price



## Typical illegal fuel mixing

- Marine diesel in automotive diesel or heating diesel
- Heating diesel in automotive diesel
- Illegal diesel or diesel that has undergone decolourization and destruction of tracers in automotive diesel
- Regular unleaded petrol in lead replacement petrol or in high octane petrol
- Chemical compounds (toluene, hexane, methanol etc.) in petrol
- Diesel in petrol
- White spirit in diesel
- Lubricants in diesel
- FAME in diesel

## Reasons for non-compliance of fuels (Greece, 2011)

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## Problem on the side of vehicles

- Efforts are made by vehicle manufacturers to optimise vehicles in terms of:
  - energy conversion efficiency
  - exhaust emission levels
  - durability of emission control systems
- Following strict technical specifications in market fuels contributes to achieving higher degrees of performance from vehicles and their emission reduction technologies
- Fuel Quality issues may cause exhaust aftertreatment or engine component failures
- Fuel quality may prevent certain vehicle models entering specific markets

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## Targets of a Fuel Quality Management System (FQMS)

- Ensure fuel quality at any point of the supply chain
- Protect consumers
- Environmental / health / technical / financial
- Safety issues and product handling
- Prohibit tax and duty evasion
- Prevent off-spec fuel
  - Unintentional
  - Intentional

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## Operational solution

- Controls
- Proper organization of the prosecution services
- Existence of necessary means of enforcement of prosecution and strict punishments
- Existence of the necessary and appropriate personnel

- Some technical aids
  - Colouring of fuels, e.g:
    - solvent yellow 124 (6 mg/l, max 9 mg/l of heating fuel)
    - quinizarin or solvent orange 86 (3 mg/l of marine diesel
  - Additivation with tracing elements

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Problem setting

Legislation of the European Union

Fuel Quality Monitoring in EU Member States

Good practice worldwide



## Implementation of FQD by member states

- Under the Fuel Quality Directive (FQD) 98/70/EC EU Member States must report various types of information relating to the quality of fuels sold in their territories
- More specifically, Member States must
  - sample fuels
  - analyse their technical characteristics
  - ensure that they are consistent with the requirements of FQD
- The European Environment Agency (EEA) is supporting DG Climate Action in the compilation, quality checking and dissemination of reported information

## Key documents for official fuel quality requirements in EU

- Directive 98/70/EC (quality of petrol and diesel fuels, amending Council Directive 93/12/EEC)
- Commission Decision 2002/159/EC (common format for the submission of national fuel quality data
- European Standard EN 14274:2003 (FQMS for Member States)
- Directive 2003/17/EC
  - amending directive 98/70/EC (quality of petrol and diesel fuels)
- Directive 2009/30/EC
  - amending directive 98/70/EC (specification of petrol, diesel and gas-oil, introduction of a mechanism to monitor and reduce GHG emissions)
  - amending directive 1999/32/EC (specification of fuel used by inland waterway vessels
  - repealing directive 93/12/EEC

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## Information required to be submitted by each country

1. **Country details** including responsible organisations, country size, summer period, a description of the FQMS used and the location of sampling)
2. **FQMS information**, including a description of sampling undertaken, FQMS administration
3. **National legislation** that transposed the FQD and reporting periods
4. **Fuel sales information**, including details of fuel sales by fuel type, bioethanol contents, the number of samples taken in winter and summer periods and the number of technical parameters measured
5. **Exceedances** of the fuel quality limits, including a summary of the parameters for which exceedances were reported for the fuel grades measured

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**Directive 98/70/EC: Test Methods, Limit Values and Tolerance Limits***

*Based on information provided by the European Commission, Belgium, the German Environmental Protection Agency, Italy, Irish EPA, UK DTI and CEN TC19

