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# Environment and Climate Regional Accession Network (ECRAN)

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Report on the Regional  
Training Seminar on the  
assessment of GHG  
inventories in Waste

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24-25 November 2015, Sarajevo

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**ENVIRONMENT AND CLIMATE REGIONAL NETWORK FOR ACCESSION - ECRAN**

**WORKSHOP REPORT**

**Activity 3.2 (Task 3.2.2A)**

**REPORT ON THE REGIONAL TRAINING SEMINAR ON THE ASSESSMENT OF GHG  
INVENTORIES IN THE WASTE SECTOR**

**Sarajevo, 24-25 November 2015**



This Project is funded by the  
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| LIST OF ABBREVIATIONS |  |
|-----------------------|--|
| ADCP                  | Annual Data Collection Plan  |
| BUR                   | Biennial Update Report   |
| CAEN                  | Croatian Agency for the Environment and Nature                     |
| CBCCAM                | Coordination Board on Climate Change and Air Management, Turkey    |
| CDR                   | Central Data Repository  |
| COP                   | Conference on Parties  |
| CRF                   | Common Reporting Format  |
| DAFM                  | Department of Agriculture, Food and Marine, Ireland                |
| DECC                  | Department of Energy and Climate Change, UK                        |
| DG                    | Directorate General  |
| ECRAN                 | Environment and Climate Change Regional Accession Network          |
| EEA                   | European Environment Agency  |
| EIONET                | European Environment Information and Observation Network           |
| EPA                   | Environmental Protection Agency                                    |
| EPRT                  | European Pollutant Release and Transfer Register                   |
| ER                    | Emissions Registration   |
| ETC/ACM               | European Topic Centre on Air Pollution & Climate Change Mitigation |
| EtEA                  | Estonian Environment Agency  |
| EU                    | European Union   |
| EU ETS                | European Union Emission Trading System                             |
| F-gases               | Fluorescent gases  |
| GHG                   | Greenhouse Gases   |
| ICC                   | Intergovernmental Coordination Committee                           |
| INC                   | 1st National Communication   |
| IPCC                  | Intergovernmental Panel on Climate Change                          |
| JRC                   | Joint Research Centre (Ispra)                                      |
| KP                    | Kyoto Protocol   |
| LEAP                  | Long-range Energy Alternatives Planning System                     |
| MAEP                  | Ministry of Agriculture and Environmental Protection, Serbia       |
| MENP                  | Ministry of Environment and Nature Protection                      |
| MMD                   | Monitoring Mechanism Decision, Decision No 280/2004/EC             |
| MME                   | Ministry of Mining and Energy, Serbia                              |
| MMR                   | Monitoring Mechanism Regulation, Regulation (EU) No 525/2013       |
| MoE                   | Ministry of Environment  |
| MOP                   | Meeting of Parties of the Kyoto Protocol                           |
| MOU                   | Memoranda of Understanding   |
| MRV                   | Monitoring, Reporting and Verification                             |
| MS                    | Member State   |
| NAEI                  | National Atmospheric Emission Inventory, UK                        |
| NAMA                  | Nationally Appropriate Mitigation Actions                          |
| NIR                   | National Inventory Report  |
| NS                    | National System  |



| LIST OF ABBREVIATIONS |  |
|-----------------------|--|
| OCLR                  | Office of Climate Licensing and Resource, Ireland                |
| PAM                   | Policies and Measures  |
| QA/QC                 | Quality Assurance / Quality Control                              |
| RVO                   | Netherlands Enterprise Agency                                    |
| SEPA                  | Serbian Environmental Protection Agency                          |
| SNC                   | Second National Communication                                    |
| SNE                   | Single National Entity   |
| TCCCA                 | Transparency, Consistency, Comparability, Completeness, Accuracy |
| UNFCCC                | United Nations Framework Convention on Climate Change            |
| WG                    | Working Group  |



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## I. Background/Rationale/Legislation covered

Effective monitoring, reporting and verification (MRV) of greenhouse gas (GHG) emissions is critical for tracking progress towards the achievement of emission reduction targets.

As Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, the European Union and Member States are required to report annually on their GHG emissions. They also have to report regularly on their climate change policies and measures through National Communications.

The annual EU GHG inventory report is prepared on behalf of the European Commission by the European Environmental Agency each spring. In line with UNFCCC reporting requirements, each Member State's annual inventory covers emissions up until two years previously.

Regulation (EU) No 525/2013 on mechanisms for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change (hereinafter: Monitoring Mechanism Regulation or MMR) revises and strengthens the EU's greenhouse gas monitoring and reporting framework in order to provide a better platform for EU action to tackle climate change. It fully substitutes the Decision No 280/2004/EC (Monitoring Mechanism Decision or MMD). Its main goals include improving the quality of the data reported, enabling the implementation of the Climate and Energy package through accurately tracking the progress of the Union and EU Member States towards meeting their emission targets for 2013-2020 and taking into account the periodic update at international level of the use of metrics (Global warming potentials) and methodologies (IPCC Guidelines) in the determination of greenhouse gas inventories.

## II. Objectives of the Training

### *General Objectives*

The aim of this training seminar was to gradually improve/increase technical knowledge and institutional and procedural capacities of the ECRAN countries to prepare submissions of the National Inventory Reports according to the requirements of the MMR.

The training seminar was covering following activities of ECRAN's Working Group 2 on "National inventory systems and the EU Monitoring Mechanism Regulation":

- Sub-task 2.2.A. related to regional technical training seminars on GHG inventory in Waste sectors in accordance with the Revised 2006 IPCC Guidelines)
- Sub-task 2.2.A. is dealing with identification of gaps in activity data and providing recommendations for establishment of data flow system for gap filling as well as checking the overall quality of implemented emission factors in GHG emission estimates with focus on key categories in waste.

The results of this training will feed into assessment report which will include recommendations for short and long-term inventory improvements in relation to applied methodology, activity data and emission factors in the beneficiaries.

This regional training seminar was based on the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Participants were requested/encouraged to bring to the workshop their latest estimates (preferably in electronic form) for GHG emissions in the waste sector prepared in the framework of the UNFCCC reporting exercises. The training addressed best practices, but also went through the national inventory reporting on the waste sector in the Waste Reporting Clinics on day 2.

### *Expected Results*

The expected results were:

- Quality control check of key categories with a focus on completeness and accuracy
- Identification of activity data gaps and providing recommendations and guidance for gap filling
- Improved skills in selecting emission factors and other calculation parameters in waste
- Setting priorities for country-specific short and long-term GHG inventory improvements



### III. Highlights from the Training

Reference is made to Annex I for the agenda. Below only the main elements are highlighted. The presentations are presented in Annex III.

