



INZRAK

Enhanced environmental protection inspection for efficient control of air quality monitoring and of all entities under obligation within system of greenhouse gas emission allowance trading, in order to achieve better quality of air in Republic of Croatia



REPUBLIKA HRVATSKA

MINISTARSTVO ZAŠTITE  
OKOLIŠA I ENERGETIKE



 **safu** | SREDIŠNJA AGENCIJA ZA  
FINANCIARANJE I UGOVARANJE



This project is funded by the European Union



**EKOENERG**

Institut za energetiku i zaštitu okoliša

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# DOCUMENTS FOR MONITORING AND REPORTING OF GREENHOUSE GAS EMISSIONS OF ETS PARTICIPANTS

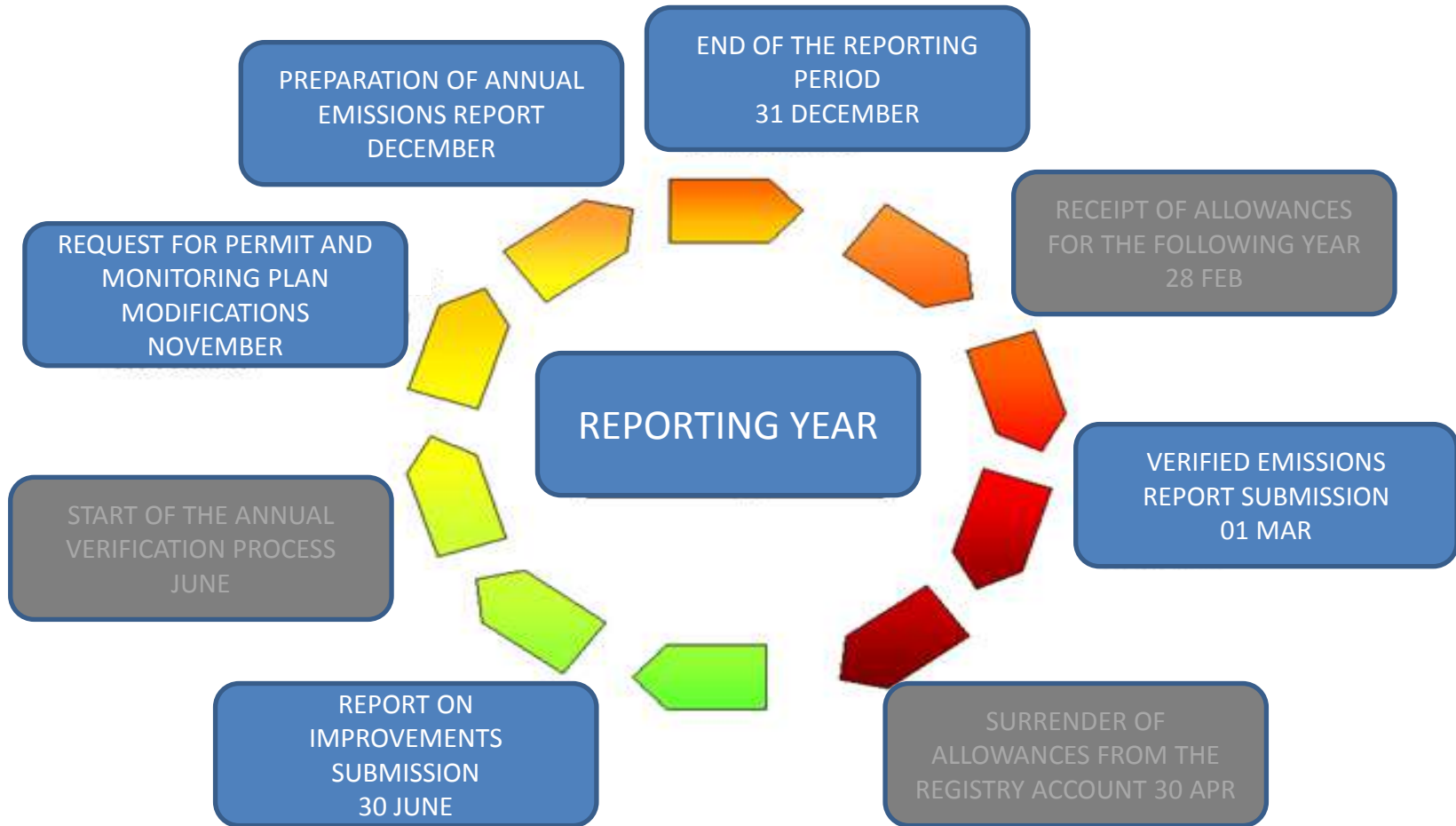
# CONTENTS

- **Reporting templates**
- **EC guidelines for operators and verifiers**
- **EC guidelines for implementation of inspection**
- **Greenhouse gas emissions national inventory**
- **Tools for calculation of emission factors, risk assessment, unjustified costs and frequency of analyses**

# REPORTING TEMPLATES

- **Reporting templates**
  - Emissions monitoring plan,
  - Emissions report,
  - Verification report,
  - Report on improvements,
  - Template for new participants and cessation of operations of an installation

# REPORTING TEMPLATES



# REPORTING TEMPLATES

- **Monitoring plan**

- Pursuant to Regulation EC 601/2012 – Chapter II, Article 11-15
- Determines a detailed, complete and transparent documentation of the monitoring methodology of a specific installation or aircraft operator
- Fundamental element of the system, established by Regulation 601/2012
- Each operator or aircraft operator monitors greenhouse gas emissions on the basis of a monitoring plan approved by the competent authority
- Standardized and simplified monitoring plans
- Monitoring plan modifications
- If an aircraft operator plans to request a free allocation of emission allowances they shall also submit a monitoring and reporting plan on tonne kilometres

# REPORTING TEMPLATES

- **Monitoring plan**

- Minimum content of the Monitoring plan - [Annex I](#)
- For stationary sources:
  - 1. general information on the installation
  - 2. detailed description of methodology on the basis of a calculation
  - 3. description of the fall-back method
  - 4. detailed description of methodology on the basis of measurements

# REPORTING TEMPLATES

- **Monitoring plan**

- Minimum content of the Monitoring plan - [Annex I](#)
- For aircraft operators:
  - 1. the identification of the aircraft operator, call sign or other unique designator used for air traffic control purposes, contact details of the aircraft operator and of a responsible person at the aircraft operator, contact address, the administering Member State, the administering competent authority
  - 2. an initial list of aircraft types in its fleet
  - 3. a description of the procedures used to monitor the completeness of the list of flights
  - 4. a description of the written procedures for monitoring fuel consumption in every aircraft



# REPORTING TEMPLATES

- **Monitoring plan**

- Minimum content of the Monitoring plan - [Annex I](#)
- Minimum content of monitoring plans for tonne-kilometre data:
  - 1. a description of the written procedures used for determining tonne-kilometre data per flight
  - 2. a description of the procedures used to determine the mass of freight and mail
  - 3. a description of the measurement devices used for measuring the mass of passengers, freight and mail

# REPORTING TEMPLATES

- **Emission report**

- Pursuant to Regulation EC 601/2012 – Chapter VI, Articles 67-68
- The operator or aircraft operator shall submit to the competent authority by 31 March of each year an emission report that covers the annual emissions of the reporting period and that is verified in accordance with Regulation (EU) No 600/2012.
- The annual emission reports and tonne-kilometre data reports shall at least contain the information listed in [Annex X](#)
  - 1. Annual emission reports of stationary source installations
  - 2. Annual emission reports of aircraft operators
  - 3. Tonne-kilometre data reports of aircraft operators

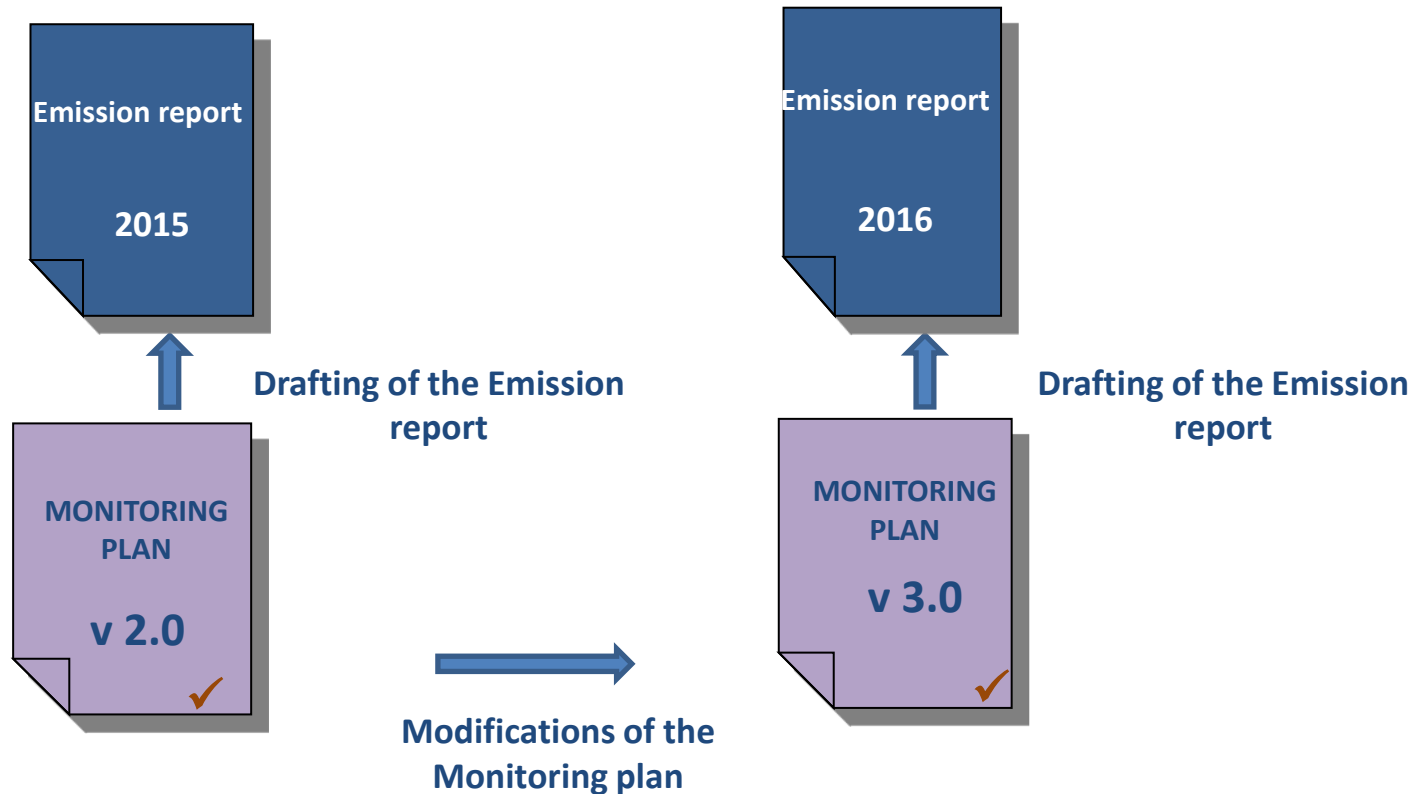
# REPORTING TEMPLATES

- **Emission report**

- Covers annual emissions from the installation
- On the basis of year-round monitoring
- Requirements for a complete report:
  - year-round emission monitoring
  - monitoring on the basis of a Monitoring plan
  - formal approval of the Monitoring plan before the beginning of the year
  - all necessary data gathered before the drafting

