Establishment of the Intergovernmental Panel on Climate Change (IPCC) Emission Factor Database

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ABSTRACT

The quality of national greenhouse gas (GHG) inventories depends substantially on reliable emission factors. Many countries have indicated that an easily accessible public database on GHG emission factors with supporting scientific information would help improve the quality of GHG inventories in a cost-effective way. Sharing of research information would also enable countries to use or develop emission factors that are more applicable to their national circumstances than previously published Intergovernmental Panel on Climate Change (IPCC) default emission factors without having to bear the associated research costs. A database on GHG emission factors with supporting scientific information would also support the future review and update of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. In response to this need, the Technical Support Unit (TSU) of the IPCC National Greenhouse Gas Inventories Programme (IPCC-NGGIP) has developed an emission factor database (EFDB). The primary goal of the EFDB is to grow towards a recognized library, where users can retrieve and submit emission factors and other parameters with background documentation that can be used for estimating GHG emissions in national inventories. The IPCC EFDB was released after a two-year development period that began in July of 2000, and which included the participation of inventory experts from many countries in the design, review, and pilot testing of the database. The EFDB currently provides a web-based platform for submission and retrieval of new emission factor and parameter data, as well as an intermittently released CD ROM version of the database. An EFDB Editorial Board has also been established with the objective of ensuring all emission factors and other parameters contained in the EFDB are technically sound according to pre-defined criteria.

INTRODUCTION

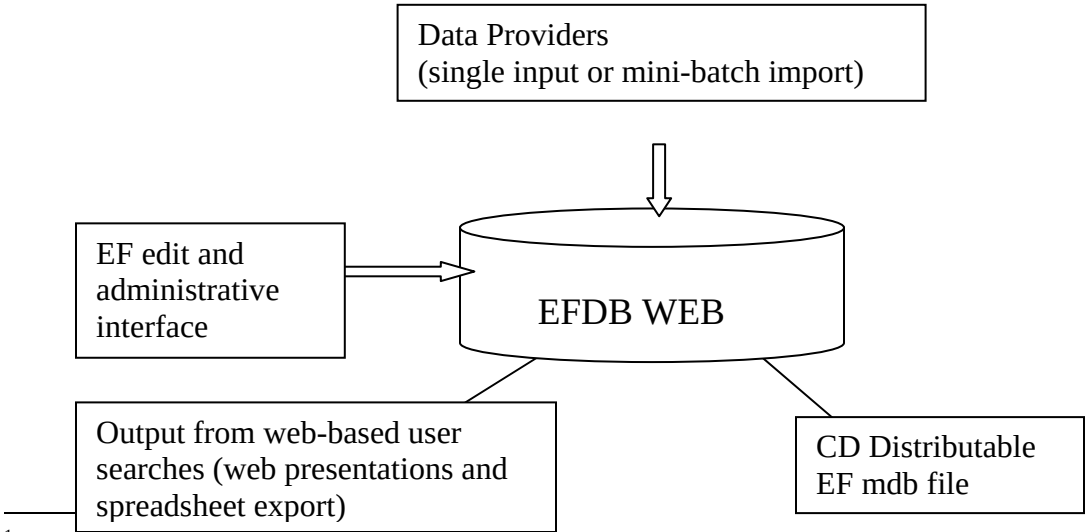
The primary goal of the EFDB is to become a recognised library of well-documented emission factors and other parameters to estimate emissions of direct greenhouse gases such as CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. Information on indirect greenhouse gases (SO_2, NOx, NMVOCs, CO) can also be supported in the EFDB. Data providers include, among others, individual researchers/scientists/experts, research programs, industry trade associations, and national databases. The primary audience for the EFDB are national inventory staff for Parties to the United Nations Framework Convention on Climate Change (UNFCCC). Other potential users of the EFDB include project developers involved in emission trading or voluntary reduction programs, scientists and consultants involved in GHG inventories work, non-governmental organisations, and the broader public.