#### Highlights Day 1

Day 1 – Hotel Bristol Sarajevo, Bosnia and Herzegovina, 24 – 25 November 2015

#### Introduction to the workshop – Imre Csikós

- Mr. Csikós presented the overview of tasks and modules in Activity 2, main goals, approach to and structure of the trainings which is presented on figure 1.
- Main results of this of this particular training to be achieved are to collectively understand the current state of progress with establishing national systems for GHG estimation in the waste sector, to identify activity data gaps and providing recommendations and guidance for gap filling, to improve skills in selecting emission factors and other calculation parameters in waste and to set priorities for country-specific short and long-term GHG inventory improvements

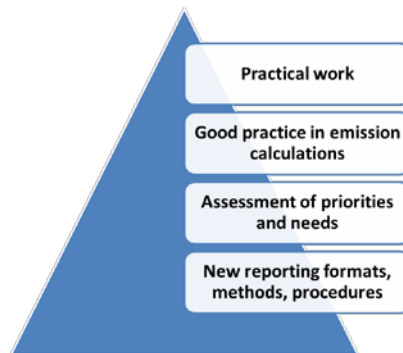


Figure 1

#### National Systems Requirements – Justin Goodwin

A National System is one of the foundations for MRV (Monitoring, Reporting and Verification). It is a team of organisations (people), available resources and agreed processes and tools focused on efficiency and repeatedly:

- Estimating and reporting GHG emissions and acceptable quality (TCCCA);
- Engaging with external review activities (verification) and the outside worlds;
- Improving estimates and evolving itself (the National system) to fit with governance structures and data suppliers.

The typical activities would include:

- Collecting data, estimating emissions/removals, reporting and archiving



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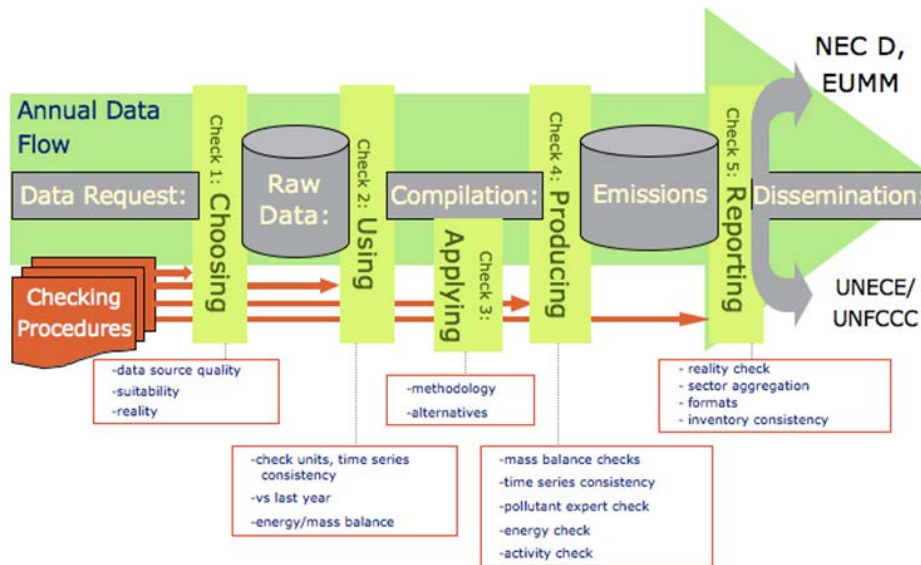


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- Using appropriate and reliable methods and data (official statistics and country specific emission factors/research;
- Applying expert judgement;
- Using tools for analysis, aggregation, QA/QC and archiving;
- Quality and continuous improvement
  - Understanding and continuous improvement;
  - QA/QC plan, quality objectives, implementation and documentation.

The figure below depicts the national system activities



The National system building blocks are the following:

1. A National Entity: (Responsible for the outputs);
2. Management/Co-ordination (Co-ordination entity: Finding and retaining the resources, skills & tools needed for a good quality GHG inventory; Establish and maintain the institutional, legal and procedural arrangements; Define and allocate specific responsibilities; Ensure sufficient capacity for timely performance of the functions; Archiving);
3. Compilation Expertise (Co-ordinators to organise the work undertake QA/QC and bring things together on time; Sector experts that understand the data & emitting/removal processes; Strong links to national networks of technical experts and data sources for sector/category);
4. Data sources (Data owners and suppliers; National Statistics).

Reference is made to the IPCC methods and guidelines, in particular the IPCC Guidelines<sup>1</sup>. In addition an overview is provided of the CRF (Common Reporting Format) reporting for the Waste Sector with a special focus on the subcategories.

<sup>1</sup> <http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html>

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES                              | CO <sub>2</sub> <sup>(1)</sup> | CH <sub>4</sub> | N <sub>2</sub> O | NO <sub>x</sub> | CO    | NM VOC | SO <sub>2</sub> |
|--|--------------------------------|-----------------|------------------|-----------------|-------|--------|-----------------|
|  | (kt)                           |                 |                  |                 |       |        |                 |
| <b>Total waste</b>   | 252.11                         | 822.12          | 5.67             | 1.51            | 24.15 | 7.31   | 0.70            |
| <b>A. Solid waste disposal</b>   | NO,NE                          | 659.95          |                  | NO,NE           | NO,NE | 2.38   |                 |
| 1. Managed waste disposal sites  | NO,NE                          | 659.95          |                  | NE              | NE    | 2.38   |                 |
| 2. Unmanaged waste disposal sites                                      | NO                             | NO              |                  | NO              | NO    | NO     |                 |
| 3. Uncategorized waste disposal sites                                  | NO                             | NO              |                  | NO              | NO    | NO     |                 |
| <b>B. Biological treatment of solid waste</b>                          |                                | 28.52           | 2.03             | NE              | NE    | NE     |                 |
| 1. Composting  |                                | 25.42           | 1.91             | NE              | NE    | NE     |                 |
| 2. Anaerobic digestion at biogas facilities                            |                                | 3.11            | 0.13             | NE              | NE    | NE     |                 |
| <b>C. Incineration and open burning of waste</b>                       | 252.11                         | 0.40            | 0.15             | 1.51            | 24.15 | 4.93   | 0.70            |
| 1. Waste incineration  | 252.11                         | 0.07            | 0.15             | 1.14            | 6.09  | 2.15   | 0.70            |
| 2. Open burning of waste   | NO,NE                          | 0.33            | NO,NE            | 0.37            | 18.07 | 2.78   | NE              |
| <b>D. Wastewater treatment and discharge</b>                           |                                | 133.25          | 3.49             | NO,NE           | NO,NE | NO,NE  |                 |
| 1. Domestic wastewater   |                                | 29.04           | 3.49             | NE              | NE    | NE     |                 |
| 2. Industrial wastewater   |                                | 104.21          | NE               | NE              | NE    | NE     |                 |
| 3. Other (as specified in table 6.B)                                   |                                | NO              | NO               | NO              | NO    | NO     |                 |
| <b>E. Other (please specify)</b>                                       | NO                             | NO              | NO               | NO              | NO    | NO     | NO              |
|  |                                |                 |                  |                 |       |        |                 |
| <b>Memo item:<sup>(2)</sup></b>  | NE                             |                 |                  |                 |       |        |                 |
| Long-term storage of C in waste disposal sites                         | NE                             |                 |                  |                 |       |        |                 |
| Annual change in total long-term C storage                             | NE                             |                 |                  |                 |       |        |                 |
| Annual change in total long-term C storage in HWP waste <sup>(3)</sup> | NE                             |                 |                  |                 |       |        |                 |

