UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE
Republic of Serbia
Ministry of Trade, Tourism and Telecommunications
Republic of Serbia
Ministry of Mining and Energy
NATIONAL PETROLEUM COMMITTEE OF SERBIA
WORLD PETROLEUM COUNCIL
University of Belgrade
Faculty of Mechanical Engineering
CEI
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ČESKÁ ASOCIACE
PETROLEJÁŘSKÉHO PRŮMYSLU A OBCHODU
CZECH ASSOCIATION
OF PETROLEUM INDUSTRY AND TRADE
Project co-financed by the CEI Know-How Exchange Programme sponsored by the CEI Fund at the EBRD

Categorization of fuel quality deviations

FUELPAGE

Non-compliant fuels

- Deviation of minimum one quality parameter from the limiting values quality parameters
- Various scope and severity of deviations →
- CATEGORIZATION OF FUEL QUALITY DEVIATIONS

  a document made by accredited test laboratory which tests motor fuels within the framework of Czech FQMS
- 3 basic categories of deviations caused by:
  - Negligence (category 1 and 2)
  - Failure in production (category 3)
  - Willful manipulation - illegal mixing (category 3)

3 categories of deviations

1. Operational deviations (category 1)

- Deviations caused by negligence
- They occur during distribution and storage due to no respect towards operational rules (rest of fuel in tank, joint pipelines for petrol and diesel, wrong connection of recuperation technology) → cross contamination of fuels
- The most frequent deviations occur in the following parameters: flash point (diesel), distillation (petrol), sulfur content (gas oil 0.1)??

- Subdivision: 1A - less serious deviation

  1B - serious deviation

3 categories of deviations

2. Seasonal deviations (category 2)

- **Deviations caused by negligence**
- **They occur during the change of fuel quality (the change of winter/summer fuel grade) due to the change of season**
- ***The most frequent deviations occur in the following parameters: vapor pressure (petrol), CFPP (diesel)***
- **Subdivision: 2A - less serious deviation**

(2B - serious deviation)

3 categories of deviations

3. Failure in production or willful manipulation (category 3)

- Deviations caused by:
  - Failure/malfunction in production
  - Illegal mixing of tax-free or tax-reduced substances
- These, often serious, deviations bring following risks
  - Harm to customer: damage of fuel system, engine, catalyst
  - Negative impact to environment (air pollution)
  - Tax evasion (the crime)
- Subdivision: (3A - less serious deviation)

  3B - serious deviation

Sanctioning for motor fuels deviations

All 3 quality deviation is subdivided:

A - less serious deviation

B - serious deviation

Usual practice by ČOI is applied as follows:

A: financial sanction in range 10-100 ths. CZK (depending on first or repeatable deviation, locality, capacity of Station, existence of quality management system), Station is not closed, unsatified fuel is sent back to refinery or WS for reprocessing

B: financial sanction in range 100-500 ths. CZK (depending on locality, capacity of Station, existence of quality management system), Station is closed, unsatified fuel is sent back to refinery or WS for reprocessing

FQMS Czech Republic 2014

Motor fuel quality at Retail Stations in 2014 according ČOI

product	Number of samples	Not in compliance with ČSN	%	Not in compliance members of ČAPPO (%)
Gasolines	1008	10	1,0	0,00/0
Disel	1202	27	2,2	0,15/4
Bio-diesel, E85	116	9	7,8	0,08/2
LPG a CNG	338	37	10,9	0,0/0
Total	2664	83	3,1	0,22/6

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PETROL

FUELPAGE

Petrol – octane number

Fuel quality parameter	Limit	Result	Category
Research Octane Number	95.0/…	> 94.6/…	O.K.
		94.5 - 94.1	1A
		94.0 - 93.5	1B
		93.4 - 93.0	3A
		< 93.0	3B
Motor Octane Number	85.0/…	> 84.5	O.K.
		84.4 - 84.0	1A
		83.9 - 83.5	1B
		83.4 - 83.0	3A
		< 83.0	3B

Petrol – vapor pressure

Fuel quality parameter	Limit	Result	Category
DVPE (kPa) (vapor pressure)	45.0 - 60.0 (class A) (summer)	43.0 - 62.0	O.K.
		62.1 - 70.0	2A
		> 70.0	2B
		42.9 - 40.0	3A
		< 40.0	3B

Petrol – distillation

Fuel quality parameter	Limit	Result	Category
<u>Distillation (% V/V):</u> E100	46.0 - 71.0	44.0 - 73.0	O.K.
		42.0 - 43.9	3A
		73.1 - 76.0	3A
		< 42.0	3B
		> 76.0	3B
<u>Distillation (% V/V):</u> E150	75.0	> 74.0	O.K.
		73.9 - 72.0	3A
		< 72.0	3B