**Petrol**

| Parameter | Unit | 2003/17/EC Limit values | | Test specified in Directive or EN 228 | | | Tolerance limits (95% confidence) | |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Method | Date | Reproducibility, R* | Minimum | Maximum |
| Research Octane Number (RON) | -- | 95 | | EN-ISO 5164 | 2005 | 0.7 | 94.6 | |
| (RON 91 fuel only) | -- | 91 | | EN-ISO 5164 | 2005 | 0.7 | 90.6 | |
| Motor Octane Number (MON) | -- | 85 | | EN-ISO 5163 | 2005 | 0.9 | 84.5 | |
| (RON 91 fuel only) | -- | 81 | | EN-ISO 5163 | 2005 | 0.9 | 80.5 | |
| Vapour Pressure, DVPE | | | | | | | | |
| --summer period (normal) | kPa | | 60 | EN 13016-1 | 2007 | 3.0 | | 61.8 |
| --summer period (arctic or severe weather conditions) | kPa | | 70 | EN 13016-1 | 2007 | 3.2 | | 71.9 |
| Distillation * | | | | | | | | |
| --evaporated at 100 °C | % v/v | 46 | | EN-ISO 3405 | 2011 | 4.0 | 43.6 | |
| -- evaporated at 150 °C | % v/v | 75 | | EN-ISO 3405 | 2011 | 4.0 | 72.6 | |
| Hydrocarbon analysis | | | | | | | | |
| -- Olefins | % v/v | | 18.0 | ASTM D1319 | 95a | 4.6 | | 20.7 |
| *without oxygenates | | | | ASTM D1319* | 95a | 6.5 | | 21.8 |
| | | | | EN 14517 | 2004 | 2.6 | | 19.5 |
| -- Olefins (RON 91 fuel only) | % v/v | | 21.0 | ASTM D1319 | 95a | 5.1 | | 24.0 |
| | | | | EN 14517 | 2004 | 3.0 | | 22.8 |
| -- Aromatics (up to 2004) | % v/v | | 42.0 | ASTM D1319 | 95a | 3.7 | | 44.2 |
| | | | | EN 14517 | 2004 | 2.0 | | 43.2 |
| -- Aromatics (from 2005) | | | 35.0 | ASTM D1319 | 95a | 3.7 | | 37.2 |
| | | | | EN 14517 | 2004 | 1.7 | | 36.0 |
| -- Benzene | % v/v | | 1.0 | EN 12177 | 1998 | 0.10 | | 1.06 |
| | | | | EN 238 | 1996 | 0.17 | | 1.10 |
| | | | | EN 14517 | 2004 | 0.05 | | 1.03 |
| Oxygen content | % m/m | | 2.7 | EN 1601 | 1997 | 0.3 | | 2.9 |
| Oxygenates | | | | | | | | |
| -- Methanol | % v/v | | 3 | EN 1601 | 1997 | 0.4 | | 3.2 |

Introduction | Instructions | Methods&Limits | Contacts&FQMS | FQMS | Sales | Annex I (Sampling PS)

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**Contacts & Summary**

**Details of those compiling the Fuel Quality Monitoring Report**

The authorities responsible for compiling the fuel quality monitoring report are requested to complete the table below.

| | |
|---|---|
| Reporting Year: | 2010 |
| Country: | |
| Date Report Completed: | |
| Organisation Responsible for Report | |
| Address of Organisation Street: | |
| City: | |
| Postcode: | |
| Person Responsible for Report: | |
| Telephone Number: | |
| Email: | |

Country
Please select reporting country from list.

**DEFINITIONS AND EXPLANATION**

*Parent fuel grade*: Directive 98/70/EC sets the environmental specifications for petrol and diesel fuel marketed in the EU. The specifications in the Directive can be thought of as 'parent fuel grades'. These include (i) regular unleaded petrol (RON > 91), (ii) unleaded petrol (RON > 95) and (iii) diesel fuel.

*National fuel grade*: Member States may, of course, define 'national' fuel grades which must still, however, respect the specification of the parent fuel grade. For example, national fuel grades may comprise super unleaded petrol (RON > 98), lead replacement petrol, zero sulphur petrol, zero sulphur diesel, etc.
*Zero sulphur or sulphur-free fuels:* As of 1st January 2009 sulphur content of all fuels marketed within a member state territory must not exceed a maximum of 10 mg/kg.