### 1. Sub-Category 5A – solid waste disposal (SDW)

- Managed solid waste disposal (SWD) - Anaerobic & Semi Anaerobic
- Unmanaged SWD
- Uncategorized SWD
- Amount sent to SWD (kt), CH<sub>4</sub> flared & recovered (kt), Emissions (kt/yr)

### 2. Sub-Category 5B – Biological Treatment of Solid Waste

- Municipal Solid Waste or other waste - Composting & Anaerobic Digestion
  - Amount treated (kt dm)
  - CH<sub>4</sub> flared & recovered (kt)
  - Emissions (kt/yr)

### 3. Sub-Category 5C waste Incineration & Open burning

- Biogenic/Non Biogenic
  - Waste burned (kt)
  - Emissions (kt)
  - Incineration
- Municipal Solid Waste
- Other e.g.
  - Sewage sludge
  - Clinical
  - Chemical
  - Open Burning
    - Municipal Solid Waste
    - Other e.g.
      - Car fires
      - House fires



#### 4. Sub-Category 5 D Wastewater treatment

- Domestic & Industrial Wastewater treatment
  - Total Organic product & Sludge removed (ktDC/yr) & N in effluent (kt N/yr)
  - CH4 recovered (kt)
  - Emission CH4, N2O (kt)

#### **Croatia – National System and results of GHG estimations in the waste sector – Tatjana Obucina**

The Ministry of Environmental and Nature Protection (MENP) is a national focal point for the UNFCCC, with overall responsibility for functioning of the National System such as: communication with the UNFCCC, EU, control of methodology for emission and GHGs removal, calculations, approval of the GHG Inventory Report, submission to UNFCCC etc.

The Croatian Agency for the Environment and Nature (CAEN) is responsible for the organisation of the GHG Inventory preparation, collection of activity data, development of QA/QC Plan, implementation activities QA/QC, archiving of all documents which used for Inventory planning, selection of Authorized Institution. CAEN is responsible to the Reporting to the European Commission under MMR.

The Authorised Institution is responsible for preparation of inventory, which includes emission calculations in line with the methodology prescribed in new 2006 IPCC guidelines.

The Committee for inter-sectorial coordination on the National System for monitoring of GHG emissions was established by Government decision and includes representatives from various ministries with an active role in streamlining activity data collection. It provides recommendations for inventory improvement, gives opinions on the GHG report and participates in the review of these reports.

The methodology used to estimate emission for waste management activities requires:

- Country-specific knowledge on waste generation;
- Information on the composition of waste;
- Information on the management practice (of collecting and archiving waste data).

The above mentioned management activities in Croatia are not organized and implemented in full and thus this results in the lack of and inconsistency of data. However, improvements (quality and quantity of data) are visible in last couple of years

An overview is presented of the results of the inventory work in the subcategories 5A to 5D, including the activity data used and data sources. (details are provided in annex III).

#### **Croatia – Collecting and evaluating the data on waste needed for the Croatian GHG inventory – Predrag Korica**

The Croatian Environmental Pollution Registry (CEPR) is presented, which is the reporting application/database developed and maintained by the Croatian Agency for the Environment and Nature (CAEN) for the reporting of the data on the:



- Sources;
- Types;
- Amounts;
- Methods;
- Places of emissions to air, water and soil (including waste).

Regarding the GHG Inventory - CEPR is the main source of information on:

- Collected, treated and disposed total amounts of waste;
- Biological treatment of waste:
  - Composted amounts of waste;
  - Digested amounts of waste in biogas plants;
- Incinerated amounts of waste.

In addition the Central management System for the data on landfills of waste (CMSDLW) is explained, including data collection in the waste waters sector.

#### **Bosnia and Herzegovina, beneficiary status update – Ranka Radic, Stana Kopanovic**

- The administrative structure of BiH is explained and the obligations and achievements under the UNFCCC are highlighted. There is no legal requirement on national systems on state level to prepare GHG inventories. The gaps were highlighted and the most salient ones were elaborated upon (i.e. Lack of horizontal and vertical cooperation and Lack of data (energy balance for BiH in 2013 (for RS in 2011 and FBiH 2013)).
- A list of critical issues in the inventory for the waste sector was presented. Basic problems relate to the lack of (quality of) data as regards SWDS management or MSW composition. Improvement recommendations were presented including:
  - Country-specific MSW composition;
  - Data on SWDS management, recovered methane;
  - Increased reliability of the data on MSW disposal;
  - Data on type of domestic and industrial ww treatments;
  - Identification of the most relevant industries and national COD values;
  - Data on waste management other than disposal (open burning).

#### **Albania – beneficiary status update – Enkeleda Shkurta**

- The Albanian Institute of Statistics (INSTAT), different ministries and specialized institutes provide activity data for all sectors as required for the GHG Inventory. The Law No.7687 dated 16.03.1993 “On Statistics” defines INSTAT as the unique central institution in the country under the Council of Ministers, which approves the National Statistical Program, the criteria of the evidences as well as methodological ones, nominations and classifications for production of uniform national statistics underlying the obligations of economic subjects, be they private or public.
- The First, Second and Third National Communications of Albania to UNFCCC, prepared through the Climate Change Programme of UNDP, in the frame of the projects ‘Enabling activities for the preparation of national communications of Albania related to the UNFCCC’. Available at



[http://www.al.undp.org/content/albania/en/home/library/environment\\_energy/](http://www.al.undp.org/content/albania/en/home/library/environment_energy/). The Third National Communications of Albania to UNFCCC is in draft version.

- The Third National Communication has a narrower and deeper analysis than the previous inventory (i.e., more detailed activity levels, data permitting) with the *baseline year of 2005*. The inventory adopted the higher tiers of the IPCC methodology and maintained a strong data validation focus on the energy and transport sectors. The inventory covers the refined time-series for the period 2000-2009. TNC is developed using the 1996 revised IPCC Guidelines. The activity data for the waste sector are generated mainly from the “Annual register of urban and inert waste production according to municipalities and districts”. However, those data were not fully complete due to:
  - lack of monitoring of daily amount of the waste production;
  - lack of their registration; contradictory data with regards to the population figures registered by Institute of Statistics (INSTAT) and figures declared by Municipalities;
  - lack of solid waste data produced by industry/private enterprises related to industry of steel and ferro-chromium, food industry, cement production, textile industry/ confection production; leather processing/leather confection production, tyre industry (especial in cover up of used tyres), plastic industry/production of different articles through plastic waste recycle, and detergents industry;
  - Urban solid wastes are disposed in open dumps only and there are problems with the use of the IPCC methodology in the case of burning waste;
  - Only two WWTP (Kavaja and Korça) are working so in general, urban waste waters are discharged directly into surface waters, without any treatment;
  - A system for collection of solid waste are equipped only to the cities but not in rural areas.
  - Only 10 % of urban waste go for recycling;
  - Albania lacks a modern system of waste collection, disposal and recycling;

In view of their importance to national policy, the statistics on emissions should become part of the regular production and dissemination process of official statistics at national level with appropriate institutional arrangements firstly established in the Ministry of Environment and INSTAT. Industrial waste water should be reported separately. Their treatment systems should be constructed according to the quantities and composition of this waste water. The industrial waste water register should contain data at least regarding the quantities, time and location of generation, treatment system technology and respective treatment time and the treated water receiving environment.