# REPORTING TEMPLATES

- Emission report must be made on the basis of a Monitoring plan



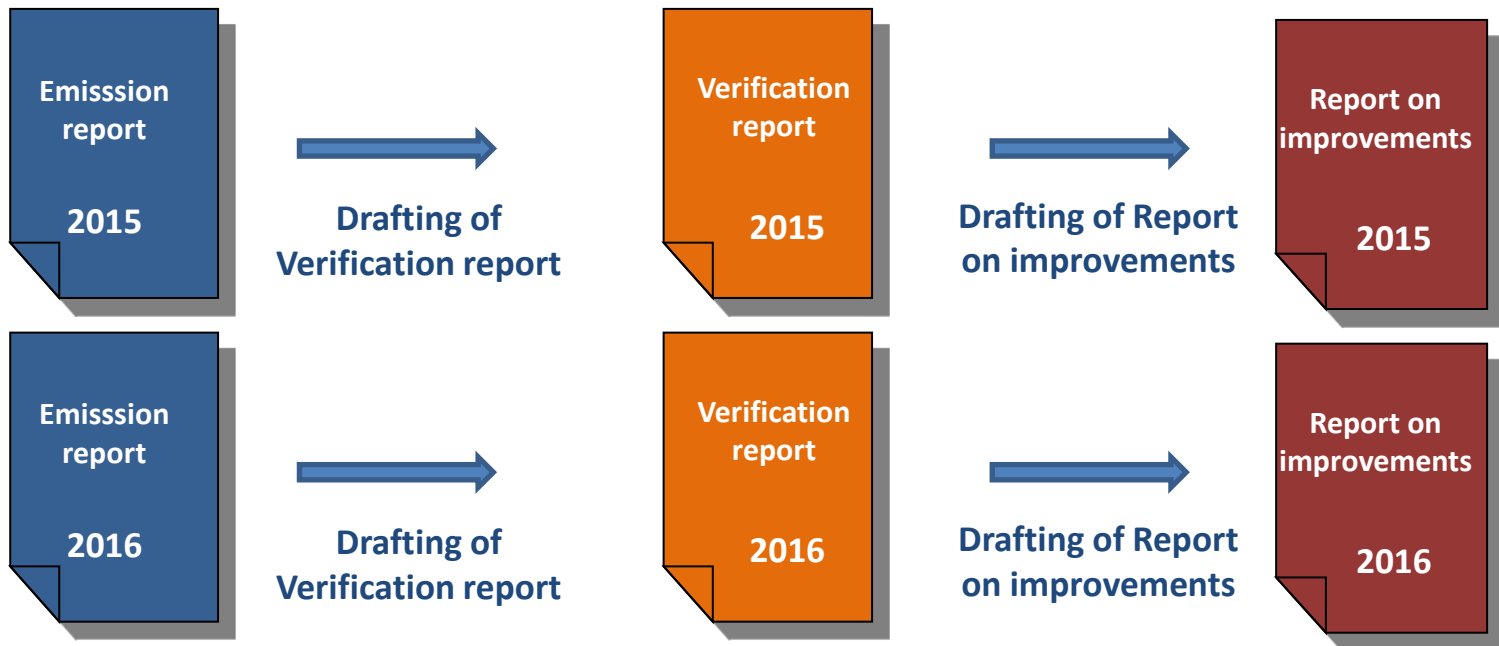
# REPORTING TEMPLATES

- **Verification report**

- Regulation EU 600/2012, Article 27
- Verification of emission reports and tonne kilometre reports
- Based on the information collected during the verification, the verifier shall issue a verification report to the operator or aircraft operator on each emission report or tonne kilometre report that was subject to verification
  - satisfactory
  - satisfactory with comments
  - contains material misstatements that were not corrected
- Internal verification documentation does not have predetermined templates
- The verifier shall submit the internal verification documentation and the verification report to an independent reviewer

# REPORTING TEMPLATES

- **Verification report may lead to a need for a report on improvements**



# REPORTING TEMPLATES

- **Report on improvements**

- Pursuant to Regulation EC 601/2012 – Chapter VI, Article 69
- Each operator or aircraft operator shall regularly check whether the monitoring methodology applied can be improved
- Report on improvements shall be submitted using a European Commission template
- Operators shall draft a Report on improvements:
  - 1. Where the operator does not apply at least the tiers required
  - 2. Where the operator applies a fall-back monitoring methodology
  - 3. Where the verification report established outstanding non-conformities or recommendations for improvements

# REPORTING TEMPLATES

- **Report on improvements**
  - Submitted to the competent authority:
    - for a category A installation, by 30 June every four years;
    - for a category B installation, by 30 June every two years;
    - for a category C installation, by 30 June every year.



# REPORTING TEMPLATES

- **Report on improvements**

- Where the verification report established in accordance with Regulation (EU) No 600/2012 states outstanding non-conformities or recommendations for improvements, the operator or aircraft operator shall submit to the competent authority for approval a report by 30 June of the year in which that verification report is issued by the verifier
- That report shall describe how and when the operator or aircraft operator has rectified or plans to rectify the non-conformities identified by the verifier and to implement recommended improvements

## REPORTING TEMPLATES

- **Template for new participants and cessation of operations of an installation (OG 70/2015)**
  - Member States have the right for free allocation of emission allowances
  - Operator of a new installation which meets conditions for free allocation of emission allowances may submit a request to the Ministry within 1 year of the start of regular operation of the installation or sub-installation
  - New installation operator shall submit data on activities, methodology report and verification report along with the request

## REPORTING TEMPLATES

- **Template for new participants and cessation of operations of an installation (OG 70/2015)**
  - Significant capacity reduction – reduces the preliminary annual amount of free emission allowances
  - Installation closure- Ministry issues an order to the Agency for cessation of issuing free emission allowances starting with the year following the year in which the installation ceased activities
  - Partial cessation of operations of an installation – reduction in the level of activity, on the basis of the emission report, notifies inspections



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**THANK YOU FOR YOUR ATTENTION**

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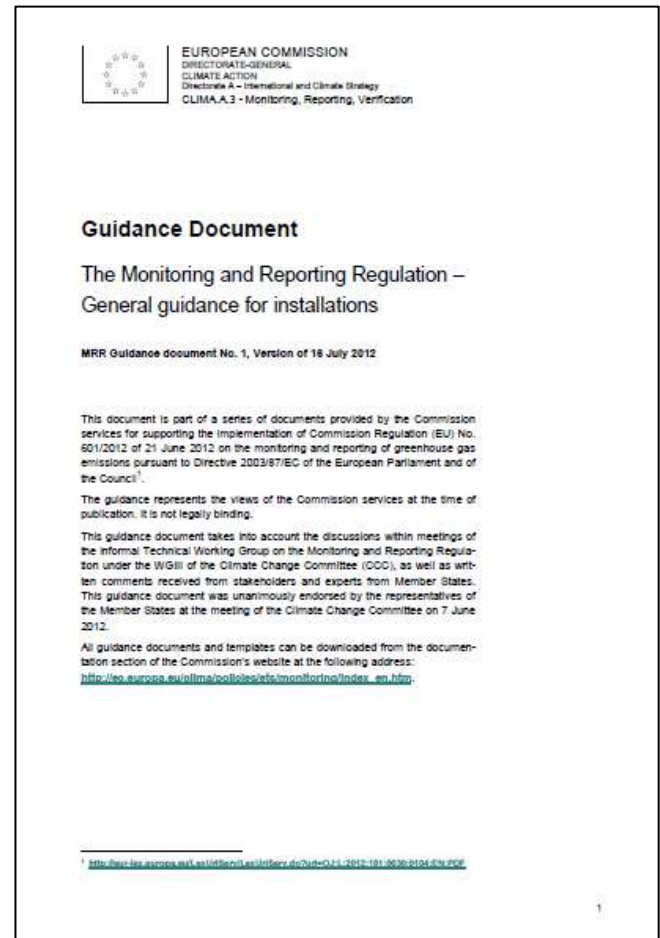
# DOCUMENTS FOR EMISSION MONITORING AND REPORTING BY ETS PARTICIPANTS

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- **EC guidelines for inspection**
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- **Tools for calculation of emission factors, risk assessment, unjustified costs and frequency of analyses**

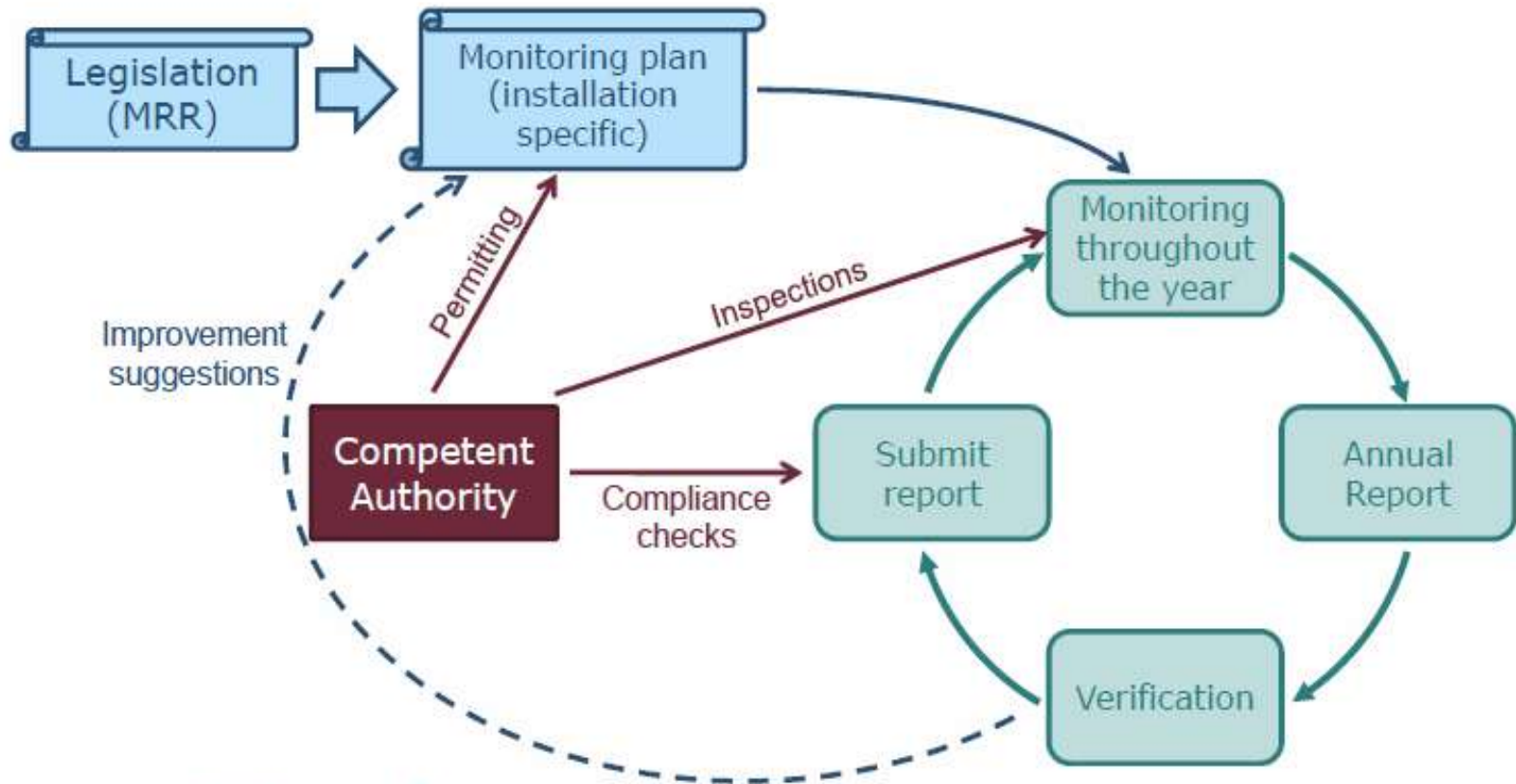
# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **Instructions for monitoring and reporting**
  - <http://www.haop.hr/hr/tematska-podrucja/zrak-klima-tlo/klimatske-promjene>
  - Arised from Commission Regulation 601/2012
  - Provides an introduction to the system of compliance with the EU ETS, concepts used for monitoring and reporting on stationary installations
  - Gives a detailed description of requirements determined in the monitoring and reporting Regulation
  - The purpose of these instructions is to aid in accurate interpretation and facilitate implementation