**SUMMARY REPORTING FORMAT FOR PETROL & DIESEL**

Member States are requested to provide a brief general summary of the results of the year's monitoring, including information on any:
- other parameters measured;
- exclusions;
- further details on breaches of parameter tolerance limits (i.e. number of samples, values);
- enforcement actions taken as a result of breaches of the limit values/tolerance limits; and

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## Fuel Quality Monitoring System

**Year:** 2010

**Description of Fuel Quality Monitoring System**

Member States should provide details on the operation of their national fuel quality monitoring systems.
Directive 98/70/EC requires the vapour pressure of petrol to be less than 60.0 kPa during the summer period, which spans 1 May until 30 September. However, for those Member States that experience 'arctic or severe weather conditions' the summer period covers the period 1 June to 31 August and the vapour pressure must not exceed 70 kPa. Member States are requested to define the Summer/Winter periods implemented in their territories and also applying to their fuel quality monitoring system reporting.

***Definition of Monitoring System Summer and Winter Periods:***

| | |
|---|---|
| **Summer Period** | |
| *Start* | |
| *End* | |
| **Winter Period** | |
| *Start* | |
| *End* | |

* Normal = 1st May to 30th September; Arctic = 1st June to 31st August

Member States should indicate whether their monitoring system is set up using the European Standard EN 14274:2003 statistical model A, B or C and whether it is based on the large or small country framework. Alternatively, the Member State should indicate if they are using their own nationally defined system. Where using a Nationally defined system, please include details of the system and the reson for using this system based on National conditions.

| **Country Size (L = Large, S = Small)** | | ***Please Note*: A country is classified as *Large* if total automotive fuel sales exceed 15 millions tons per annum.** | |
|---|---|---|---|
| | *Please select "Yes" below according to FQM model used* | **Minimum number of samples each period* (Petrol, per grade; Diesel)** | |
| **Fuel Quality Monitoring System model used:** | **Yes / No** | **Small Country** | **Large Country** |
| EN 14274 Statistical Model A | No | 50 | 100 |
| EN 14274 Statistical Model B | No | 100 | 200 |
| EN 14274 Statistical Model C | No | 50 | -- |
| National System | No | -- | -- |

If Member States **are** using the European Standard EN 14274:2003, they should also provide details on the sampling programme by completing the relevant



# 2010 FQM Reporting Template_Final5.xls

## Total Sales of Petrol and Diesel

**Year:** 2010

Member states are requested to complete the following table, as applicable detailing the quantities of each type and grade of petrol and diesel fuel marketed in their territory.

***NB: Please do not report national fuel grade sales under more than one category. To provide further information about automotive road fuel sampling, please use the comments box, below.**

| **Fuel Grade[2]** | **Name of national fuel grade** | **National sales total** | | **No. Samples** | | | |
|---|---|---|---|---|---|---|---|
| | | **Litres** | **Tonnes** | **Service Stations** | **Terminals** | **Refinery** | **Total** |
| Regular unleaded petrol (minimum RON = 91)[1] | | | | | | | 0 |
| Unleaded petrol (minimum RON = 95)[1] | | | | | | | 0 |
| Unleaded petrol (minimum 95 =< RON < 98)[1] | | | | | | | 0 |
| Unleaded petrol (minimum RON >= 98)[1] | | | | | | | 0 |
| **Total Petrol** | | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | |
| Diesel fuel[2] | | | | | | | 0 |
| **Total Diesel** | | 0 | 0 | 0 | 0 | 0 | 0 |

1 as specified in Annex I of Directive 98/70/EC with maximum sulphur content of 10ppm.
2 as specified in Annex II of Directive 98/70/EC with maximum sulphur content of 10ppm.

| **Comments (completeness of data, particular issues, additional information, etc.)** |
|---|
| |