### **Montenegro – beneficiary status update – Ranka Zarubica**

The obligations associated with the making of inventories of greenhouse gas emissions, its updating, data management and storage are transferred to the Environmental Protection Agency. The GHG emissions inventory is an integral part of the environmental information system;

A Rulebook has been adopted about the list of gases and method of preparing GHG emission inventory, and it is based on the 2006 IPCC guidelines.

The waste management sector contributed to 2,11% of the total GHG emissions in Montenegro in 2011, and it is growing annually (details are presented in Annex III).



Reference was made to the key issues that need to be addressed to promote an improved waste management system in Montenegro.

**Kosovo<sup>2\*</sup> – beneficiary status update –**

The current inventory includes reporting on the waste sector. Greenhouse Gases are reported only within the NIR (National Inventory Report). Results on the waste sector were presented as a separate excel file.

- Strong points: Core team created and capacities have been built on data sources identification, data collection, understanding the IPCC 2006 guidelines; calculations using IPCC 2006 software.
- Weak points: The national inventory system has not yet formally been established; there is a need to maintain consistency of work, learning to fill CRF tables. There is still a too heavy reliance on external skills.

Immediate needs relate to consolidating the recent results as regards the development of the national inventory system. Additional work will also be required to develop QA/QC plans and to increase the capacities on calculations estimations (higher tiers, uncertainty assessment).

**Serbia – beneficiary status update – Nemanja Stanisavljevic, Laura Lepojevic, Ivana Dukic, Ivana Antonovic**

Currently, there is no legally defined responsibility of specific institution(s) for projections, while this as well as QA/QC procedures will be defined and legally prescribed under the IPA 2013 project: "Establishment of mechanism for the implementation of MMR". The project began in May 2015.

For inventory compiling the 2006 IPCC Guidelines for National Greenhouse Gas Inventories was used, as well as all other instructions whose use is mandatory. To calculate the emissions of greenhouse gases from all categories, the IPCC Inventory Software 2006<sup>th</sup> has been used. Uncertainty analysis was not performed. The 2006 IPCC Guidelines for GHG Inventory offers default values for the Activity data and Emission factors for uncertainties, which all were used.

In 2013, emissions from the waste sector were 5.1% of total GHG emissions. In the period 2010-2013, emissions have increased by 2.1% due to higher emissions rate from wastewater treatment and discharge, and in comparison with 1990 they decreased by 16.5%.

Within the sector, 61.9% of the emissions were from solid waste disposal on land, followed by 38.1% from wastewater treatment and discharge.

Under activity 2.6 of the IPA 2012 project: "Establishment of a monitoring, reporting and verification system necessary for the effective implementation of the EU emissions trading system (EU ETS)", an analysis on compliance of National GHG inventory's preparation with the EU and UNFCCC

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<sup>2</sup> This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.



requirements was conducted. The main technical recommendations had been considered by SEPA concerning the waste sectors.

Critical issues relate to the following:

- QA/QC implementation according IPCC guidelines is not requested for Non Annex I countries. As a consequence, no documentation and no clear QA/QC activities are established in Serbia. However, establishment of robust QA/QC procedures and documentation is a key element of Annex I reporting. Moreover, by principle, QA/QC procedures aim to improve the quality of data in regard of GHG emissions. Such improvement leads to a better assessment and follow up of policies and measures in place at national level.
- Annex I requires to justify data by providing relevant underlying documentation and by maintaining an archive system to ensure the tracking of information. Such requirement does not apply to Non Annex I countries and, as a consequence, is currently not established in Serbia.
- There is currently no improvement strategy formalized (the main possible improvements concern the TACCC principles).

The key short-term challenges in further development of the GHG inventory are primarily related to institutional and human resources strengthening and data flow management, including IT infrastructure, since existing capacities are underdeveloped as compared to the monitoring and reporting requirements.

#### **The Former Yugoslav republic of Macedonia – beneficiary status update – Daniela Ristova**

The inventory is available on the website of the UNFCCC:

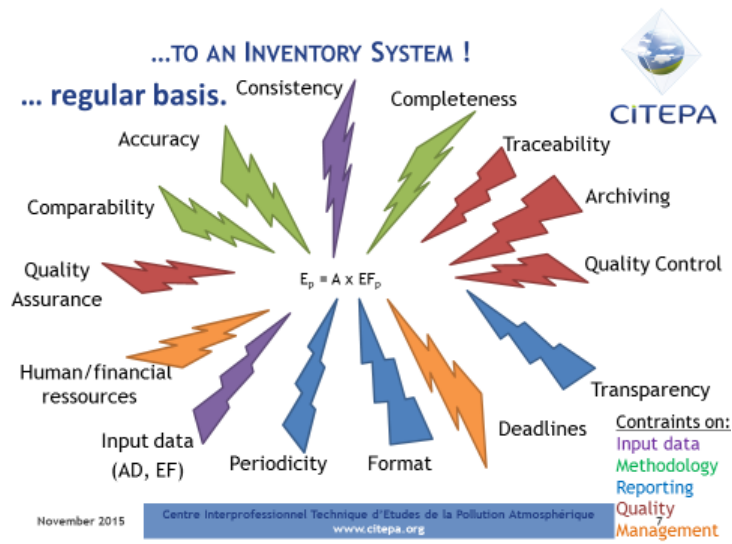
<http://unfccc.org.mk/content/InventoryHtml/MKInventoryApplication.html>.

The presentation included an overview of the set up of the current national system for the inventory work and the emissions from the sector waste for the country.

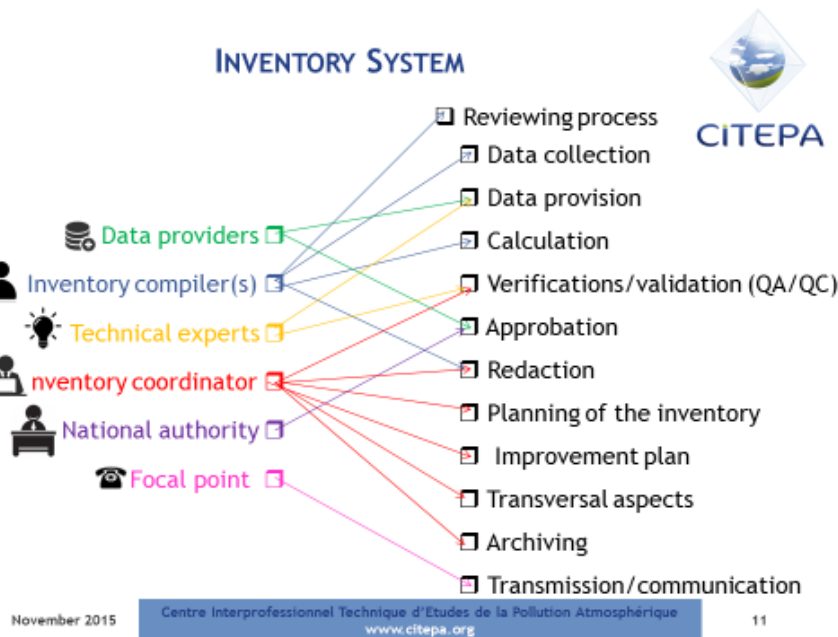
#### **National systems – Céline Gueguen**

The figure below summarises the framework conditions that are necessary to be considered when developing an inventory system.