# EC GUIDELINES FOR OPERATORS AND VERIFIERS



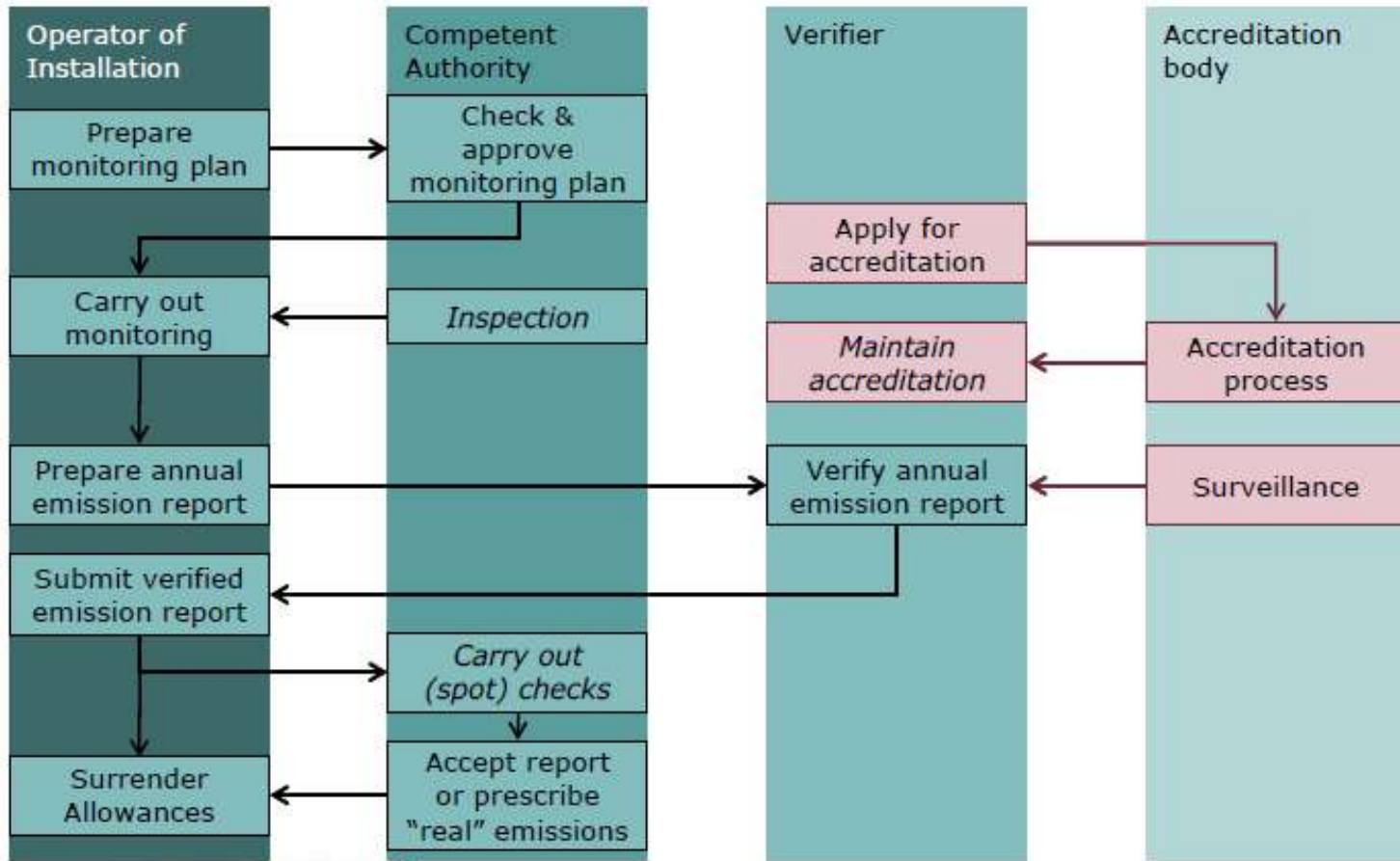
Picture by  umweltbundesamt

# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- Annual reporting cycle

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	Start of the period	█																		
2	CA issues allowances	█	█										█							
3	Operator carries out monitoring	█	█	█	█	█	█	█	█	█	█	█	█							
4	Operator contracts verifier	█			█	█	█						█							
5	Verifier starts analysis							█	█	█	█	█	█	█						
6	Operator compiles annual report										█	█	█	█						
7	Verifier finalizes verification												█	█	█					
8	Operator submits report to CA															█				
9	CA assesses reports																█	█	█	█
10	CA issues allowances															█				
11	Operator surrenders allowances																	█		
12	Operator reports on improvements																			█
13	Monitoring of following year													█	█	█	█	█	█	█

# EC GUIDELINES FOR OPERATORS AND VERIFIERS



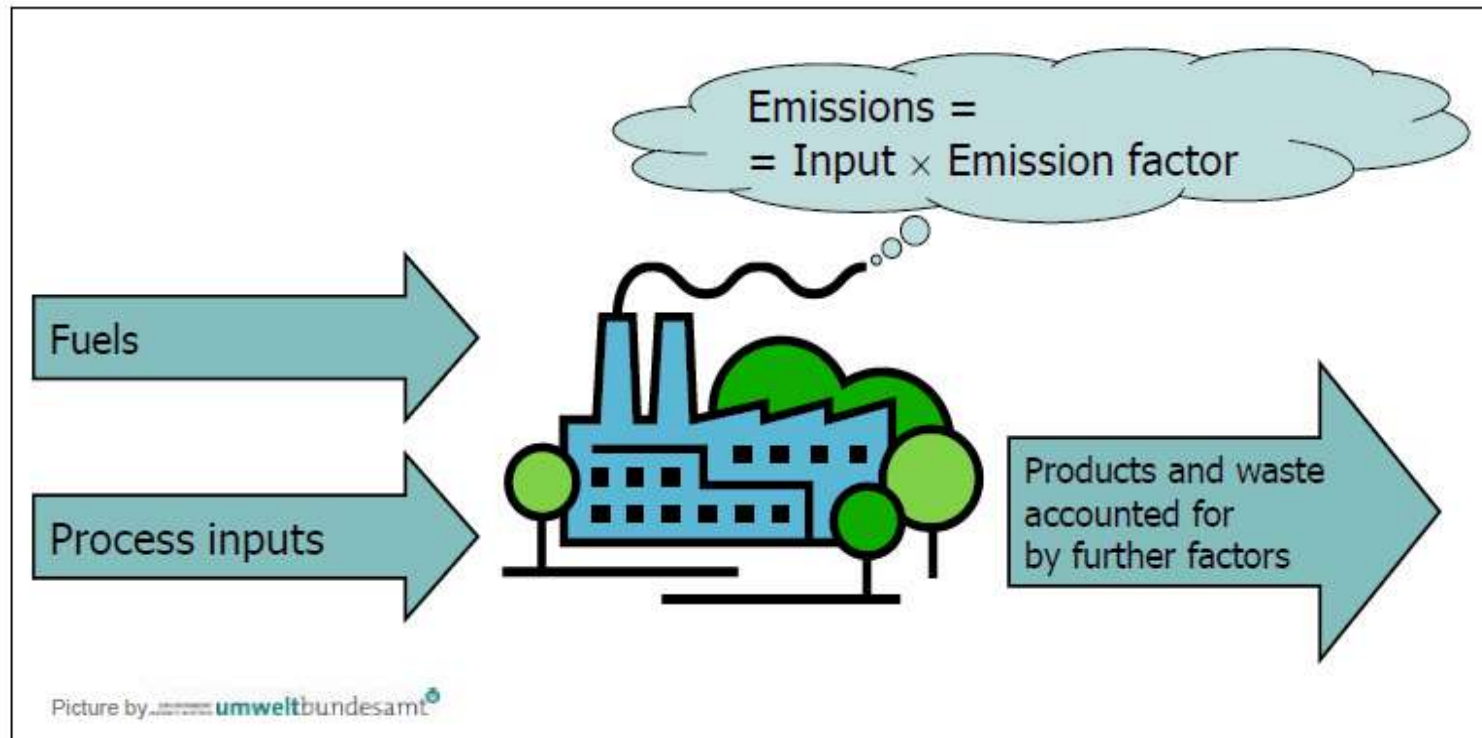
# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **Importance of the Monitoring plan**
  - The most important document for each installation participating in EU ETS = Cookbook for emission monitoring
  - Monitoring plan typical elements:
    - Data gathering (measuring device, invoices, production protocols...)
    - Sampling of materials and fuel
    - Laboratory analyses of fuel and materials
    - Measuring device maintenance and calibration
    - Description of calculations and formula that will be used
    - Oversight activities (e.g. „four eyes” principle for data gathering)
    - Data archiving (including protection from manipulation)
    - Regular identification of possibilities for improvement

# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **CONCEPTS AND APPROACHES**