The EFDB is intended to be a database to facilitate the use of the IPCC Methodology Reports by complementing the information on emission factors and other parameters given in those reports (e.g., the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* [*1996 IPCC Guidelines*] (IPCC, 1997) and the IPCC report on *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* [*GPG2000*] (IPCC, 2000)). The choice of emission factor or other parameters should be guided by the principles and approaches in those documents, and subsequent revisions to them. While there is an Editorial Board responsible for reviewing submissions to the EFDB (see section below "Criteria for Evaluating Submissions"), ultimate responsibility of using the information in the EFDB appropriately remains with the expert using it. Both the database and the user interface on the web have been designed such that the user has access to all information needed to make his/her own judgement on the applicability of every specific emission factor or other parameter.

SUBMISSIONS TO THE EFDB

Figure 1 shows an overview of the EFDB system. Submissions of emission factor data or emission related parameters[1] can be made by any user after they have registered with the TSU of the IPCC-NGGIP as a data provider and have received their login name and password.

Figure 1. Overview of the EFDB system.



[1] In addition to what are typically referred to as emission factors (e.g., kg of gas per ton of fuel consumed), the EFDB also allows the submission of other parameters associated with an emission estimate, such as gas destruction factors, energy coefficients, and conversion factors. See the Annex to the EFDB User's Manual for more examples of parameters.

Data providers can utilize either a single input or mini-batch import (for multiple submissions) format to submit data to the EFDB. Detailed instructions on submitting data utilizing the web-based platform are provided in the EFDB User Manual [http://www.ipcc-nggip.iges.or.jp/EFDB/documents.php]. The User Manual also describes the hardware and software requirements for the EFDB as well as the step-by-step procedures for submitting and searching for data.

One of the most important aspects of the submission process for the EFDB is the additional information called for in preparing the input form. A combination of 'mandatory' and 'optional' fields has been developed for the input form. The mandatory fields are critical to providing information so that user's of the EFDB can make informed decisions about the applicability and application of the emission factor (or other parameter) for their particular circumstances. Mandatory fields include such information as the description of the value, the technical reference for the value, technologies and practices associated with the value presented, and uncertainty estimates where available. Table 1 shows the template for the input form of the EFDB and some examples of what is included in each field.

CRITERIA FOR EVALUATING SUBMISSIONS

The EFDB is open to any relevant proposal on emission factors or other related parameters. Acceptance of such proposals is subject to evaluation by an EFDB Editorial Board comprised of international experts with expertise in each of the given sectors and source categories. Using the criteria given below, the Editorial Board evaluates each submission to determine if it can be accepted for entry into the EFDB, or whether additional information from the data provider is necessary to make an evaluation.

Is the emission factor or other parameter robust?

A robust emission factor or other parameter is one that, within the accepted uncertainty, is unlikely to change if there was repetition of the original measurement programme or modelling activity. Specific issues concerning robustness are:

- Are the measurement techniques including raw data validated and/or verified?
- Are the modelling techniques including supporting data validated and/or verified?
- Is the conversion (if any) from model assumptions or measurement conditions to annual or other forms of emission factors or other parameters sufficiently explained and justified?
- Is an uncertainty assessment on the emission factor or other parameter presented?

Is the emission factor or other parameter applicable?

An applicable emission factor or other parameter is one that matches either a specific IPCC Source/Sink Category or subcategory, or another well defined source category that can be used in a national inventory compilation. An emission factor is applicable if the source and its mix of technology, operating and environmental conditions and abatement and control technologies under which the emission factor was measured or modelled are clear and allow the user to see how it can be applied.

Is the emission factor or other parameter documented?

The information provided in the database should be detailed and comprehensive enough so that users may be able to evaluate the applicability to a national GHG inventory. Pivotal elements include an accurate source definition, adequate description of properties related to the parameter, information on how the parameter was derived, and the type and extent of any validation performed. For emission factors or other parameters to be transparent, access information to the original technical reference should be provided to evaluate the robustness and applicability as described above. This can be done by

providing sufficient reference information through a scientific or technical publication in an internationally available journal or a document with an ISBN number. For those emission factors or other parameters where this is not available, the data provider can provide the information required to enable a judgement on its robustness and applicability as described above by providing sufficient information in the proposal document fields of the database to satisfy the acceptance requirements.