The slide below outlines the tasks to be performed within the inventory system (on the right side) and the key players (on the left side):



A centralised and a dispatched national arrangement was shown and outlined/explained with special focus on the required tasks. The coordinator has to define the planning of the inventory (retroplanning based on the final transmission deadline to UNFCCC/UNECE). The main issue is to collect input data **on time**. This would require an agreement between the inventory team and data providers, the development of dedicated registers (e.g. ETS)/ surveys, and by-laws on data collection and data flow

The coordinator has to define the specifications of the inventory:

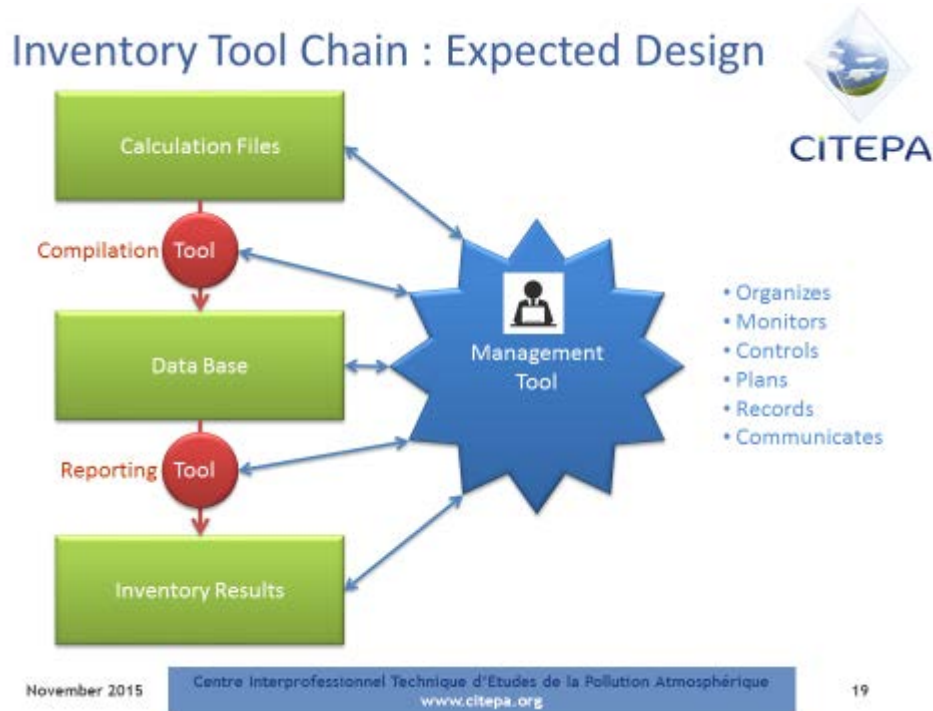
- pollutants (integrated approach between GHG and pollutants is possible);
- methodologies to be applied (which GL?);
- geographical perimeter;
- reference year;





- QC procedures;
- calculation nomenclature;

The expected inventory tools would include the tools for the calculations, tools for storage of data and reporting of data, as well as different management tools



**Methods, data sources and assumptions – Hans Oonk**

The presentation started with a detailed explanation of the basis processes that are causing GHG emissions (methanogenesis, nitrification and denitrification, combustion and aerobic decomposition).

Waste combustion has a straightforward calculation method:  $Emission = Activity * EF$  (Emission Factor), where

- Activity: amount of waste burnt
- EF CO<sub>2</sub>: contains fossil carbon

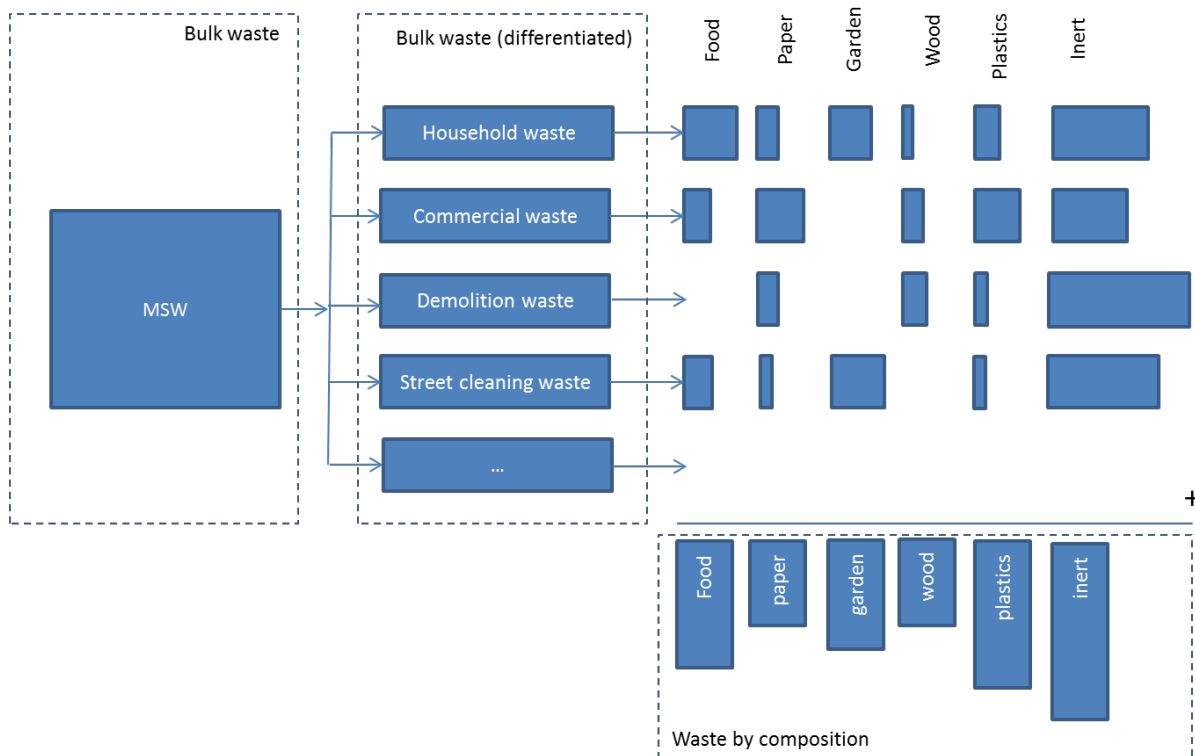
The Methane correction factor (MCF) was explained, where a high MCF is associated with more anaerobic conditions and methane emissions.