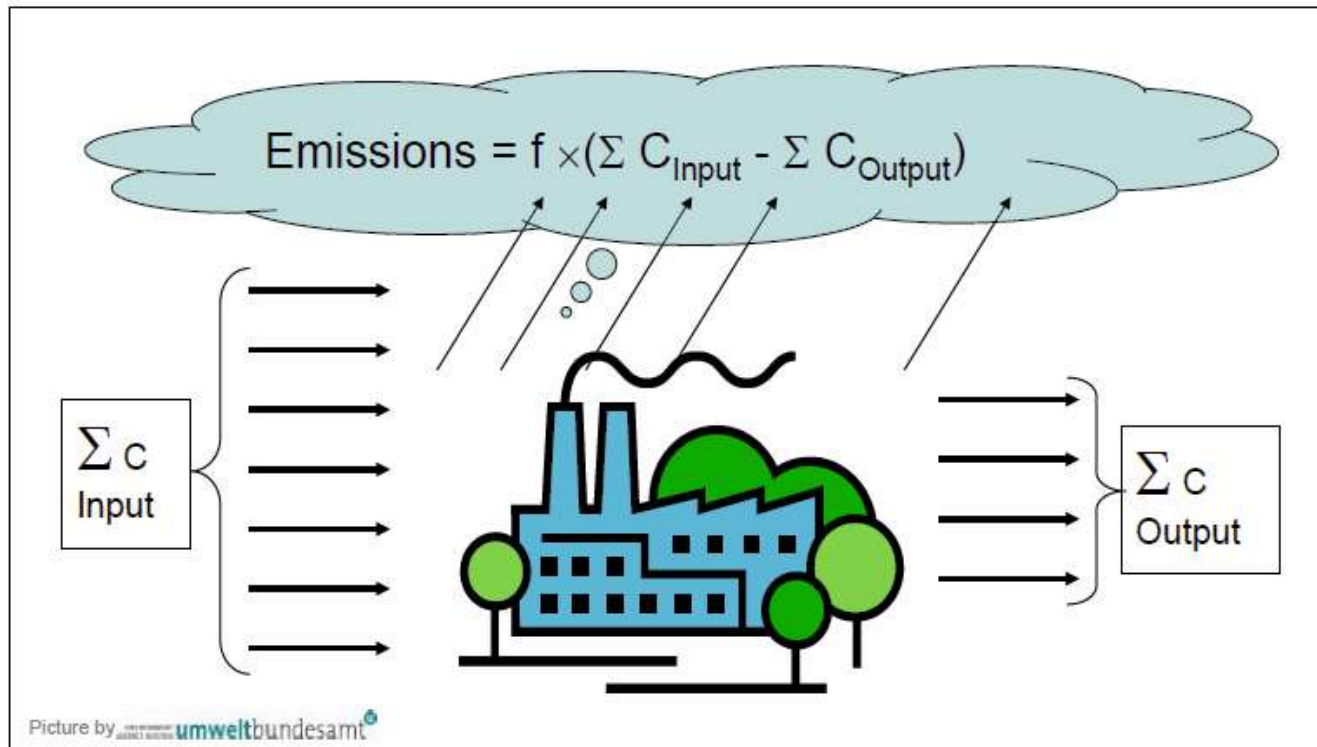
- Standard methodology



# EC GUIDELINES FOR OPERATORS AND VERIFIERS

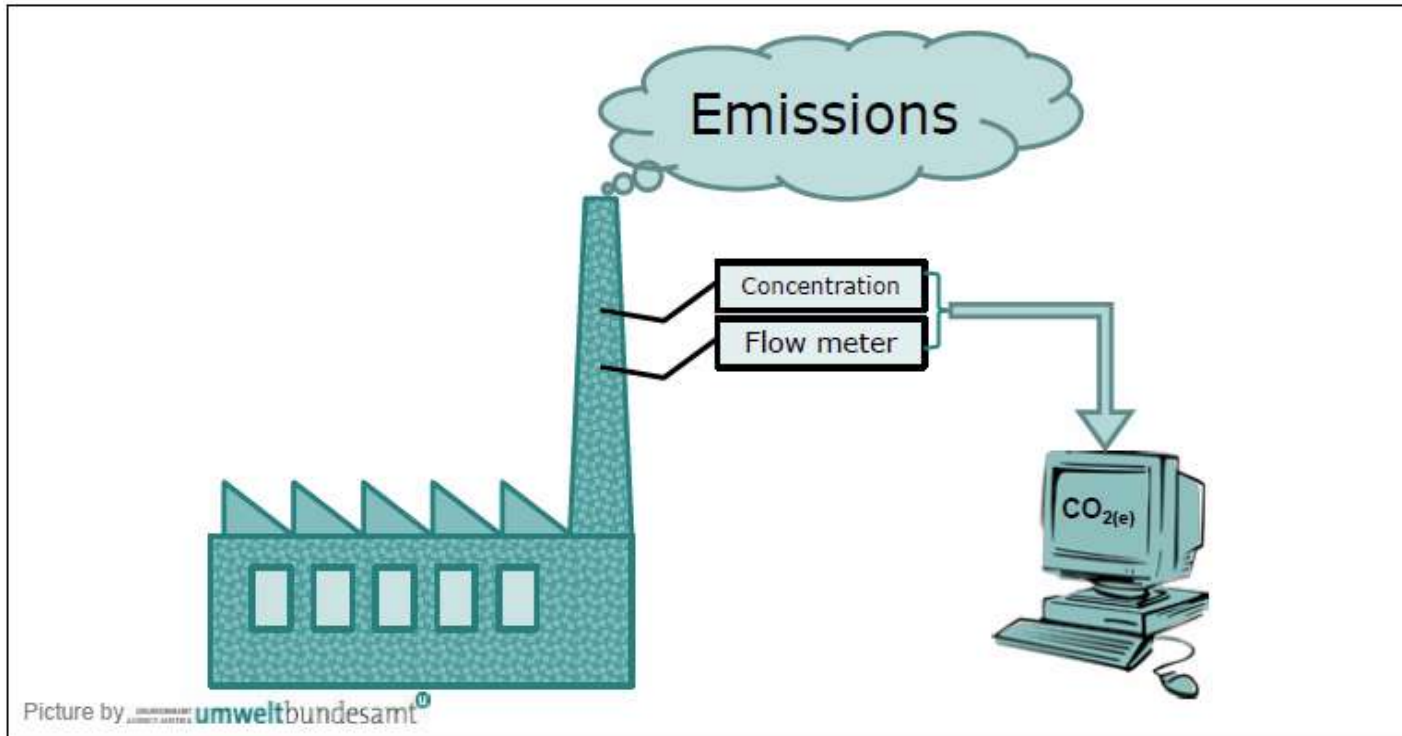
- **CONCEPTS AND APPROACHES**

- Emission balance



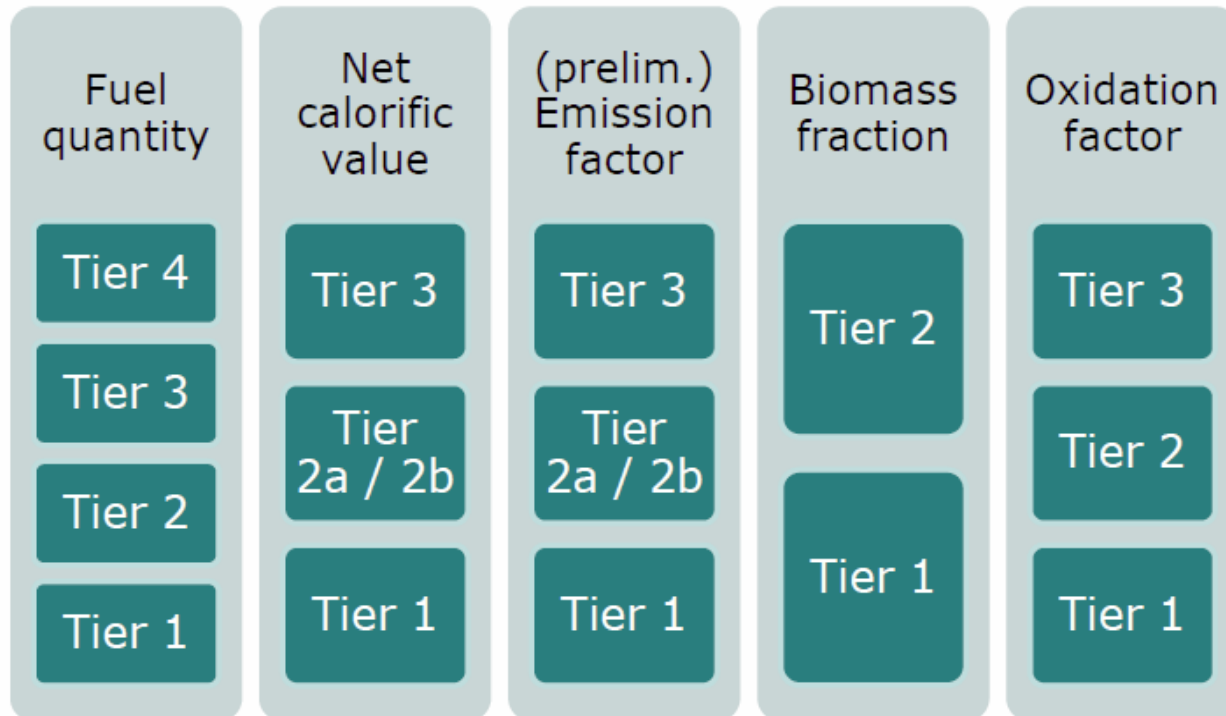
# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **CONCEPTS AND APPROACHES**
  - Measurement-based approach



## DETERMINATION OF ACCURACY LEVELS

- According to Commission Regulation 601/2012, installations can be sorted into three groups A, B or C (A Annex V, B and C Annex II)





# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **MONITORING PLAN**

- Monitoring plan drafting
- Selection of the correct level
- Uncertainty assessment as accompanying documentation
- Data flow and oversight system
- Monitoring plan update
- Improvement principle

# EC GUIDELINES FOR OPERATORS AND VERIFIERS

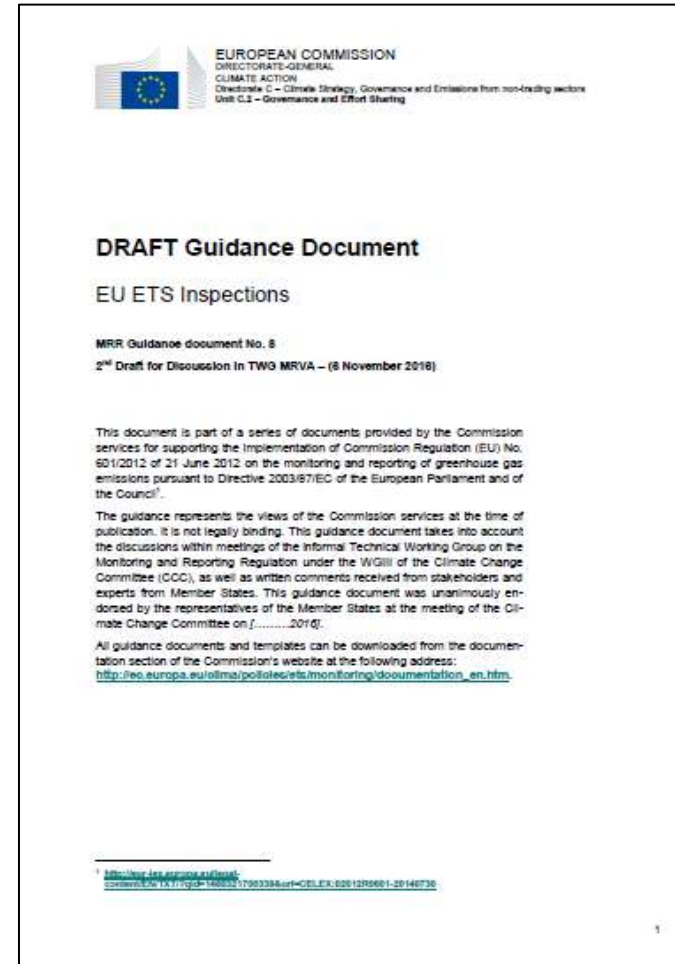
- **CALCULATION-BASED APPROACHES**
  - Activity data monitoring
  - Calculation factors - principles
    - Default values
    - Laboratory analyses
  - Calculation factors— special requirements
    - Emission factors
    - Net calorific value
    - Oxidation and conversion factor
    - Carbon content in case of mass balance
    - Biomass fraction

# EC GUIDELINES FOR OPERATORS AND VERIFIERS

- **SIMPLIFIED APPROACHES**
  - Low emission installations
  - Other simple installations
  
- **CEMS**
  - General requirements
  - N<sub>2</sub>O emission

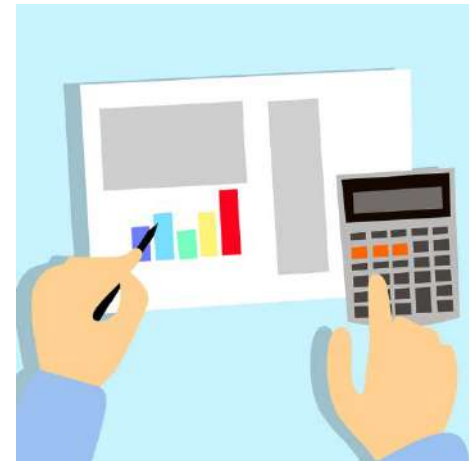
# EC GUIDELINES FOR INSPECTION

- [http://ec.europa.eu/clima/policies/ets/monitoring/documentation\\_en.htm](http://ec.europa.eu/clima/policies/ets/monitoring/documentation_en.htm)
- Arised from Commission Regulation 601/2012
- Guidelines represent EC opinions – not legally binding
- Guide takes into account:
  - discussions at the informal Technical Working Group meetings on monitoring and reporting Regulation
  - Written comments of stakeholders and experts from Member States



# EC GUIDELINES FOR INSPECTION

- **ROLE OF THE INSPECTION IN EU ETS**
  - Sinergy
  - Inspection's role
  - Relationship between inspection and verification
- **GUIDE FOR INSPECTION**
  - Inspection plan
  - Risk assessment
  - Inspection methodology
  - Conducting an inspection
  - Documentation and reporting
- **ANNEX II – SIMPLIFIED CHECKLIST**



# EC GUIDELINES FOR INSPECTION

- **ROLE OF THE INSPECTION IN EU ETS**
  - Inspection's specific benefit over other compliance check methods is the visit to an installation
  - Guideline focuses on compliance checks which include visits to installations
  - The following check is suggested:
    - A. Inspections conducted as part of MP approval or update
    - B. Routine check, to check if the approved MP is still valid
    - C. Non-routine (targeted) inspection: Such an inspection can be a result of comments in the Verification Report (VR), competent authority's suspicion regarding details in the Monitoring Report
    - D. Inspections conducted as part of the emission determination process

# EC GUIDELINES FOR INSPECTION

- **ROLE OF THE INSPECTION IN EU ETS**
  - There is no definition or limitation of responsibility of the competent authority in the EU ETS Directive or its implementation instruments
  - Inspection is more a matter of efficiency and common sense than a legal requirement
  - Focus attention on avoiding duplication of tasks of verifiers and the inspection – review of same documents but with a different focus
  - Final decision on scope and tasks of the inspection will be defined on a case by case basis
  - Use of risk assessment while planning an inspection gives very important conclusions on what needs to be checked
  - Focus on data the verifier checked to a lesser extent

# EC GUIDELINES FOR INSPECTION

- **INSPECTION GUIDE**

- There is no requirement for the frequency of installation inspections in the EU ETS Directive
- Implementation of the Inspection Plan is suggested:
  - Is there a legal obligation for a Member to perform a certain minimum number of inspections;
  - Available resources (number of inspectors and budget);
  - Has the competent authority identified irregularities during reviews of annual emission reports or verification reports or reports on improvements



# EC GUIDELINES FOR INSPECTION

## • INSPECTION GUIDE

- Risk assessment is a very important item in inspection planning
- Primarily inspecting installations that show a greater risk of non-compliance

Risk	Installations total	Frequency of inspections	Inspections per year
High	20	2	10
Medium	60	4	15
Low	70	8	8-9
Non-routine inspections			5-7
Total			40

# EC GUIDELINES FOR INSPECTION

- **INSPECTION GUIDE**

- The following must be taken into account in the inspection preparation phase:
  - Newest approved monitoring plan, including description of the installation and its processes;
  - Additional documents – risk assessment and uncertainty assessment;
  - Previous annual emission reports, verification reports and reports on improvements;
  - Data used to apply for (change) the free quota;
  - Internal documentation of competent authorities;
  - List of recent or planned modifications of the monitoring plan;
  - Monitoring of data such as production protocols, invoices, analyses results, kept samples;

# EC GUIDELINES FOR INSPECTION

- **INSPECTION GUIDE**
  - Conducting inspection at an installation
  - Check list