# 2010 FQM Reporting Template_Final5.xls

**ANNEX I: Fuel Quality Monitoring System Regional Sampling of Petrol and Diesel (1)**

| | |
|---|---|
| **Country:** | |
| **Fuel type:** | Petrol |
| **Statistical Model (A, B or C) (2)** | Select Model used in FQMS |
| **Reporting Year:** | 2010 |
| **Period:** | Summer |

| | | | | | | The number of samples to be tested per fuel grade | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Min. number of samples per grade:** | | | | | | | | | | |
| | | | | | | Actual number of samples taken | | | | |
| | **Macro / Non-Macro Regions** | **Fuel Consumption (million tonnes)** | **Variability factor (3)** | **Proportion of total samples** | **Min. number of Samples per grade (4)** | **Grade:** | **Grade 1** | **Grade 2** | **Grade 3** | **Grade 4** | **Grade 5** |
| | | | | | | **Name/ID:** | | | | | |
| 1 | | | | - | - | | | | | | |
| 2 | | | | - | - | | | | | | |
| 3 | | | | - | - | | | | | | |
| 4 | | | | - | - | | | | | | |
| 5 | | | | - | - | | | | | | |
| 6 | | | | - | - | | | | | | |
| 7 | | | | - | - | | | | | | |
| 8 | | | | - | - | | | | | | |
| 9 | | | | - | - | | | | | | |
| 10 | | | | - | - | | | | | | |
| 11 | | | | - | - | | | | | | |
| 12 | | | | - | - | | | | | | |
| 13 | | | | - | - | | | | | | |
| 14 | | | | - | - | | | | | | |
| 15 | | | | - | - | | | | | | |
| 16 | | | | - | - | | | | | | |
| 17 | | | | - | - | | | | | | |
| 18 | | | | - | - | | | | | | |
| 19 | | | | - | - | | | | | | |
| 20 | | | | - | - | | | | | | |
| 21 | | | | - | - | | | | | | |
| 22 | | | | - | - | | | | | | |
| 23 | | | | - | - | | | | | | |
| 24 | | | | - | - | | | | | | |
| 25 | | | | - | - | | | | | | |

Remainder



# 2010 FQM Reporting Template_Final5.xls

**Annex V: Market Fuels used in Vehicles with Spark Ignition Engines (Petrol)**

| | |
|---|---|
| **Country** | |
| **Reporting Year** | 2010 |
| **Period** | Summer |
| **Parent fuel grade** | Petrol |
| **National fuel grade** | |
| **Summer Period*** | 1st May to 30th September (normal) |

* 1st May to 30th September (normal) or 1st June to 31st August (arctic).

**Reporting results**

| **Parameter** | **Unit** | **Analytical and statistical results** (Please see an explanation and examples for new columns/ information required in Cells I15 to K37 on the *Introduction & Instructions tab).* | | | | | | | | | **Limiting Value (1)** | | | | **Test method** (more recent versions may also be used) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **National Specification, if any** | | **According to Directive 2009/30/EC** | | | |
| | | **N° Samples** | **Minimum** | **Maximum** | **Median** | **Mean** | **Standard Deviation** | **N° Samples outside 95% tolerance limit** | **25% of Sample Value** | **75% of Sample Value** | **Minimum** | **Maximum** | **Minimum** | **Maximum** | **Method** | **Date** |
| Research Octane Number | -- | | | | | | | | | | | | | | | |
| Motor Octane Number | -- | | | | | | | | | | | | | | | |
| Vapour Pressure, DVPE –summer period only | kPa | | | | | | | | | | | | | | | |
| Distillation | | | | | | | | | | | | | | | | |
| -- evaporated at 100 °C | % (v/v) | | | | | | | | | | | | | | | |
| -- evaporated at 150 °C | % (v/v) | | | | | | | | | | | | | | | |
| Hydrocarbon analysis | | | | | | | | | | | | | | | | |
| -- Olefins | % (v/v) | | | | | | | | | | | | 95 (2) | | EN 25164 | 1993 |
| -- Aromatics | % (v/v) | | | | | | | | | | | | 85 (3) | | EN 25163 | 1993 |
| -- Benzene | % (v/v) | | | | | | | | | | | | | (4) 60.0 | PrEN 13016-1 | 1997 |
| Oxygen content | % (m/m) | | | | | | | | | | | | 46.0 | | PrEN ISO 2405 | 1999 |
| Oxygenates | | | | | | | | | | | | | | | | |
| -- Methanol | % (v/v) | | | | | | | | | | | | | 75.0 | | |
| -- Ethanol | % (v/v) | | | | | | | | | | | | | | | |
| -- Iso-propyl alcohol | % (v/v) | | | | | | | | | | | | | 18.0 (5) | ASTM D 1319 | 1995 |
| -- Tert-butyl alcohol | % (v/v) | | | | | | | | | | | | | 35.0 | ASTM D 1319 | 1995 |
| -- Iso-butyl alcohol | % (v/v) | | | | | | | | | | | | | 1.0 | EN 238 | 1996 |
| -- Ethers with <5 carbon atoms / molecule | % (v/v) | | | | | | | | | | | | | 2.7 | EN 1601 PrEN 13132 | 1997 1998 |
| -- other oxygenates | % (v/v) | | | | | | | | | | | | | | | |