Methane Generation is result of

- Methane potential: W(amount of waste) , MCF (methane correction factor), DOC (degradable organic carbon in the year of deposition (DOC<sub>F</sub> – fraction of DOC that can decompose ; F – fraction of CH<sub>4</sub> in generated landfill gas);
- Release in time: FOD (First Order Decay);
- Bulk waste: MSW (municipal solid waste) , IW (industrial waste) waste by composition: Food, garden, paper, wood.



The more advanced IPCC waste models include subcategorization of different types of waste to be considered.



Waste Water Treatment Discharge (WWT&D) systems were described (uncontrolled anaerobic, controlled aerobic and controlled anaerobic systems).

- Emission per pathway: activity \* EF
  - Activity = TOW = f (P, BOD, I)
  - EF = Bo (maximum methane producing capacity for domestic waste water) \* MCF
- WWTP
  - Default: Water and sludge combined
  - Emission = (TOW) \* EF<sub>1</sub>
  - Better: Water and sludge separately
  - Emission = (TOW-S) \* EF<sub>1</sub>
  - Emission = S \* EF<sub>2-R</sub>
- Industrial Waste Water; CH<sub>4</sub>= activity \* EF (-R)
  - Activity: TOW (per ton product)
- N<sub>2</sub>O = activity \* EF
  - Activity (P, Protein, F<sub>pr</sub>, ad-ons)

### Afternoon break out session

The afternoon break out session addressed four key questions:

1. The key institutional arrangements



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2. The key institutional arrangements that are needed
3. The tier methods that are successfully being used
4. The improvements needed to methods, data sources and assumptions.

### *Highlights Day 2*

#### **Day 2 – Hotel Bristol Sarajevo, Bosnia and Herzegovina, 24 – 25 November 2015**

#### **Development of activity data and defining parameters – Juraj Farkas**

For the development of activity data it is useful to find surrogates. The use of surrogate is necessary to verify existing data (mass balance), to extrapolate historical data (First Order Decay FOD models) and to extrapolate projections. The requirements for surrogates are to be:

- Inflation independent (constant/real prices, production)
- Targeted (total or per unit?)

Used surrogates are:

- GDP
  - General characteristics;
  - Often not available for history data;
  - Unreliable in transition period;
- Production indices
  - Generally available, detailed;
  - Unreliable in transition period;
- Index of Real Wage, Household income
  - Defines money available for purchase of goods;
  - Long time series;
  - Good in reflecting changes in real income;
- Electricity consumption
  - Who wastes energy, wastes materials;
  - Good for transition period;

For activity data: to achieve transparency and completeness it is required to

- Map all streams
  - Fill in reported data, estimates
  - Calculate/estimate missing data
  - Verify all population/industries are covered
- Use decision trees
  - Helps to select Tier
  - Helps understanding your approach



Parameters in the 1996 Guidelines should not be used as they are clearly not sufficient. As such the 2006 parameters have to be used and then it is easier to move to higher tiers. For the determination of the methane generation rate constant, we use the reciprocal Mean Annual precipitation (MAP)/Potential evapotranspiration (PET) ration (MAP/PET).

The role of uncertainty: Balance the uncertainty of parameters with the uncertainty of data. Below the typical uncertainty of given parameters are presented:

- Disposal: methane generation potential LO  $\pm 50\%$ , k -40% +300%
- Biological treatment  $\pm 100\%$  (EF)
- Incineration  $\pm 30\%$  (EF CO<sub>2</sub>)  $\pm 100\%$  (EF N<sub>2</sub>O)  $\pm 50\%$  (EF CH<sub>4</sub>)
- Waste water CH<sub>4</sub>  $\pm 100\%$  (MCF)
- Waste Water N<sub>2</sub>O -90% + 4900% (EF)

For non-municipal waste, the EU list of waste has to be considered (19 groups of waste were presented).

### **Best Practice and inventory tools – Richard Claxton**

The presentation focused on best practice examples for calculating and documenting GHG emissions from the waste sector. Reference is made to Annex III for the detailed screenshots of documenting tables, that show how references, assumptions and methods applied are reported. The application of expert opinion for country specific data was addressed. The way how results can be presented was outlined, including an advanced review of outputs.

### **Afternoon Session – GHG emission estimation Clinics**

4 ad-hoc inventory teams were formed based on identified common and country-specific issues and priorities. The GHG emission tables were reviewed and discussed by the experts. Discussions focused on country specific recommendations for improving the GHG estimates from the waste sector.

## **V. Evaluation**

Reference is made to Annex IV for the detailed evaluation

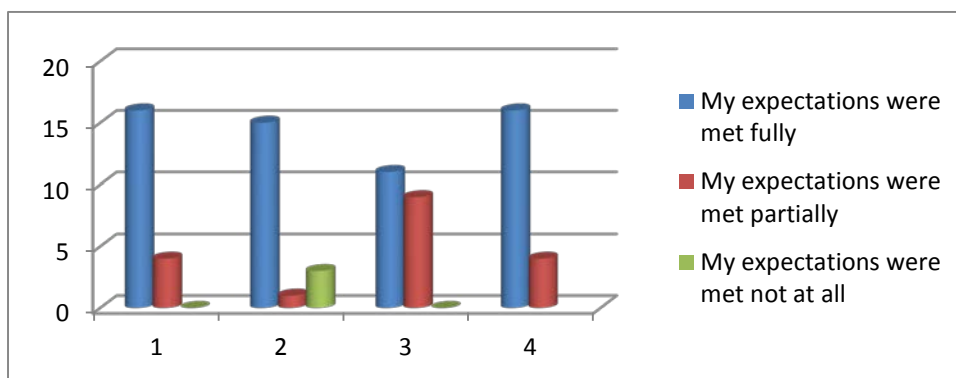
In the evaluation of the workshop a 80% majority of participants indicated that their expectations were fully met in the areas of quality control checks of key categories with a focus on completeness and accuracy and the identification of activity data gaps and providing recommendations and guidance for gap filling. Only half of the participants indicated that they have fully achieved improved skills in selecting emission factors and other calculation parameters in the waste sector, while the other half indicated that this was only partially achieved.

80% of the participants indicated that their expectations were fully met regarding the setting of priorities for country-specific short and long-term GHG inventory improvements.