+ E70 and final boiling point

Petrol – hydrocarbon composition

Fuel quality parameter	Limit	Result	Category
Aromatics (% V/V)	35.0	< 37	O.K.
		37.1 - 40.0	3A
		> 40.0	3B
Olefines (% V/V)	18.0	< 20.8	O.K.
		20.9 - 22.0	3A
		> 22.0	3B
Benzene (% V/V)	1.00	< 1.10	O.K.
		1.11 - 1.50	3A
		> 1.50	3B

Petrol – oxygenates

Fuel quality parameter	Limit	Result	Category
Methanol (% V/V)	3.0	< 3.2	O.K.
		3.3 - 4.0	3A
		> 4.0	3B
Ethanol (% V/V)	5.0 (E5)	< 5.2	O.K.
		5.3 - 7.5	1A
		7.6 - 10.0	1B
		10.1 - 20.0	3A
		> 20.0	3B

Other oxygenates - no deviations observed

Petrol – total oxygen

Fuel quality parameter	Limit	Result	Category
Oxygen content (% m/m)	2.70 (E5)	< 2.70	O.K.
		2.91 - 3.80	1A
		3.81 - 4.60	1B
		4.61 - 8.00	3A
		> 8.01	3B

Petrol – sulfur content

Fuel quality parameter	Limit	Result	Category
Sulfur content (mg/kg)	10	< 13	O.K.
		13.1 – 30.0	1A
		30.1 – 50.0	1B
		50.1 – 100	3A
		> 100	3B

Petrol – lead and manganese

Fuel quality parameter	Limit	Result	Category
Lead content (mg/l)	5.0	< 5.5	O.K.
		5.5 - 8.0	3A
		> 8.0	3B
Manganese content (mg/l)	2.0	< 2.6	O.K.
		2.7 - 6.0	3A
		> 6.0	3B

\+ categorization for other tested parameters for quality monitoring



Petrol – other tested parameters



Fuel quality parameter	Limit	Result	Category
Final boiling point (°C)	210.0	< 214	O.K.
		214.1 - 225.0	1A
		225.1 - 240.0	1B
		240.4 - 260.0	3A
		> 260	3B

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DIESEL

FUELPAGE

Diesel for moderate climate (1)

Fuel quality parameter	Limit	Result	Category
Cetane number	51.0	> 48.4	O.K.
		45.8 - 48.3	3A
		< 45.8	3B
Density (kg/m^3)	820 (min)	> 819.0	O.K.
		818.1 - 818.9	3A
		< 818.0	3B
	845 (max)	< 846.0	O.K.
		846.1 - 848.0	3A *
		> 848.0	3B **

** if the sample contains FAME in the range 7.4-8.0 % ……..1A*

*** if the sample contains FAME in the range 8.1-10.0 % ……1B*

FUELPAGE

Diesel for moderate climate (2)

Fuel quality parameter	Limit	Result	Category
Distillation: T95 (°C)	360	< 365.0	O.K.
		365.1 - 375.0	3A
		> 375.0	3B
Polycyclic aromatic hydrocarbon (% m/m)	8.0	< 8.6	O.K.
		8.7 - 10.0	3A
		> 10.0	3B

Distillation:

+ R250 and R350 (% V/V recovered at 250 and 350 °C)

Diesel for moderate climate (3)

Fuel quality parameter	Limit	Result	Category
Sulfur (mg/kg)	10.0	< 12.0	O.K.
		12.1 - 30.0	1A
		30.1 - 50.0	1B
		50.1 - 100.0	3A
		> 100.0	3B
FAME (% V/V)	7.0	< 7.4	O.K.
		7.4 - 8.0	1A
		8.1 - 10.0	1B
		10.1 - 15.0	3A
		> 15.0	3B

Diesel – other tested parameters



Fuel quality parameter	Limit	Result	Category
Flash point (°C) 	55.0	< 52.5	O.K.
		52.5 - 45.0	1A
		< 45.0 !!!	1B

+ testing and categorization of other parameters, …

… CFPP - very important for operability in winter

Other fuels

- Categorization of deviations for other tested fuels:
  - CNG
  - Biodiesel (B100)
  - High FAME diesel (B30)
  - Ethanol fuel (E85)
  - LPG

Favorite fuel in Serbia:

Total consumption of gasoline and LPG in 2014 was in the ratio of 100 : 75

LPG – categorization of deviations (1)

Fuel quality parameter	Limit	Result	Category
Motor Octane Number (calculated)	89.0	> 88.8	O.K.
		88.7 - 88.0	1A
		< 88.0	1B
Sulfur (mg/kg)	50.0	< 71	O.K.
		72 - 85	3A
		> 85	3B
Hydrogen sulphide (positive/negative)	negative	negative	O.K.
		positive	3A

LPG – categorization of deviations (2)

Fuel quality parameter	Limit	Result	Category
Dienes content (% mol/mol)	0.5	< 1.1	O.K.
		1.2 - 1.5	3A
		> 1.5	3B
Evaporation residue (mg/kg)	60	< 74	O.K.
		75 - 90	1A
		> 90	1B
Copper strip corrosion	class 1	class 1	O.K.
		class 2	3A
		> class 2	3B

THANK YOU FOR YOUR ATENTION