CONTENTS OF THE EFDB

At this point in time, the EFDB contains all emission factors and other parameters that are included in the *1996 IPCC Guidelines* and the *GPG2000*. Inclusion of the emission/removal factors and other parameters in the IPCC report on *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (IPCC, 2003) is underway.

Since its release, an increasing number of new data are being submitted from independent experts and evaluated by the Editorial Board. The system now has begun working as it was intended: a dynamically evolving database as well as a platform for exchange of knowledge and expertise on emission estimation between experts and all those that need this information.

The EFDB will also be used during the upcoming revision of the *1996 IPCC Guidelines* as one of the most important resources/tools on which the IPCC will base its work. This will enable the users to have direct and easy access to all new and updated emission factors and other parameters that will be developed within the revision of the Guidelines.

SEARCHING THE EFDB

The EFDB is designed with a user-friendly search function that allows a number of ways to search for emission factors in the EFDB. One of the most common search applications is when a user is looking for a particular source or sink category, along with a combination of one or more GHG gases. Figure 2 shows how such a search is applied in the EFDB. In addition to this typical search, user's can also utilize 'full text' searches using key words without specifying a particular source category or gas. Regardless of which type of search is conducted, the EFDB provides filtering tools to further narrow down the resulting data records to match the user's needs. The end result of the search process is the emission factor detail report, which provides the value for the parameter and the critical information necessary to apply the parameter.

CONCLUSIONS

The EFDB has the objective to provide a variety of users, in particular the inventory compilers of the Parties to the UNFCCC, with current and well-documented emission factors and other parameters, as well as to establish a communication platform for distributing and commenting on new research and measurement data. The EFDB is open to anyone in the world for use and will be frequently visited by the larger community of GHG inventory experts in the near future. Such a platform can provide an efficient means for experts and researchers to disseminate new emission factors or other parameters in a timely manner to a world-wide audience of potential end users. The EFDB is meant to be a recognised data repository where users can find emission factors and other parameters with background documentation or technical references.

The success of the EFDB will be dependent on regular input from the global scientific/inventory community and feedback from the Editorial Board evaluation process.

Continuous improvement on the content and functionality, particularly with regard to experiences and feedback on user friendliness and reliability is very important (please forward any comments on usage to the IPCC-NGGIP/TSU: ipcc-efdb@iges.or.jp).

The EFDB, along with the User's Manual and information on how to become a registered data provider, can be accessed at the following website: http://www.ipcc-nggip.iges.or.jp/EFDB/main.php

REFERENCES

Intergovernmental Panel on Climate Change (IPCC). (1997). Houghton J.T., Meira Filho L.G., Lim B., Treanton K., Mamaty I., Bonduki Y., Griggs D.J. and Callander B.A. (Eds). *Revised 1996 IPCC Guidelines for National Greenhouse Inventories*. IPCC/OECD/IEA, Paris, France.
Also available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>

Intergovernmental Panel on Climate Change (IPCC). (2000). Penman J., Kruger D., Galbally I., Hiraishi T., Nyenzi B., Emmanuel S., Buendia L., Hoppaus R., Martinsen T., Meijer J., Miwa K., and Tanabe K. (Eds). *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. IPCC/OECD/IEA/IGES, Hayama, Japan.
Also available at <http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm>

Intergovernmental Panel on Climate Change (IPCC). (2003). Penman J., Gytarsky, M., Hiraishi T., Krug T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K. and Wagner F. (Eds). *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. IPCC/IGES, Hayama, Japan.
Also available at <http://www.ipcc-nggip.iges.or.jp/public/gp/gpglulucf.htm>