Problem setting

Legislation of the European Union

Fuel Quality Monitoring in EU Member States

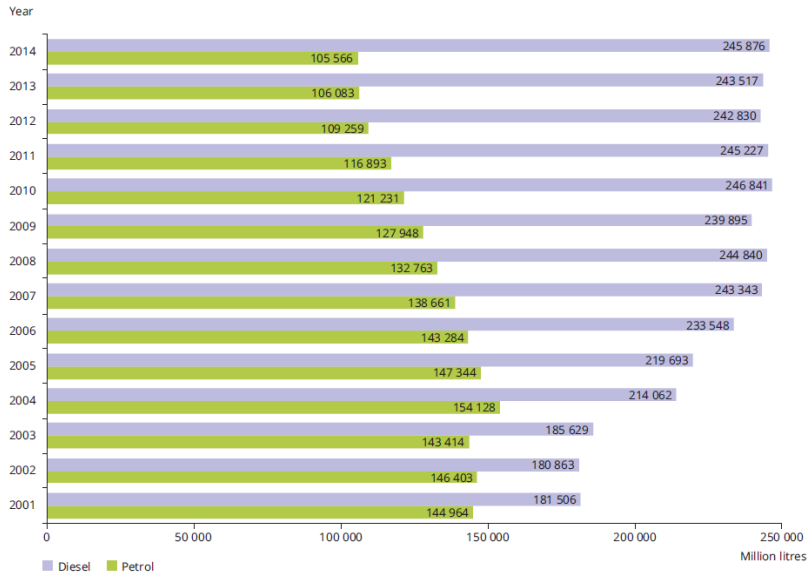
Good practice worldwide



## Common problems

- FQMS model not declared
- No fuel sales reported in the regional sampling sheets
- Biofuel content not provided or incorrect units used
- Missing values for various fuel parameters
- Summer-grade fuel samples taken outside the summer period
- Exceedances of certain fuel quality parameters (e.g. summer vapour pressure, sulphur content, etc.), without specifying the number of samples outside the tolerance limits, or providing any explanations or a description of the action taken
- Analytical and statistical values (e.g. maximum, minimum, median, mean, etc.) reported for the full year not consistent with the corresponding summer/winter data

## How the EU market looks like (yearly evolution)

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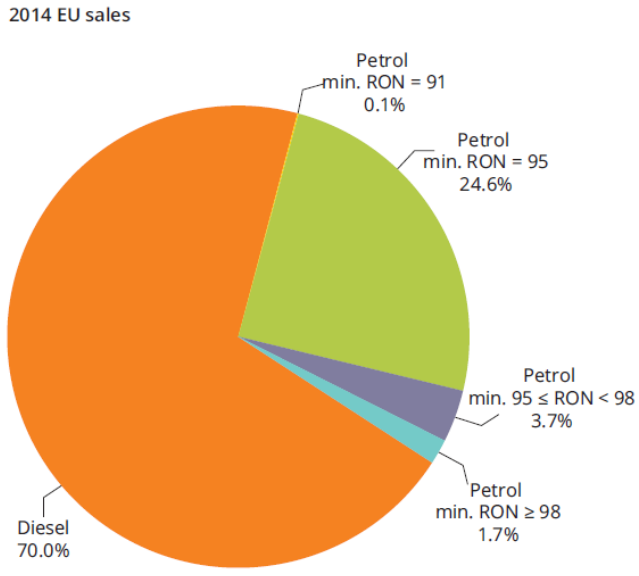
## How the EU market looks like (share of sales)