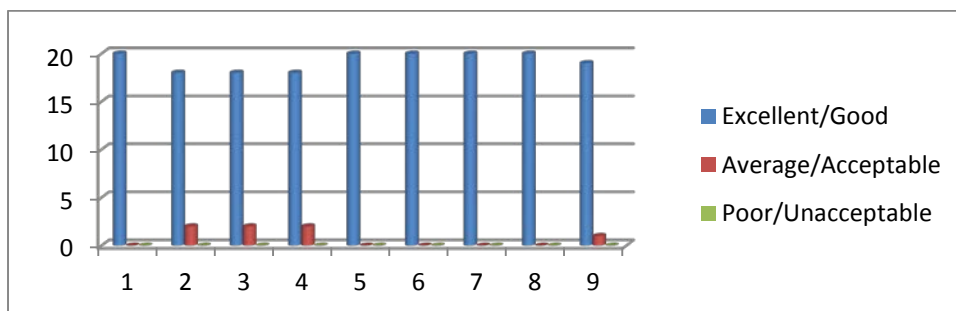


100% of the evaluation scores regarding the quality aspects of the workshop such as achieved objectives, overall quality, practical work, presentations, facilitators, and logistics, obtained the marks 'excellent' to 'good'. Almost all participants (except for one) indicated that they found the workshop 'time well spent'. Only two participants indicated that the content of the workshop did not completely match their level and skills.

| My Expectations   |
|---|
| 1. Quality control check of key categories with a focus on completeness and accuracy                  |
| 2. Identification of activity data gaps and providing recommendations and guidance for gap filling    |
| 3. Improved skills in selecting emission factors and other calculation parameters in the waste sector |
| 4. Setting priorities for country-specific short and long-term GHG inventory improvements             |



| Aspect of Workshop  |
|---|
| 1 The workshop achieved the objectives set  |
| 2 The quality of the workshop was of a high standard                                      |
| 3 The content of the workshop was well suited to my level of understanding and experience |
| 4 The practical work was relevant and informative   |
| 5 The workshop was interactive  |
| 6 Facilitators were well prepared and knowledgeable on the subject matter                 |
| 7 The duration of this workshop was neither too long nor too short                        |
| 8 The logistical arrangements (venue, refreshments, equipment) were satisfactory          |
| 9 Attending this workshop was time well spent   |



ANNEX I – Agenda

**Day 1 : 24 November 2015**

| <p><b>Topic: Assessment of GHG Inventories in Waste</b></p> <p><b>Chair and Co-Chair: Imre Csikós, Justin Goodwin</b></p> <p><b>Experts: Hans Oonk , Céline Gueguen, Juraj Farkas, Richard Claxton , Predrag Korica, Tatjana Obučina, Dr Andrea Hublin</b></p> <p><b>Venue: Sarajevo</b></p> |        |   |  |  |
|--|--------|---|--|--|
| Start  | Finish | Topic   | Speaker  | Sub topic/Content  |
| 08:30  | 09:00  | <b>Registration</b>   |  |  |
| 09.00  | 09.15  | Welcome   | Imre Csikós,<br>ECRAN  | <ul style="list-style-type: none"> <li>- Introduction of participants</li> <li>- Approval of the agenda</li> </ul>   |
| 09.15  | 09.30  | Introduction to Sub-task 2.2-A (15')  | Justin Goodwin,<br>ECRAN   | <ul style="list-style-type: none"> <li>- Overview</li> <li>- Overall and specific goals of training seminar</li> </ul>   |
| 09.30  | 10.00  | Background & Technical objectives (30')   | Justin Goodwin,<br>ECRAN   | <ul style="list-style-type: none"> <li>- Overview of IPCC guidance and MMR reporting objectives.</li> <li>- Main categories of emissions</li> <li>- Introduction to CRF categories and parameters for waste.</li> <li>- National inventory report (NIR)</li> <li>- MMR reporting contents and detail for waste.</li> <li>- CRF.</li> </ul> |
| 10.00  | 10.30  | Croatian work and experiences on estimates on waste (30')   | Mr Predrag Korica<br>Ms Tatjana Obučina<br>Dr Andrea Hublin<br>Croatia   | <ul style="list-style-type: none"> <li>- Results Waste CRF National Inventory Report</li> <li>- Methods applied</li> <li>- Challenges encountered and improvements implemented and planned</li> </ul>  |
| 10.30  | 11.30  | Beneficiary status updates <b>(Part 1)</b> : Progress and issues in beneficiary countries. 15 min/country (60') | <ul style="list-style-type: none"> <li>- Bosnia and Herzegovina</li> <li>- Albania</li> <li>- Montenegro</li> <li>- Kosovo*</li> </ul> | <p>Where have beneficiary countries got to with their estimates, national systems. What tools are being used, who are in the teams, what QA/QC is being used/done.</p> <ul style="list-style-type: none"> <li>• Overview of National system relevant to categories of sources and removals in Waste sector</li> </ul>                      |



|       |       |   |   |   |
|-------|-------|---|---|---|
|       |       |   |   | <p>(institutions, legislation, organization)</p> <ul style="list-style-type: none"> <li>• Completeness (years, gases)</li> <li>• Non-estimates (NEs)</li> <li>• Key categories</li> <li>• 3 most critical issues (AD, EF, method)</li> <li>• Progress made and planned/wanted improvements</li> </ul>   |
| 11.30 | 11.45 | <b>Coffee Break (15')</b>   |   |   |
| 11.45 | 12.30 | Beneficiary status updates (Part 2): Progress and issues in beneficiary countries. 10 min/country (45') | <ul style="list-style-type: none"> <li>- Serbia</li> <li>- Turkey</li> <li>- Former Yugoslav Republic of Macedonia</li> </ul> | <p>Where have beneficiary countries got to with their estimates, national systems. What tools are being used, who are in the teams, what QA/QC is being used/done.</p> <ul style="list-style-type: none"> <li>• Overview of National system relevant to categories of sources and removals in Waste sector (institutions, legislation, organization)</li> <li>• Completeness (years, gases)</li> <li>• Non-estimates (NEs)</li> <li>• Key categories</li> <li>• 3 most critical issues (AD, EF, method)</li> <li>• Progress made</li> </ul> |
| 12:30 | 13:00 | Discussion on Beneficiary progress.   | <p>Chair Justin Goodwin</p> <p>Experts</p>  | <p>WG 2 coordinator will develop and present initial matrix with common and country-specific priorities for GHG inventory improvement based on country presentations</p>  |
| 13.00 | 14.30 | <b>Lunch Break (90') Lunch and handling of administrative issues participants</b>                       |   |   |
| 14:30 | 14:45 | <b>National systems show-case. (15')</b>  | Céline Gueguen  | <p>Examples of NS and lessons learned:</p> <ul style="list-style-type: none"> <li>- Institutional arrangements,</li> <li>- planning,</li> <li>- preparation and archiving,</li> <li>- sectoral expertise,</li> <li>- QA/QC,</li> <li>- establishing regular data suppliers etc.</li> <li>- Archiving.</li> </ul>  |



|       |       |  |   |   |
|-------|-------|--|---|---|
| 14:45 | 15:15 | <b>National Systems breakout. (30')</b>  | Break out groups chaired by workshop experts: <i>Celine, Hans, Juraj, Richard, Justin</i> | Break out session (three rooms):<br><ul style="list-style-type: none"> <li>- 'xyz; note on flipcharts</li> <li>- Forum reactions to the findings</li> <li>- Discussion, recommendations and conclusions</li> </ul>  |
| 15:15 | 15:45 | <b>National Systems</b><br>Plenary feedback on break out groups and discussion | Break out group experts   |   |
| 15:45 | 16:00 | <b>Coffee Break (15')</b>  |   |   |
| 16:00 | 16:30 | <b>Method, data sources and Assumptions show-case. (30')</b>                   | Hans Oonk   | Examples of methods used for categories & lessons learned:<br><ul style="list-style-type: none"> <li>- Main changes made in 2006 IPCC Guidelines as compared with 1996 IPCC Guidelines</li> <li>- Solid waste disposal. E.g. <ul style="list-style-type: none"> <li>o historical activity data</li> <li>o landfill gas recovery</li> </ul> </li> <li>- Waste water treatment. E.g. <ul style="list-style-type: none"> <li>o managed waste-water</li> </ul> </li> <li>- Biological treatment. E.g. <ul style="list-style-type: none"> <li>o anaerobic</li> </ul> </li> <li>- Incineration.</li> <li>- QA/QC of waste.</li> </ul> |
| 16.30 | 16.45 | Conclusions and closing of Day 1 (15')   | Justin Goodwin, ECRAN   |   |