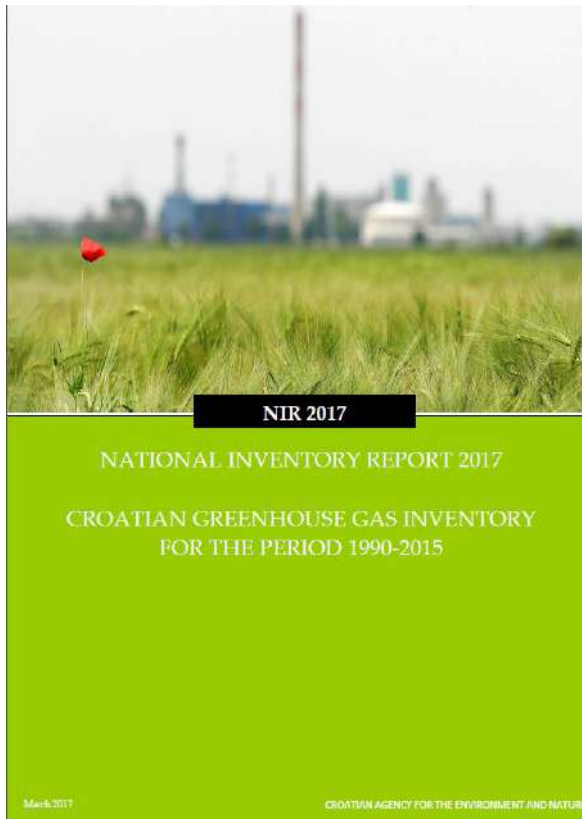


# EC GUIDELINES FOR INSPECTION

- **INSPECTION GUIDE**

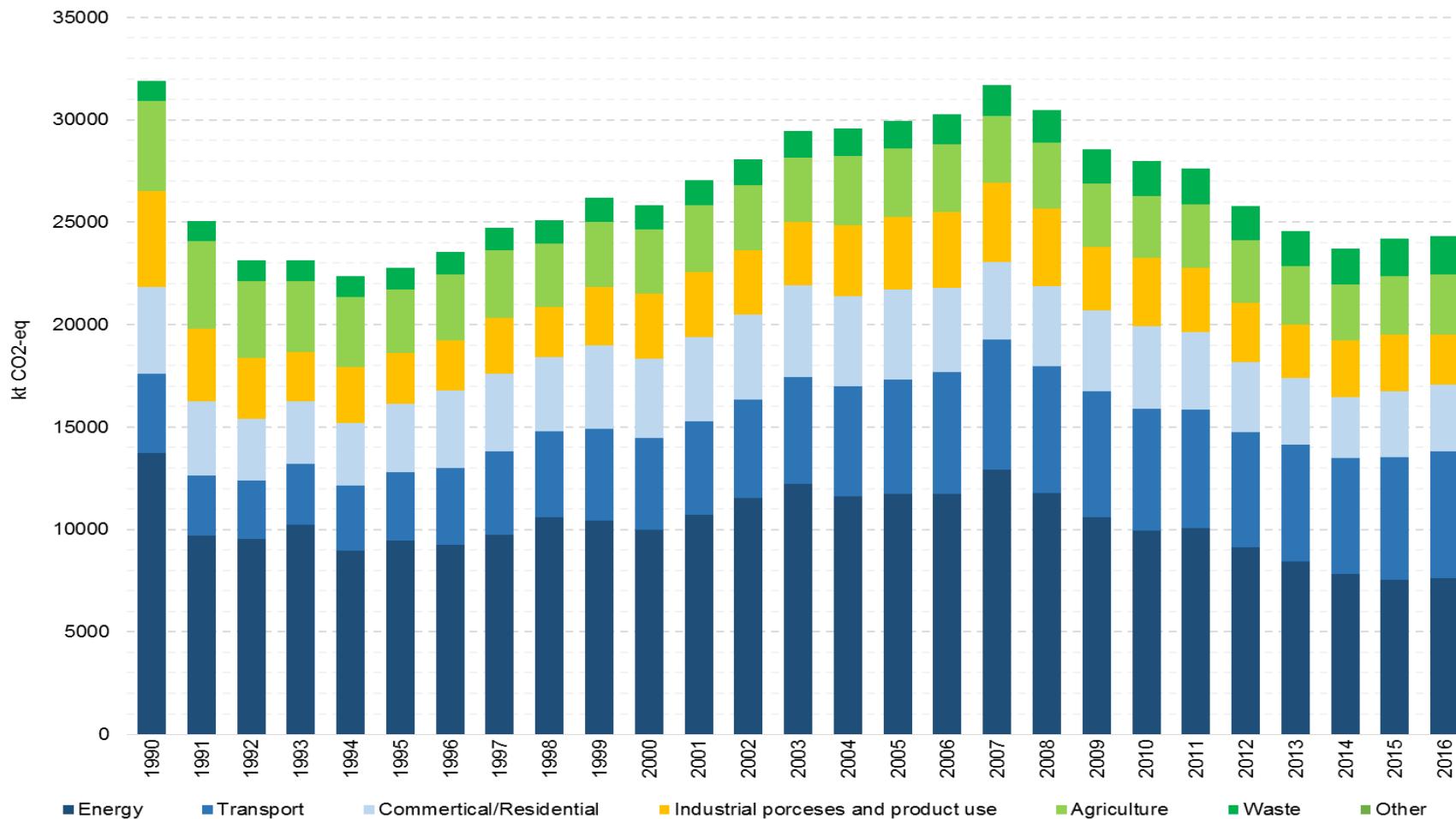
- After a check, it is suggested that the inspection findings contain:
  - Introduction
  - Grounds for inspection, brief history of previous inspections (when were the last inspections, are there any unresolved issues), is there a reason for inspection on the basis of the latest Emission Monitoring Report
  - Brief description / installation inspection
  - Which topics were considered during the inspection and findings during the visit
  - Control list, if there is one, should be attached
  - Actions following the inspection findings
  - List of mandatory non-compliance corrective measures
  - Recommendations for other improvements of the monitoring plan and/or accompanying documents

# NATIONAL EMISSION INVENTORY

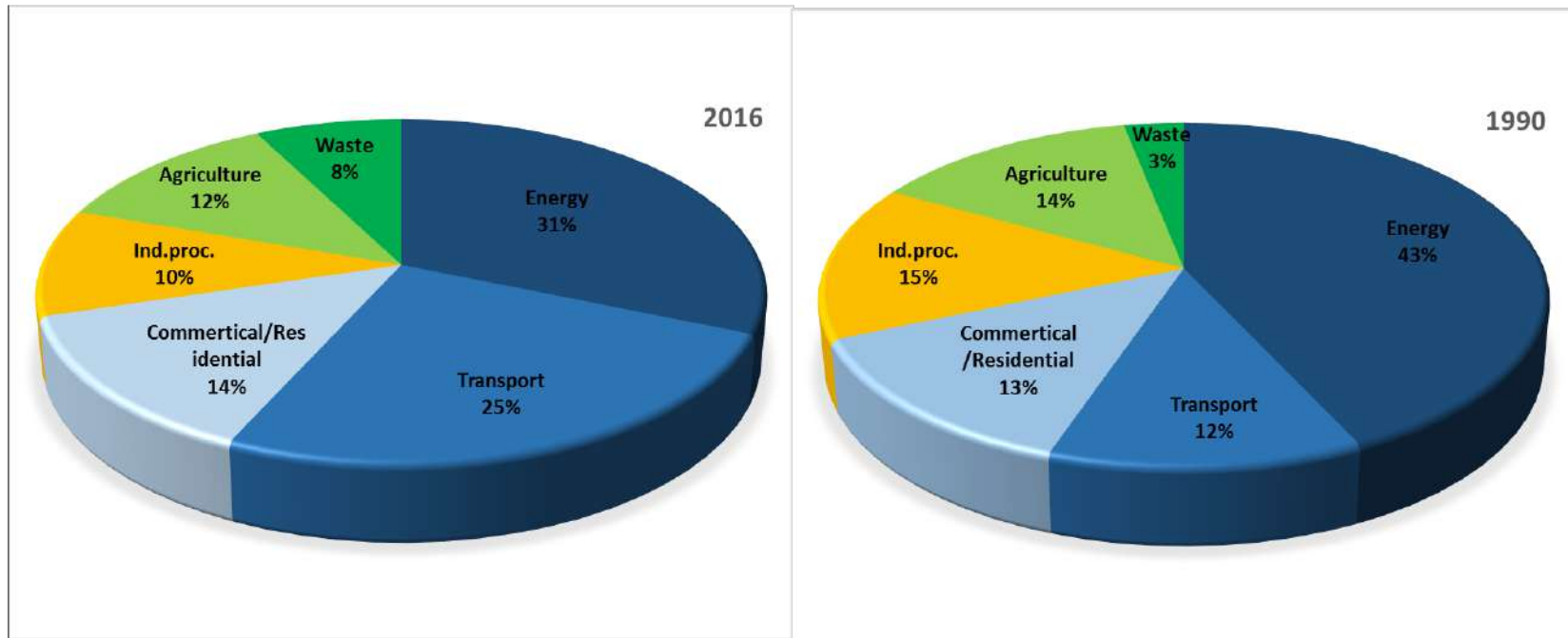


- <http://www.haop.hr/hr/tematska-podrucja/zrak-klima-tlo/klimatske-promjene/izvjesca>
- Report on greenhouse gas emissions inventory in the territory of the Republic of Croatia
- Croatia is a UN Climate Change and Kyoto Protocol signatory
- once a year for the period from year 1990 to year (n-2)

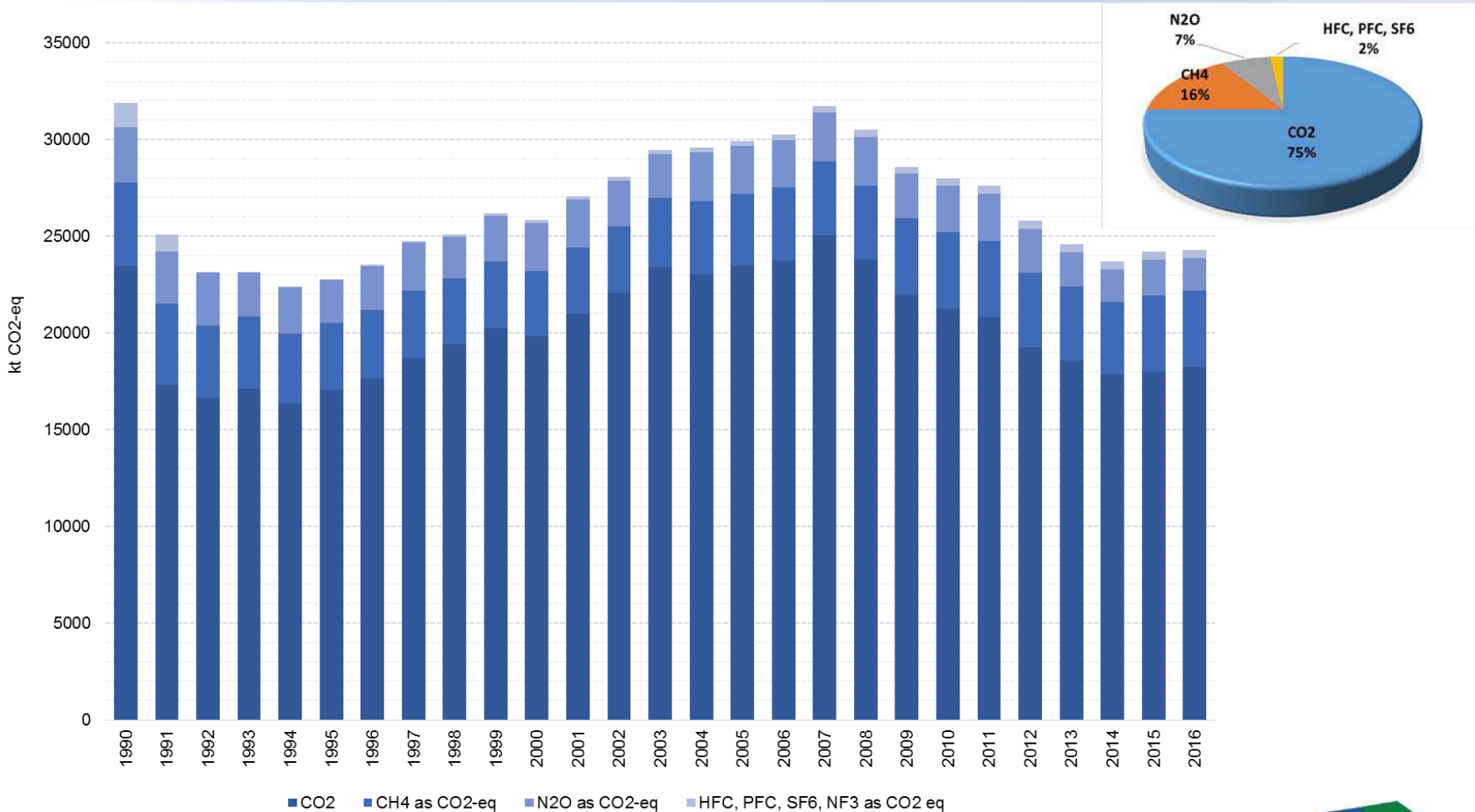
# NATIONAL EMISSION INVENTORY



# NATIONAL EMISSION INVENTORY



# NATIONAL EMISSION INVENTORY





# NATIONAL EMISSION INVENTORY

## • INVENTORY AND EMISSION MONITORING REPORT LINK

- Emission factors table, low calorific values and oxidation factors which can be used for drafting of the Emission Monitoring Report
- Chapter 3: ENERGY; Table 3.1-3

Table 3.1-3: National net calorific values, CO<sub>2</sub> emission factors and oxidation factors for 2015

Fuel	Unit	DOV		CO <sub>2</sub> Emission factor (t CO <sub>2</sub> /TJ)	Oxidation factor (OF)
		Unit	2015		
Motorni benzin	Motor Gasoline	GJ/t	44.5900	69.20	1
Aviobenzin	Aviation Gasoline	GJ/t	44.5900	70.00	1
Kerozin (Mlazno gorivo)	Jet Kerosene	GJ/t	43.5600	71.50	1
Dizel i ekviva tako loživo ulje (plinsko ulje)	Gas/Diesel Oil	GJ/t	42.7100	74.10	1
Loživo ulje i srednje loživo ulje	Residual Fuel Oil	GJ/t	40.1900	77.40	1
Ukapljani naftni plin	Liquefied Petroleum Gases	GJ/t	46.8900	63.10	1
Nafta	Lubricants	GJ/t	39.5000	73.40	1
Naftni koke	Petroleum Coke	GJ/t	31.0000	97.50	1
Petrolej	Petroleum	GJ/t	43.5600	73.30	1
Antracit	Anthracite	GJ/t	29.3100	98.20	1
Kameni ugljen- Industrijski	Other bituminouse coal Industry	GJ/t	26.7000	94.60	1
Kameni ugljen- Termoelektrane	Other bituminouse coal Thermal power plant	GJ/t	25.0000	94.60	1
Ugljen za proizvodnju koks (koksni ugljen)	Coking coal	GJ/t	28.2000	94.60	1
Mali ugljen (smeđi ugljen) Industrijski	Sub bituminouse coal Industry	GJ/t	17.0000	96.10	1
Lignit	Lignite	GJ/t	10.5000	101.00	1
Brisati kamenog ugljena	Brown coal briquettes	GJ/t	20.7000	97.50	1
Koke	Coke oven coke	GJ/t	29.3100	107.00	1
Enodni plin	Natural Gas	GJ/10 <sup>3</sup> m <sup>3</sup>	34.6000	56.00	1
Gradski plin	Gas Works Gas	GJ/10 <sup>3</sup> m <sup>3</sup>	17.1000	44.40	1
Koksni plin	Coke Oven Gas	GJ/10 <sup>3</sup> m <sup>3</sup>	38.7000	44.40	1
Refinerijski plin	Refinery Gas	GJ/t	42.6000	57.60	1

The structure of energy consumption of fossil fuels from 1990 to 2015 is shown in Figure 3.1-6.