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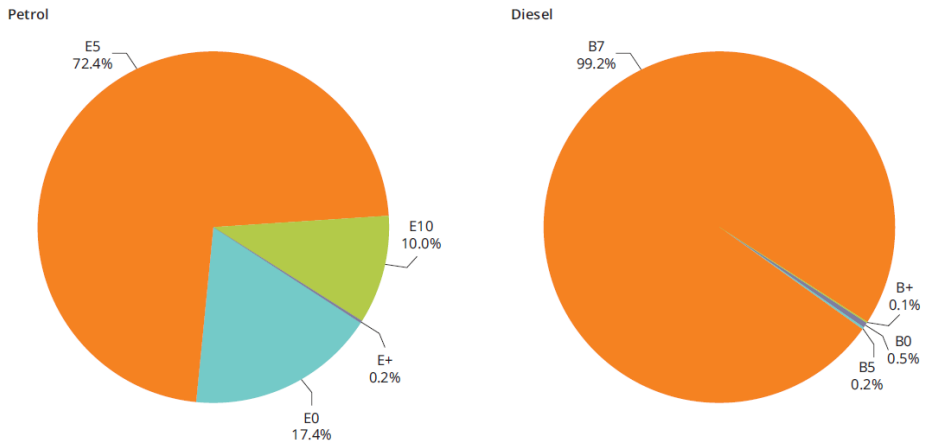
## Use of biocomponents

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## Definition of country size

- L, large country

total automotive road fuel sales of > 15 million tonnes per annum

- S, small country:

total automotive road fuel sales of < 15 million tonnes per annum

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## FQMS summary

| Member State | FQMS model | Country size | Summer and winter sampling | Total samples required (a) | |
|---|---|---|---|---|---|
| | | | | Petrol | Diesel |
| Austria | A | S | Yes | 106 | 104 |
| Belgium | National | S | Yes | 200 | 100 |
| Bulgaria | B | S | Yes | 205 | 200 |
| Croatia | C | S | Yes | 105 | 100 |
| Cyprus | C | S | Yes | 106 | 100 |
| Czech Republic | C | S | Yes | 104 | 104 |
| Denmark | National | S | Yes | 200 | 100 |
| Estonia | C | S | Yes | 108 | 100 |
| Finland | A | S | Yes | 200 | 100 |
| France | B | L | Yes | 1 211 | 400 |
| Germany | B | L | Yes | 849 | 400 |
| Greece | A | S | Yes | 105 | 100 |
| Hungary | C | S | Yes | 103 | 100 |
| Ireland | C | S | Yes | 100 | 100 |
| Italy | A | L | Yes | 200 | 200 |
| Latvia | National | S | Yes | 113 | 200 |
| Lithuania | C | S | Yes | 104 | 200 |
| Luxembourg | National | S | Yes | 200 | 100 |
| Malta | National | S | Yes | 100 | 100 |
| Netherlands | A | | Yes | 101 | 100 |
| Poland | B | L | Yes | 444 | 400 |
| Portugal | C | S | Yes | 108 | 100 |
| Romania | B | S | Yes | 212 | 200 |
| Slovakia | C | S | Yes | 101 | 100 |
| Slovenia | C | S | Yes | 106 | 100 |
| Spain | A | L | Yes | 215 | 200 |
| Sweden | National | S | Yes | 103 | 100 |
| United Kingdom | National | L | No | 208 | 200 |

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## Fuel Quality Monitoring Systems

- EN 14274 Statistical Model A — macro-regions
- EN 14274 Statistical Model B — non-macro-regions
- EN 14274 Statistical Model C — non-region model
- National models

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## EN 14274 Statistical Model A — macro-regions

- Regions within the country are grouped (preserving some geographical identity) into macro-regions
- Target is to have
  - similar total sales volumes relative to each other
  - approximately the same number of different supply sources
- This approach is recommended, as it is designed to capture fuel variations efficiently and hence requires a smaller number of samples
- Minimum overall number of samples per grade and per season: 50 per small country and 100 per large country

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## EN 14274 Statistical Model B — non-macro-regions

- If the construction of macro-regions (based on fuel supply patterns) is not possible within a country, then the country shall be divided into regions using only geographic and administrative criteria.
- To ensure that fuel variability is reliably captured, a large number of samples per grade is required: 100 for small countries and 200 for large countries.