## Day 2 : 25 November 2015

| <b>Topic: Assessment of GHG Inventories in Waste</b>    |              |   |   |  |
|---|--------------|---|---|--|
| <b>Chair and Co-Chairs: Imre Csikós, Justin Goodwin</b> |              |   |   |  |
| <b>Venue: Sarajevo</b>                                  |              |   |   |  |
| Start   | Finish       | Topic   | Speaker   | Sub topic/Content  |
| <b>08:30</b>  | <b>09:00</b> | <b>Registration</b>                               |   |  |
| 09.00   | 09.15        | Introduction to Day 2                             | Imre Csikós,<br>ECRAN   |  |
| 09.15   | 09.45        | <b>Tools show-case.</b><br>(30')                  | - Juraj Farkas<br>- Richard Claxton   | Examples of tools & lessons learned:<br><br>- Solid waste disposal.<br>- Waste water treatment.<br>- Biological treatment.<br>- Incineration.<br>- QA/QC of waste. |
| 9:45  | 10:45        | <b>Tools breakout.</b> (60')                      | Break out Groups chaired by workshop experts: <i>Celine, Hans, Juraj, Richard, Justin</i> | - Deeper look at tools<br>- 'xyz; note on flipcharts<br>- Forum reactions to the findings<br>- Discussion, recommendations and conclusions                         |
| 10.45   | 11.00        | <b>Coffee Break (15')</b>                         |   |  |
| 11:00   | 11:15        | <b>Tools</b> Plenary feedback on BOG & discussion | BOG experts:<br><i>Celine, Hans, Juraj, Richard, Justin</i>                               | Feedback to plenary.   |
| 11:15   | 11:45        | Introduction to practical exercise                | Juraj Farkas and Richard Claxton  |  |
| 11.45   | 13:00        | Waste estimation clinics Part 1                   | Waste experts working with country experts.   | <ul style="list-style-type: none"> <li>4 ad-hoc inventory teams will be formed based on identified</li> </ul>  |



|       |       |  |   |  |
|-------|-------|--|---|--|
|       |       |  |   | <p>common and country-specific issues and priorities</p> <ul style="list-style-type: none"> <li>• team work with expert supervision</li> <li>• Hands on working progressing country calculations.</li> </ul>   |
| 13.00 | 14.00 | <b>Lunch Break (60')</b>                       |   |  |
| 14:00 | 15:15 | Waste estimation clinics continued Part 2.     | Waste experts working with country experts.                             | <ul style="list-style-type: none"> <li>• 3 ad-hoc inventory teams will be formed based on identified common and country-specific issues and priorities</li> <li>• team work with expert supervision</li> <li>• Hands on working progressing country calculations.</li> </ul> |
| 15.15 | 15.30 | <b>Coffee Break (15')</b>                      |   |  |
| 15:30 | 16:00 | Reporting back (30')                           | Summary for each beneficiary country provided by breakout group leaders | <ul style="list-style-type: none"> <li>- Presentations of break out group results (3 presentations)</li> <li>- Discussion</li> </ul>   |
| 16:00 | 16:30 | wrap up summary of recommendations and actions | Justin Goodwin, ECRAN   | <ul style="list-style-type: none"> <li>- Conclusions workshop</li> <li>- Workshop evaluation</li> <li>- Next workshop(s)</li> </ul>  |



## ANNEX II – Participants

| First Name | Family Name    | Institution Name   | Country                               | Email   |
|------------|----------------|--|---------------------------------------|---|
| Aspri      | Kapo           | National Environment Agency  | Albania                               | <a href="mailto:aspri.kapo@akm.gov.al">aspri.kapo@akm.gov.al</a> / <a href="mailto:asbeka@hotmail.com">asbeka@hotmail.com</a>         |
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| First Name | Family Name    | Institution Name                              | Country                               | Email  |
|------------|----------------|---|---------------------------------------|--|
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### ANNEX III – Workshop materials (under separate cover)

Additional Workshop materials including presentations and exercises, can be downloaded from:

[http://www.ecranetwork.org/Files/Workshop\\_Presentations\\_GHG\\_Waste\\_November\\_2015\\_Sarajevo.zip](http://www.ecranetwork.org/Files/Workshop_Presentations_GHG_Waste_November_2015_Sarajevo.zip)



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Human Dynamics Consortium

## ANNEX IV – Evaluation

### Statistical information

|     |   |  |
|-----|---|--|
| 1.1 | Workshop Session  | Activity 3.2.2 A – ECRAN workshop GHG inventory assessments in the sector waste<br>24-25 November 2015, Sarajevo, Bosnia and Herzegovina |
| 1.2 | Facilitators name   | As per agenda  |
| 1.3 | Name and Surname of Participants (evaluators)<br>optional | As per participants' list  |

### Your Expectations

Please indicate to what extent specific expectations were met, or not met:

| My Expectations   | My expectations were met |           |            |
|---|--------------------------|-----------|------------|
|   | Fully                    | Partially | Not at all |
| 1. Quality control check of key categories with a focus on completeness and accuracy                  | I                        |           |            |
| 2. Identification of activity data gaps and providing recommendations and guidance for gap filling    |                          | I         |            |
| 3. Improved skills in selecting emission factors and other calculation parameters in the waste sector | I                        |           |            |
| 4. Setting priorities for country-specific short and long-term GHG inventory improvements.            | I                        |           |            |



## Workshop and Presentation

Please rate the following statements in respect of this training module:

| Aspect of Workshop  | Excellent | Good | Average | Acceptable | Poor | Unacceptable |
|---|-----------|------|---------|------------|------|--------------|
| 1 The workshop achieved the objectives set  |           |      |         |            |      |              |
| 2 The quality of the workshop was of a high standard                                      |           |      |         |            |      |              |
| 3 The content of the workshop was well suited to my level of understanding and experience |           |      |         |            |      |              |
| 4 The practical work was relevant and informative   |           |      |         |            |      |              |
| 5 The workshop was interactive  |           |      |         |            |      |              |
| 6 Facilitators were well prepared and knowledgeable on the subject matter                 |           |      |         |            |      |              |
| 7 The duration of this workshop was neither too long nor too short                        |           |      |         |            |      |              |
| 8 The logistical arrangements (venue, refreshments, equipment) were satisfactory          |           |      |         |            |      |              |
| 9 Attending this workshop was time well spent   |           |      |         |            |      |              |