CROATIAN AGENCY FOR THE ENVIRONMENT AND NATURE

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<http://www.haop.hr/hr/tematska-podrucja/zrak-klima-tlo/klimatske-promjene>

NIR national factors, November 2017

# CALCULATION TOOLS

- EMISSION FACTORS CALCULATION TOOL
- RISK ASSESSMENT TOOLS
- UNJUSTIFIED HIGH COSTS TOOL
- FREQUENCY OF ANALYSES TOOL
  
- <http://www.haop.hr/hr/tematska-podrucja/zrak-klima-tlo/klimatske-promjene>

- Additional tools



# EMISSION FACTORS CALCULATION TOOLS

- EF CALCULATION TOOL FOR FUEL OIL

**Calculation example:**

Laboratory testing data:

	MJ/kg	TJ/t	%	kgC/MJ	tCO <sub>2</sub> /TJ
DOV	40.32	0.04032			
Carbon content ©			85.02	0.021086	
CO <sub>2</sub> Emission factor					77.260

C into CO<sub>2</sub> Conversion factor

3.664

ANALYSIS SHOWS: 40.32 MJ corresponds to 1 kg heat oil, or 0.8502 kg C

HOW MUCH kgC/MJ?

$1 \text{ MJ} * 0,8502 / 40,32 = 0,021086 \text{ kgC/MJ}$

EF?

$EF = 0,021086 * 3,664 * 1000 = 77,26 \text{ t CO}_2/\text{TJ}$

# EMISSION FACTORS CALCULATION TOOLS

## • EF CALCULATION TOOL FOR GAS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
19	Primjer za zadane volumne udjele (uz pretpostavku da je vol.%=mol.%)													
20	spoj	vol. %	x (vol. udio)	M kg/kmol	Gustoća (p) kg/m3	w kg spoj/kg PP	w(C), kg C/kg spoja	kg C/kg PP	kg C/m <sup>3</sup> PP	Pretvorbni faktor	EF (kg CO <sub>2</sub> /m <sup>3</sup> PP)	EF (t CO <sub>2</sub> /TJ)		
21	CH <sub>4</sub> (C <sub>1</sub> )	96.71	0.9671	16.0426	0.6785	0.9331	0.7480	0.6980	0.4908					
22	C <sub>2</sub> H <sub>6</sub> (C <sub>2</sub> )	1.70	0.0170	30.0694	1.2718	0.0307	0.7982	0.0245	0.0173					
23	C <sub>3</sub> H <sub>8</sub> (C <sub>3</sub> )	0.38	0.0038	44.0982	1.8950	0.0101	0.8164	0.0082	0.0058					
24	C <sub>n</sub> H <sub>2n</sub> (i-C <sub>n</sub> + n-C <sub>n</sub> )	0.11	0.0011	58.1230	2.4583	0.0038	0.8258	0.0032	0.0022					
25	C <sub>n</sub> H <sub>2n</sub> (i-C <sub>n</sub> + n-C <sub>n</sub> )	0.03	0.0003	72.1498	3.0516	0.0013	0.8316	0.0011	0.0008					
26	C <sub>n</sub> H <sub>2n</sub> (C6+)	0.02	0.0002	86.1766	3.6448	0.0010	0.8355	0.0009	0.0006					
27	CO <sub>2</sub>	0.23	0.0023	44.0090	1.8514	0.0061	0.2727	0.0017	0.0012					
28	N <sub>2</sub>	0.82	0.0082	28.0140	1.1848	0.0138	0.0000	0.0000	0.0000					
29	suma	100.00	1.00	16.62729488	0.7032	1.0000			0.5187	3.664	1.900	55.1		
30	EMISijski FAKTOR: 55.1 t CO <sub>2</sub> /TJ													
31														
32														
33														
34														
35	gustoća plina		0.7047	kg/m <sup>3</sup>	gustoća plina za standardne uvjete očitana s laboratorijske analize									
36														
37	Primjer za zadane masene udjele													
38	spoj	mas %	w (maseni udio)	M kg/kmol	V spoja m <sup>3</sup>	x (mol. udio)	Gustoća Ro kg/m3	w(C), kg C/kg spoja	kg C/kg PP	kg C/m <sup>3</sup> PP	Pretvorbni faktor	EF (kg CO <sub>2</sub> /m <sup>3</sup> PP)	EF (t CO <sub>2</sub> /TJ)	
39	CH <sub>4</sub> (C <sub>1</sub> )	93.32	0.9332	16.0426	1.3753	0.9671	0.6785	0.7480	0.6980	0.4909				
40	C <sub>2</sub> H <sub>6</sub> (C <sub>2</sub> )	3.07	0.0307	30.0694	0.0241	0.0170	1.2718	0.7982	0.0245	0.0172				
41	C <sub>3</sub> H <sub>8</sub> (C <sub>3</sub> )	1.01	0.0101	44.0982	0.0054	0.0038	1.8950	0.8164	0.0082	0.0058				
42	C <sub>n</sub> H <sub>2n</sub> (i-C <sub>n</sub> + n-C <sub>n</sub> )	0.38	0.0038	58.1230	0.0015	0.0011	2.4583	0.8258	0.0031	0.0022				
43	C <sub>n</sub> H <sub>2n</sub> (i-C <sub>n</sub> + n-C <sub>n</sub> )	0.13	0.0013	72.1498	0.0004	0.0003	3.0516	0.8316	0.0011	0.0008				
44	C <sub>n</sub> H <sub>2n</sub> (C6+)	0.10	0.0010	86.1766	0.0003	0.0002	3.6448	0.8355	0.0007	0.0005				
45	CO <sub>2</sub>	0.61	0.0061	44.0090	0.0033	0.0023	1.8514	0.2727	0.0017	0.0012				
46	N <sub>2</sub>	1.38	0.0138	28.0140	0.0116	0.0082	1.1848	0.0000	0.0000	0.0000				
47	suma	100.00	1.00		1.4221	1.0000	0.7032		0.7374	0.5185	3.664	1.900	55.1	
48	EMISijski FAKTOR: 55.1 t CO <sub>2</sub> /TJ													
49														

## OTHER TOOLS

- **RISK ASSESSMENT TOOL**
  - Made by the EC for harmonization of approach to risk assessment purposes
  - Using the tool is not mandatory – alternative approaches
- **UNJUSTIFIED HIGH COSTS TOOL**
  - Made by the EC for harmonization of establishing unjustified costs in accordance with Article 18 of the Monitoring and Reporting Regulation
- **FREQUENCY OF ANALYSES TOOL**
  - Competent authority may allow the installation operator to use frequency of analyses listed in the Ordinance
  - Tool developed to aid the operator to get, on the basis of historical data, data on minimum frequency of sampling and source stream analyses



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INZRAK

Enhanced environmental protection inspection for efficient control of air quality monitoring and of all entities under obligation within system of greenhouse gas emission allowance trading, in order to achieve better quality of air in Republic of Croatia



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## **4. COMPETENCES OF THE INSPECTION RELATED TO OBLIGATIONS OF THE INSTALLATION OPERATOR AND THE AIRCRAFT OPERATOR**



# CONTENTS

- **Competences of the environmental protection inspection related to ETS**
  - In accordance with criminal provisions of the Air Protection Act
- **9 subjects of inspection**
  - Legal obligation
  - Inspected person
  - Enforcement control procedure in phases
    - preparation of inspection
    - implementation of inspection
    - acting on the conducted inspection

## SUBJECTS OF INSPECTION (1)

**4.1. performing activities that release greenhouse gases without a greenhouse gas emission permit**

**4.2. notifying the Ministry of planned changes to the installation**

**4.3. notifying the Ministry of planned changes to the person installation operator, or a planned modification of the greenhouse gas emission from an installation Monitoring Plan**

**4.4. notifying the Ministry of the planned date for cessation of activities at the installation**

## SUBJECTS OF INSPECTION (2)

- 4.5. submitting the verified report to the Agency within the prescribed deadline**
- 4.6. notifying the Ministry of partial cessation of activities**
- 4.7. obtaining the Ministry's approval of the greenhouse gas emission from an aircraft Monitoring and Reporting Plan**
- 4.8. opening an account at the Union Registry**
- 4.9. implementation of greenhouse gas emission monitoring and submitting the verified report by March 1 for the previous calendar year**

## 4.1. PERFORMING ACTIVITIES WHICH RELEASE GREENHOUSE GASES WITHOUT AN EMISSION PERMIT (1)

- **Legal basis**
  - Air Protection Act
    - Article 82 – greenhouse gas emission permit
    - Article 138, Paragraphs 5 and 6 – inspection
    - Article 146 – criminal provisions
- **Inspected person**
  - Installation operator



## 4.1. PERFORMING ACTIVITIES WHICH RELEASE GREENHOUSE GASES WITHOUT AN EMISSION PERMIT (2)

- **Preparation of inspection**

- activity which leads to greenhouse gas emission
  - Annex I of the Regulation (OG 69/12, 154/14)
- greenhouse gases for which an emission permit must be obtained
  - Annex I of the Regulation
- greenhouse gas emission permit
  - monitoring plan, modifications of the monitoring plan
  - modifications of the emission permit
  - decision on revocation of the permit
- correspondence between the installation operator and the Ministry
  - notifications, requests

## 4.1. PERFORMING ACTIVITIES WHICH RELEASE GREENHOUSE GASES WITHOUT AN EMISSION PERMIT (3)

- **Implementation of inspection**

- Determination of facts:

- does the installation have a valid greenhouse gas emission permit
- valid version of the monitoring plan
- installation activity from Annex I
- greenhouse gases
- obligations of the operator
- has the installation's permit been revoked

## 4.1. PERFORMING ACTIVITIES WHICH RELEASE GREENHOUSE GASES WITHOUT AN EMISSION PERMIT (4)

- **acting on the conducted inspection**
  - installation does have a valid emission permit
    - log that in the record
  - installation does not have an emission permit / revoked permit
    - log that in the record
    - issue a decision banning performance of activities that release greenhouse gases (**Article 138, Paragraph 5(1)**)
    - indictment (**Article 146, Paragraph 1 (19) and Article 146, Paragraph 2)**)

## 4.1. PERFORMING ACTIVITIES WHICH RELEASE GREENHOUSE GASES WITHOUT AN EMISSION PERMIT (5)

- **acting on the conducted inspection**
  - installation does have an emission permit, but does not meet conditions on which it obtained the emission permit
    - log that in the record
    - issue a decision banning the activities that release greenhouse gases until the conditions are met (**Article 138, Paragraph 5 (2)**)
    - if the installation does not act according to the decision, suggest revocation of the emission permit to the Ministry (**Article 138, Paragraph 6**)
    - indictment (**Article 146, Paragraph 1(19) and Article 146, Paragraph 2**)



## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (1)

- **legal basis**
  - Air Protection Act
    - Article 86, Paragraph 1 – planned changes to the installation
    - Article 132, Paragraphs 3 and 4
    - Article 138, Paragraphs 5 and 6
    - Article 146 – criminal provisions
- **inspected person**
  - installation operator



## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (2)

- **preparation of inspection**
  - latest approved version of the monitoring plan
  - information on planned changes to the installation
    - technical-technological characteristics of the installation
      - type of fuel, raw material or other material used at the installation, increase or reduction of the heat input, installation's capacity
  - Ministry's decision on permit modification / approval of significant modifications of the greenhouse gas emission from an installation monitoring plan
  - correspondence between the plant operator and the Ministry
    - notification of the planned change to the installation, requests

## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (3)

- **implementation of the inspection**
  - determination of facts:
    - are technical-technological changes planned at the installation
    - did the installation operator notify the Ministry of the planned changes without delay
    - have the changes to the installation already been implemented

## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (4)

- **acting on the conducted inspection**
  - installation operator is not planning technical-technological changes to the installation
    - log that in the record
  - installation operator is planning technical-technological changes to the installation and has notified the Ministry
    - log that in the record

## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (5)

- **acting on the conducted inspection**
  - installation operator is planning technical-technological changes to the installation and has not notified the Ministry
    - log that in the record
    - issue a decision ordering removal of procedural deficiencies and irregularities (**Article 132, Paragraph 3**)
    - if the installation does not act according to the decision, force them to do so with a fine (**Article 132, Paragraph 4**)
    - indictment (**Article 146, Paragraph 1(20) and Article 146, Paragraph 2**)

## 4.2. NOTIFYING THE MINISTRY ON PLANNED CHANGES TO THE INSTALLATION (6)

- **acting on the conducted inspection**
  - planned changes to the installation have already been implemented, changes which have led to emissions, and the installation operator has not notified the Ministry of this
    - log that in the record
    - issue a decision banning performance of activity which releases greenhouse gases until conditions have been met (**Article 138, Paragraph 5(2)**)
    - if the installation does not act according to the decision, suggest revocation of the emission permit (**Article 138, Paragraph 6**)
    - indictment (**Article 146, Paragraph 1(20) and Article 146, Paragraph 2**)

## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (1)

- **legal basis**

- Air Protection Act

- Article 86, Paragraph 1 –planned changes to the person installation operator, planned changes of the monitoring plan

- Article 132, Paragraphs 3 and 4

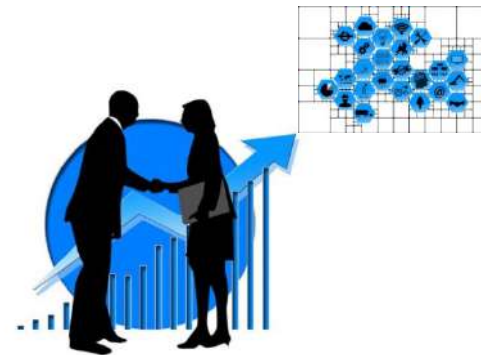
- Article 138, Paragraphs 5 and 6

} inspection

- Article 146 –criminal provisions

- **inspected person**

- installation operator



## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (2)

- **preparation of inspection**
  - latest approved version of the monitoring plan
  - information on the planned change of the person installation operator
  - information on the planned change to the greenhouse gas emission from an installation monitoring plan
  - Ministry's decision on determination of the change of the person operator / approval of the change to the greenhouse gas emission from an installation monitoring plan
  - correspondence between the installation operator and the Ministry
    - notification on the planned change of the person installation operator
    - notification on the planned change to the greenhouse gas from an installation monitoring plan



## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (3)

- **implementation of inspection**

- **determination of facts:**

- is a change of the person installation operator being planned
- is a change to the greenhouse gas emission from an installation monitoring plan being planned
- has the installation operator notified the Ministry of the planned change of the person installation operator without delay
- has the installation operator notified the Ministry of the planned change to the greenhouse gas emission from an installation monitoring plan by 31 December of the current year
- have the changes of the person installation operator already been implemented

## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (4)

- **acting on the conducted inspection**
  - installation operator is not planning changes of the person installation operator and/or changes to the greenhouse gas emission from an installation monitoring plan
    - log that in the record
  - installation operator is planning changes of the person installation operator and/or changes to the greenhouse gas emission from an installation monitoring plan and has notified the Ministry of it
    - log that in the record

## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (5)

- **acting on the conducted inspection**
  - installation operator is planning changes of the person installation operator and/or changes to the greenhouse gas emission from an installation monitoring plan and has not notified the Ministry of it
    - log that in the record
    - issue a decision ordering removal of procedural deficiencies and irregularities (**Article 132, Paragraph 3**)
    - if the installation does not act in accordance with the decision, force them to do so with a fine (**Article 132, Paragraph 4**)
    - indictment (**Article 146, Paragraph 1(21) and Article 146, Paragraph 2**)

## 4.3. NOTIFYING THE MINISTRY OF PLANNED CHANGES TO THE PERSON AND THE MONITORING PLAN (6)

- **acting on the conducted inspection**
  - planned changes to the installation operator have already been implemented at the installation, and the installation operator has not notified the Ministry of it
    - log that in the record
    - issue a decision banning performance of activity which releases greenhouse gases until conditions have been met (**Article 138, Paragraph 5(2)**)
    - if the installation does not act according to the decision, suggest revocation of the emission permit (**Article 138, Paragraph 6**)
    - indictment (**Article 146, Paragraph 1(20) and Article 146, Paragraph 2**)

## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (1)

- **legal basis**

- Air Protection Act

- Article 87, Paragraph 1 –cessation of activities at the installation
    - Article 132, Paragraphs 3 and 4
    - Article 138, Paragraph 6
    - Article 146 – criminal provisions

} inspection

- **inspected person**

- installation operator



## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (2)

- **preparation of inspection**
  - latest approved version of the monitoring plan
  - information on the planned cessation of activities at the installation
    - for example, stopping production, reducing thermal input to under 20 MW
  - correspondence between the installation operator and the Ministry
    - notification of the planned date of cessation of activities at the installation
  - Ministry's decision on revocation of the greenhouse gas from an installation emission permit

## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (3)

- **implementation of inspection**

- determination of facts:

- installation activity according to Annex I of the Regulation
- is cessation of activities at the installation being planned
- has the installation operator notified the Ministry of the planned date of cessation of activities at the installation
- has the cessation of activities already been carried out
- has the installation's greenhouse gas from an installation emission permit been revoked?

## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (4)

- **acting on the conducted inspection**
  - installation operator is not planning cessation of activities at the installation
    - log that in the record
  - installation operator is planing cessation of activities at the installation and has notified the Ministry of it
    - log that in the record



## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (5)

- **acting on the conducted inspection**
  - installation operator is planning cessation of activities at the installation and has not notified the Ministry of it
    - log that in the record
    - issue a decision ordering removal of procedural deficiencies and irregularities (**Article 132, Paragraph 3**)
    - if the installation does not act in accordance with the decision, force them to do so with a fine (**Article 132, Paragraph 4**)
    - indictment (**Article 146, Paragraph 1(21) and Article 146, Paragraph 2**)

## 4.4. NOTIFYING THE MINISTRY OF THE PLANNED DATE OF CESSATION OF ACTIVITIES (6)

- **acting on the conducted inspection**
  - installation has already ceased activities and has not notified the Ministry of it
    - log that in the record
    - suggest revocation of the emission permit (**Article 138, Paragraph 6**)
    - indictment (**Article 146, Paragraph 1(22) and Article 146, Paragraph 2**)

## 4.5. SUBMITTING THE VERIFIED REPORT TO THE AGENCY WITHIN THE PRESCRIBED DEADLINE (1)

- **legal basis**
  - Air Protection Act
    - Article 88, Paragraph 2 –submitting the verified report to the Agency
    - Article 132, Paragraphs 1 and 4 –inspection
    - Article 146 – criminal provisions
- **inspected person**
  - installation operator



## 4.5. SUBMITTING THE VERIFIED REPORT TO THE AGENCY WITHIN THE PRESCRIBED DEADLINE (2)

- **preparation of inspection**
  - Ministry's decision on revocation of the greenhouse gas emission from an installation permit
  - emission report for the reporting period in question
  - verification report for the emission report for the same period
  - correspondence between the installation operator and the Agency
    - notification of submission of the verified annual report and the verification report to the Agency

## 4.5. SUBMITTING THE VERIFIED REPORT TO THE AGENCY WITHIN THE PRESCRIBED DEADLINE (3)

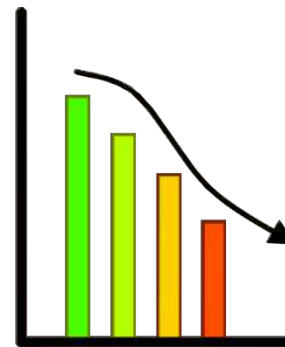
- **implementation of inspection**
  - determination of facts:
    - has the installation's greenhouse gas emission permit been revoked
    - has the installation operator drafted the annual emission report
    - has the installation operator sent the annual report to an accredited verifier for verification
    - has the installation operator submitted the verified annual report and the verification report to the Agency within two months of the date of enforceability of the permit revocation decision

## 4.5. SUBMITTING THE VERIFIED REPORT TO THE AGENCY WITHIN THE PRESCRIBED DEADLINE (4)

- **acting on the conducted inspection**
  - installation operator has submitted the verified annual report and the verification report to the Agency within the prescribed deadline
    - log that in the record
  - installation operator has not submitted the verified annual report and the verification report to the Agency within the prescribed deadline
    - log that in the record
    - issue a decision ordering removal of procedural deficiencies and irregularities (**Article 132, Paragraph 3**)
    - if the installation does not act in accordance with the decision, force them to do so with a fine (**Article 132, Paragraph 4**)
    - indictment (**Article 146, Paragraph 1(21) and Article 146, Paragraph 2**)

## 4.6. NOTIFYING THE MINISTRY OF PARTIAL CESSATION OF ACTIVITIES (1)

- **legal basis**
  - Air Protection Act
    - Article 90, Paragraph 9 –partial cessation of activities
    - Article 132, Paragraphs 1 and 4 –inspection
    - Article 146 –criminal provisions
- **inspected person**
  - Installation operator



## 4.6. NOTIFYING THE MINISTRY OF PARTIAL CESSATION OF ACTIVITIES (2)

- **preparation of inspection**
  - decision determining the amount of emission allowances allocated to the installation for free
  - template for new participants and the closing of an installation
  - correspondence between the installation operator and the Ministry
    - request for agreement on the amount of the installation's free emission allowances
    - agreement on the amount of free emission allowances



## 4.6. NOTIFYING THE MINISTRY OF PARTIAL CESSATION OF ACTIVITIES (3)

- **implementation of inspection**
  - determination of facts:
    - did the installation operator obtain a decision determining the amount of emission allowances allocated for free
    - did the installation operator submit to the Ministry a filled out template for new participants and closing of an installation by 31 December of each year

## 4.6. NOTIFYING THE MINISTRY OF PARTIAL CESSATION OF ACTIVITIES (4)

- **acting on the conducted inspection**
  - installation operator has submitted to the Ministry a filled out template for new participants and the closing of an installation
    - log that in the record
  - installation operator has not submitted to the Ministry a filled out template for new participants and the closing of an installation
    - log that in the record
    - issue a decision ordering removal of illegalities within the prescribed deadline **(Article 132, Paragraph 1)**
    - if the installation does not act in accordance with the decision, force them to do so with a fine **(Article 132, Paragraph 4)**
    - indictment **(Article 146, Paragraph 1(21) and Article 146, Paragraph 2)**



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# **FILLING OUT TEMPLATES FOR INSTALLATION OPERATORS AND AIRCRAFT OPERATORS - practical exercises -**

# CONTENTS

- **exercise description**
- **task**
- **review of results**

## EXERCISE DESCRIPTION (1)

- **Group work**
- **Each group will get a filled out monitoring plan for a fictional installation and the accompanying annual emission report**



## EXERCISE DESCRIPTION (2)

- **exercise 1:**
  - finding information in the emission from an installation monitoring plan template
  - goal: familiarization with the monitoring plan template
- **exercise 2:**
  - finding information in the emission from an installation report template
  - goal: familiarization with the emission report template
- **exercise 3:**
  - comparing information in the emission monitoring plan and the emission report
  - goal: checking information and finding potential irregularities



## EXERCISE 1 – TASK (1)

- **EMISSION FROM AN INSTALLATION MONITORING PLAN**

- **task:**

Find the following information in the monitoring plan:

- a) Number of the current version of the monitoring plan and its status
- b) Date of the approval of the current monitoring plan
- c) Greenhouse gas emission permit number
- d) Installation's unique ID
- e) Installation's name and location
- f) Activities from Annex I of the Regulation (OG 69/12 and 154/14)

## EXERCISE 1 – ANSWERS (1)

- **EMISSION FROM AN INSTALLATION MONITORING PLAN**
- **answers:**
  - a) 1.0; approved by HAOP (formerly AZO)
  - b) 19 March 2014
  - c) CLASS: UP/I-351-02/12-15/55
  - d) HR-887
  - e) Elekrika d.o.o. Pogon 4, Strujna 42, Električno Polje
  - f) Combustion of fuel

## EXERCISE 1 – TASK (2)

- **EMISSION FROM AN INSTALLATION MONITORING PLAN**

- **task:**

Find the following information in the monitoring plan:

- g) Category of the installation
- h) Is it a low emission installation
- i) Methodology for determining CO<sub>2</sub> emissions
- j) Emission sources
- k) Source streams
- l) Measuring instruments used
- m) Laboratory analysis and are there non-accredited methods

## EXERCISE 1 – ANSWERS (2)

- **EMISSION FROM AN INSTALLATION MONITORING PLAN**

- **answers:**

g) B

h) It is not a low emission installation

i) CO<sub>2</sub> calculation methodology

j) boiler KP1, boiler PK1, diesel aggregate, desulphurization

k) coal, fuel oil EL, diesel fuel, limestone

l) Beltweighers

m) C content, DOV, (sampling); there are no non-accredited methods

## EXERCISE 2 - TASK

- **ANNUAL EMISSIONS FROM AN INSTALLATION REPORT**

- **task:**

Find the following information in the annual report:

- a) Name of the authorized representative
- b) Emission monitoring plan version that was used
- c) Emission report verifier
- d) Activities from Annex I of the Regulation (OG 69/12 and 154/14)
- e) Methodology used to determine emissions
- f) Source streams at the installation
- g) Individual source stream's emission
- h) Total CO<sub>2e</sub> emission from the installation

## EXERCISE 2 - ANSWERS

- **ANNUAL EMISSIONS FROM AN INSTALLATION REPORT**
- **answers:**
  - a) Marko Strujić
  - b) 2.0
  - c) Veri-Fikator d.o.o.
  - d) Combustion of fuel
  - e) CO<sub>2</sub> calculation methodology
  - f) lignite, fuel oil EL, diesel fuel, limestone
  - g) F1: 433.524,3 ; F2: 9.996,8; F3: 2,7; F4: 5.967,7
  - h) Total CO<sub>2e</sub> from the installation: 449.491 t

## EXERCISE 3 - TASK

- **HARMONIZATION OF THE EMISSION MONITORING PLAN AND THE ANNUAL EMISSION REPORT**

- **task:**

Compare the following information in the emission monitoring plan and the annual report:

- a) Current edition number of the approved monitoring plan
- b) Activities from Annex I of the Regulation (OG 69/12 and 154/14)
- c) Emission monitoring methodology
- d) Source streams

## EXERCISE 3 - ANSWERS

- **HARMONIZATION OF THE EMISSION MONITORING PLAN AND THE ANNUAL EMISSION REPORT**
- **answers:**
  - a) Incorrect: 1.0 in the monitoring plan/2.0 in the emission report
  - b) Correct: Combustion of fuel
  - c) Correct: CO<sub>2</sub> calculation methodology
  - d) Incorrect: „Coal” in the monitoring plan/”Lignite” in the emission report





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# DETERMINATION OF ACTIVITY DATA (FUEL AND RAW MATERIAL AMOUNT) - practical exercises -

# CONTENTS

- Exercise description
- Task
- Review of results

## EXERCISE DESCRIPTION

- **Group work**
- **Each group will get three tasks, two related to determination of fuel amount, one to determination of raw material amount**
- **The purpose of the exercise is to determine total annual amount of fuel/raw material used at the installation**



# EXERCISE 1

- **Task:**

- Fuel being used: natural gas
- Default: monthly consumption of natural gas

month	consumption m <sup>3</sup>	month	consumption m <sup>3</sup>
January	0	July	150,000
February	150,000	August	150,000
March	250,000	September	150,000
April	250,000	October	0
May	250,000	November	0
June	150,000	December	0

- Calculate annual consumption of natural gas in m<sup>3</sup>

# REVIEW OF EXERCISE 1 RESULTS

- **answer:**
  - Annual consumption of natural gas is **1,500,000 m<sup>3</sup>**



## EXERCISE 2

- **Task:**

- Fuel being used: natural gas
- Default: meter readings at the beginning and at the end of the year

date	Consumption in m <sup>3</sup>
1 Jan. 2014	353,428
31 Dec. 2014	3,825,251

- Calculate annual consumption of natural gas in m<sup>3</sup>



## REVIEW OF EXERCISE 2 RESULTS

- **answer:**
  - Annual consumption of natural gas is **3,471,823 m<sup>3</sup>**



## EXERCISE 3

- **Task:**

- Raw material being used: limestone

- Default:

	date	amount
Supply situation	31 Dec. 2016	25,000 kg
Purchase 1	05 Jan. 2017	20,000 t
Purchase 2	20 June 2017	10,000 t
Purchase 3	19 Oct. 2017	17,000 t
Dispatch	11 July 2017	5,000 t
Supply situation	31 Dec. 2017	15,000 kg

- Calculate annual consumption of limestone in tonnes

## EXERCISE 3

- Task:

**Consumption [t] = supply(2016) + purchased – dispatched – supply(2017)**



## REVIEW OF EXERCISE 3 RESULTS

- **answer:**
  - Annual limestone consumption is **42,010 t**





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# DETERMINATION OF CALCULATION FACTORS - practical exercises -

# CONTENTS

- Exercise description
- Task
- Review of results



## EXERCISE DESCRIPTION

- **Group work**
- **Each group will get three tasks for determination of calculation factors (emission factor, lower calorific value, oxidation factor)**
- **The purpose of the exercise is to determine calculation factors which will be used for CO<sub>2</sub> emission calculation**



# EXERCISE 1

- **Task:**

- Fuel being used: listed in the table
- Default: according to the monitoring plan, the installation is using calculation factors from the National Emission Inventory to determine emissions
- For each fuel determine the following: emission factor, lower calorific value and the oxidation factor, and enter them into the table

fuel	EF [tCO <sub>2</sub> /TJ]	LCF [GJ/t, GJ/10 <sup>3</sup> m <sup>3</sup> ]	OF
Lignite			
Coke			
Natural gas			
Fuel oil			
Gas oil			

# REVIEW OF EXERCISE 1 RESULTS

- answer:

fuel	EF [tCO <sub>2</sub> /TJ]	LCF	OF
Lignite	96,10	17,00 [GJ/t]	1
Coke	107,00	29,31 [GJ/t]	1
Natural gas	56,10	34,80 [GJ/10 <sup>3</sup> m <sup>3</sup> ]	1
Fuel oil	77,40	40,19 [GJ/t]	1
Gas oil	74,10	42,71 [GJ/t]	1



## EXERCISE 2

- **Task:**

- Fuel being used: fuel oil
- Default: according to the monitoring plan, the installation must conduct laboratory measurements of carbon content in fuel and lower calorific value. Two fuel analyses are shown in the table

Analysis no.	LCF [MJ/kg]	Carbon content [%]
1	40,20	86,40
2	40,61	86,48

- Determine the emission factor for each of the analyses

## EXERCISE 2

- **Task:**

EF calculation formula:

$$EF = (1000 * \text{carbon content} * C) / LCF$$

C - Stoichiometric ratio kg CO<sub>2</sub>/kg C

C = 3.664

# REVIEW OF EXERCISE 2 RESULTS

- **answer:**

Analysis no.	LCF [MJ/kg]	Carbon content [%]	EF [t CO <sub>2</sub> /TJ]
1	40,20	86,40	78,75
2	40,61	86,48	78,03



## EXERCISE 3

- **Task:**

- Fuel being used: listed in the table
- Default: according to the monitoring plan, the installation is using calculation factors from Annex VI of Commission Regulation 601/2012 to determine emissions
- For each fuel determine: the emission factor, lower calorific value and the oxidation factor and enter them into the table

fuel / raw material	EF [tCO <sub>2</sub> /TJ, tCO <sub>2</sub> /t karb.]	LCF [GJ/t]	OF
Lignite			1
Petroleum coke			1
Natural gas			1
Diesel fuel			1
Limestone		-	-

# REVIEW OF EXERCISE 3 RESULTS

- answer:

fuel / raw material	EF [tCO <sub>2</sub> /TJ, tCO <sub>2</sub> /t karb.]	LCF [GJ/t]	OF
Lignite	101,00 [tCO <sub>2</sub> /TJ]	11,90 [GJ/t]	1
Petroleum coke	97,50 [tCO <sub>2</sub> /TJ]	32,50 [GJ/t]	1
Natural gas	56,10 [tCO <sub>2</sub> /TJ]	48,00 [GJ/t]	1
Diesel fuel	74,10 [tCO <sub>2</sub> /TJ]	43,00 [GJ/t]	1
Limestone	0,44 [tCO <sub>2</sub> /t carbonate]	-	-







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# DETERMINATION OF INDIVIDUAL SOURCE STREAM'S EMISSION BASED ON ORIGINAL DATA - practical exercises -

# CONTENTS

- Exercise description
- Task
- Review of results

## EXERCISE DESCRIPTION

- **Group work**
- **Each group will get one task which contains three source streams**
- **The purpose of the exercise is to determine CO<sub>2</sub> emission for each source stream**



## EXERCISE DESCRIPTION

- Formula for determining CO<sub>2</sub> emission from combustion of fuel

$$\text{emission } E [t] = AD * LCF * EF * OF$$

AD = activity data [t, m<sup>3</sup>] – fuel amount

LCF = lower calorific value [TJ/t, GJ/10<sup>3</sup>m<sup>3</sup>]

EF = emission factor [tCO<sub>2</sub>/TJ]

OF = oxidation factor OF [-]

## EXERCISE DESCRIPTION

- Formula for determining CO<sub>2</sub> emission from raw material

$$\text{emission } E \text{ [t]} = AD * EF * CF$$

AD = activity data [t] – consumption of limestone

EF = emission factor [tCO<sub>2</sub>/t]

KF = portion of carbonate turned into CO<sub>2</sub>

# EXERCISE 1

- **Task:**

- Fuel being used: natural gas and diesel fuel
- Raw material being used: limestone
- Default: yearly amounts of used oil and raw material, per the table

Fuel/raw material	amount	Portion of carbonate not turning into CO <sub>2</sub>
Natural gas	2.568.235 m <sup>3</sup>	-
Diesel fuel	2.560 kg	-
Limestone	3.200 t	10 %

$$\text{emission E [t]} = \text{AD} * \text{LCF} * \text{EF} * \text{OF}$$

$$\text{emission E [t]} = \text{AD} * \text{EF} * \text{KF}$$



# EXERCISE 1

- **Task:**

- Default: calculation factors, per the table

Fuel/raw material	Calculation factors
Natural gas	National Emission Inventory
Diesel fuel	Annex VI of Commission Regulation 601/2012
Limestone	Annex VI of Commission Regulation 601/2012

- Calculate CO<sub>2</sub> emission for each source stream

# REVIEW OF EXERCISE 1 RESULTS

- answer:

Fuel/raw material	amount	LCF	EF	OF	CF	CO <sub>2</sub> emission [t]
Natural gas	2.568.235 m <sup>3</sup>	34,80 [GJ/10 <sup>3</sup> m <sup>3</sup> ]	56,10 [t CO <sub>2</sub> /TJ]	1	-	5.013,91
Diesel fuel	2.560 kg	43,00 [GJ/t]	74,10 [t CO <sub>2</sub> /TJ]	1	-	8,16
Limestone	3.200 t	-	0,44 [t CO <sub>2</sub> /t carbon.]	-	0,9	1.267,20





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# **CALCULATING GREENHOUSE GAS EMISSIONS FROM INSTALLATIONS AND AIRCRAFTS - practical exercises -**

# CONTENTS

- Exercise description
- Task
- Review of results

## EXERCISE DESCRIPTION

- **Group work**
- **Each group will get two tasks, one related to determining total CO<sub>2</sub> emissions from an installation, the other to determining total CO<sub>2</sub> emissions from one aircraft flight**
- **The purpose of the exercise is to determine total annual CO<sub>2</sub> emissions from an installation and an aircraft**



# EXERCISE 1

- **Task:**

- Fuel being used: natural gas and diesel fuel
- Raw material being used: limestone
- Default: CO<sub>2</sub> emissions according to source streams from the previous exercise
- Determine total CO<sub>2</sub> emissions from the installation





# EXERCISE 1

- **Task:**

**Total emission E [t] = Emission (1) + Emission (2) +  
Emmission (3)**

# REVIEW OF EXERCISE 1 RESULTS

- **answer:**

Fuel / raw material	CO <sub>2</sub> emission [t]
Natural gas	5.013,91
Diesel fuel	8,16
Limestone	1.267,20
	<b>6.289,27</b>



## EXERCISE 2

- **Task:**

- Fuel being used: jet fuel

- Default:

	količina
Fuel supply before flight	8 t
Fueling for flight	50 t
Fuel supply after flight	500 kg

- In the monitoring plan, aircraft operator is using jet fuel laboratory analysis for emission calculation (table)

No.	LCF [GJ/t]	EF [tCO <sub>2</sub> /TJ]	OF
1	43.98	70.30	1

# REVIEW OF EXERCISE 2 RESULTS

- answer:

fuel	amount [t]	LCF [GJ/t]	EF [tCO <sub>2</sub> /TJ]	OF	CO <sub>2</sub> emission [t]
Jet fuel	57.50	43.98	70.30	1	177.78





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