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## EN 14274 Statistical Model C — non-region model

- If the country is small and it can be demonstrated that a division into macro-regions or non-macro-regions is not possible, having considered the procedures and provisions given in this European standard, then the country shall be considered one region for sampling purposes
- A total of 50 samples per grade and per season are required



## National models

Some countries have implemented their own models for the FQMS in accordance with their national legislation:

- Belgium
- Denmark
- Latvia
- Luxembourg
- Malta
- Sweden
- United Kingdom

## Minimum number of samples per fuel grade in each winter and summer period

- For fuel grades with market shares of ≥10%

| Model | A | B | C |
|---|---|---|---|
| **Small-size country** | | | |
| Petrol, per grade | 50 | 100 | 50 |
| Diesel fuel | 50 | 100 | 50 |
| **Large-size country** | | | |
| Petrol, per grade | 100 | 200 | N/A |
| Diesel fuel | 100 | 200 | N/A |

- For each fuel grade with a market share of < 10%, considering petrol and diesel separately:

$N_{grade\ i} = market\ share_{grade\ i} / market\ share_{parent\ grade} \times N_{parent\ grade}$

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## FQMS summary

| Member State | Samples taken | | Non-compliant | | Parameters outside tolerance limits for non-compliant samples |
|---|---|---|---|---|---|
| | Petrol | Diesel | Petrol | Diesel | |
| Austria | 106 | 99 | 1 | 0 | Vapour pressure |
| Belgium | 1 843 | 5 885 | 53 | 68 | RON, Vapour pressure, Sulphur content, FAME content |
| Bulgaria | 267 | 382 | 11 | 20 | RON, Vapour pressure, Distillation, Ethanol, Sulphur content |
| Croatia | 134 | 182 | 3 | N/A | Vapour pressure, Benzene, Cetane number, Density at 15 C, Distillation |
| Cyprus | 265 | 140 | 15 | 2 | Vapour pressure, Sulphur content |
| Czech Republic | 1 007 | 1 201 | 4 | 10 | Vapour pressure, Aromatics, Oxygen content, Ethanol, Cetane number, Density at 15 C, Distillation, Sulphur content, FAME content |
| Denmark | 39 | 20 | 0 | 20 | RON, MON, Vapour pressure, FAME content |
| Estonia | 351 | 209 | 20 | 1 | MON, Vapour pressure, Aromatics |
| Finland | 225 | 117 | 5 | 8 | RON, MON, Distillation, Aromatics |
| France | 476 | 408 | 12 | 14 | Vapour pressure, Benzene, Sulphur content, FAME content |
| Germany | 726 | 394 | 22 | 1 | Oxygen content, Sulphur content, FAME content |
| Greece | 114 | 100 | 2 | 19 | Vapour pressure, Oxygen content, Ethanol, Sulphur content, FAME content |
| Hungary | 120 | 120 | 0 | 2 | FAME content |

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## FQMS summary (cont'd)

| Member State | Samples taken | | Non-compliant | | Parameters outside tolerance limits for non-compliant samples |
|---|---|---|---|---|---|
| | Petrol | Diesel | Petrol | Diesel | |
| Ireland | 100 | 100 | 14 | 3 | RON, Vapour pressure, Sulphur content, FAME content |
| Italy | 200 | 200 | 7 | 2 | RON, Vapour pressure, Sulphur content |
| Latvia | 70 | 156 | 5 | 0 | RON, Aromatics, Benzene |
| Lithuania | 106 | 100 | 0 | 0 | |
| Luxembourg | 69 | 86 | 1 | 0 | Oxygen content |
| Malta | 61 | 65 | 0 | 0 | |
| Netherlands | 102 | 100 | N/A | N/A | MON, Vapour pressure, Aromatics, Distillation |
| Poland | 528 | 403 | 5 | 6 | RON, MON, Oxygen content, Distillation, Sulphur content, FAME content |
| Portugal | 50 | 42 | 0 | 0 | |
| Romania | 100 | 100 | 0 | 0 | |
| Slovakia | 152 | 120 | 8 | 2 | RON, MON, Vapour pressure, Olefins, Aromatics, FAME content |
| Slovenia | 135 | 151 | N/A | 0 | Sulphur content |
| Spain | 200 | 200 | N/A | 1 | Vapour pressure, Distillation (evaporated at 100 and 150 C), Oxygen content, Sulphur content |
| Sweden | 552 | 684 | 0 | 0 | |
| United Kingdom | 1 282 | 2 361 | 43 | 3 | Vapour pressure, Aromatics, Oxygen content, Density at 15 C, FAME content |

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## Summary of FQMS in EU for 2014

- Most Member States are using one of the Statistical Models A, B or C.
- Seven Member States are using a national monitoring system.
- Most key fuel parameters in the samples taken are within the tolerance limits. Only very few exceedances are observed.
- Almost all Member States (with the exception of Romania and the United Kingdom) provided information for both summer and winter fuel grades.

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## Summary of FQMS in EU for 2014 (cont'd)

- Petrol reporting exceedances:
  - Summer vapour pressure (in 16 Member States (MS))
  - RON in (9 MS)
  - Aromatics, oxygen content and distillation (in 6 MS)
- Diesel reporting exceedances:
  - Sulphur content (in 12 MS)
  - Fatty Acid Methyl Ester (FAME) content (in 11 MS)

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Problem setting

Legislation of the European Union

Fuel Quality Monitoring in EU Member States

Good practice worldwide

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## Good practices in USA, Japan, UK – ICCT working paper

- The International Council on Clean Air Transportation (ICCT) performed a survey among countries applying efficient Fuel Quality Inspection programmes
- Experiences have been presented in a public working paper No. 2011-11 entitled Best Practices for Fuel Quality Inspection Programs (Freda Fung, November 2011)



## Steps for establishing a FQA program

- Establish in-house capacity to enforce fuel standards
  - Fuel sampling and testing can be outsourced to contractors
  - The environmental agency should design and execute the reporting and testing → ensures that the regulatory agency and the industry are not over-burdened with paperwork and fuel testing
- Secure funding for conducting fuel testing and managing the program
  - Substantial resources for conducting comprehensive fuel quality inspections and for verifying and auditing industry-submitted testing data are needed.
  - If substantial funding cannot be secured initially, the regulatory agency may prioritize resources by conducting a small number of targeted tests at retail stations that are suspected of selling fuel that is off specifications
  - Potential funding sources: fuel taxes, vehicle taxes, fuel registration fees, retail station registration fees, vehicle registration fees and/or inspection and maintenance (I/M) fees

## Steps for establishing a FQA program (cont'd)

- Seek authority to impose non-compliance fines
  - Punitive non-compliance fines provide considerable incentives for fuel providers to comply with regulations.
  - The environmental agency should seek the authority to impose non-compliance fines on the oil industry and retailers.
- Secure industry cooperation (mandatory/voluntary self testing, and mandatory reporting)
  - Since funding for fuel testing programs is limited for many countries, it would be best to spend the limited resources on conducting targeted testing or limited randomized testing.
  - The government should leverage industry resources by demanding industry-funded self-testing and monitoring.



## Conclusions on the FQM experiences

- Fuel regulation to compete with air quality and human health effects can only be realized with an effective fuel quality management program.
- Advanced emission control devices, which are susceptible to damage by fuel specifications (e.g. high sulphur), could be more often deployed.
- Worldwide experience suggest that an effective program should include three key elements:
  1. Fuel sampling and testing upstream at the refineries/import facilities and retail stations
  2. A presumptive liability policy that places the burden of testing on industry to assure fuel quality along the distribution chain
  3. Heavy non-compliance penalties

## Acknowledgements


- European Environment Agency, Emisia S.A., EU fuel quality monitoring 2014
- ICCT, Best Practices for Fuel Quality Inspection Programs
- Dr. Nikolaos Liapis, Doctoral Thesis
- Liisa Kiuru, Fuel Quality Strategies, International Fuel Quality Center
- Greek Ministry of Finance, Working Group for the development of an integrated fuel tracing system




Thank you for your attention


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