YWORDS

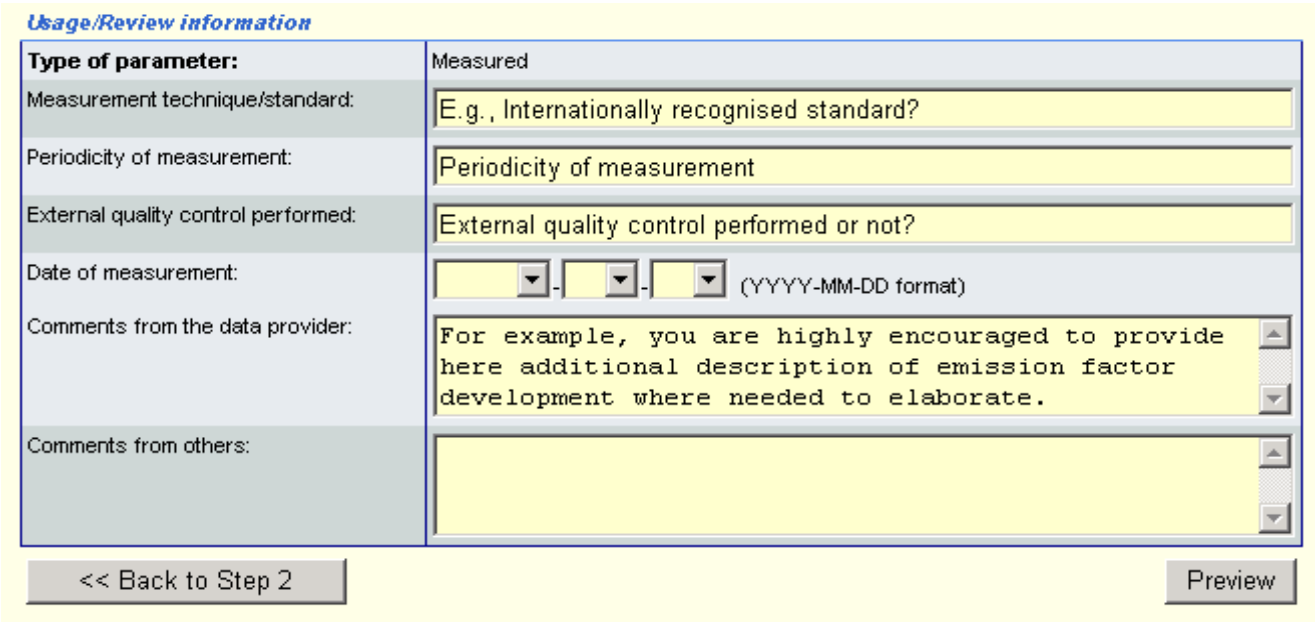
Greenhouse Gases
Emission Inventories
Emission Factors
Database

Table 1. EFDB input form.

Technical information

Gas:	**CARBON DIOXIDE**
IPCC Source/Sink Category:	**Energy (1) -> Fuel Combustion Activities (1A) -> Transport (1A3) -> Road Transportation (1A3b) -> Cars (1A3b1)**
Fuel:	**Motor Gasoline**
***Properties:**	
Technologies/Practices:	Information on technologies used and practices performed
Parameters/Conditions:	Information on parameters and conditions
Region/Regional Conditions:	Information on region, country, climate, etc.
Abatement/Control Technologies:	Information on abatement and/or control technologies used
Others:	Other properties that do not fit in the abovementioned four property fields
***Description:**	Full discription of the emission factor or other parameter
***Value:**	280 g/km New
Value in common units:	(Select common unit)
Equation:	Practice Guidance and Uncertainty Management in National Greenhouse
IPCC Worksheet Number:	For example, "Worksheet 4-1, Sheet 1 of 2"...
***Source of data:**	e.g., science literature, official national inventory report, ...
***Technical Reference:**	Full technical reference should be provided here
***Reference language:**	English
Abstract in English:	You are encouraged to provide the abstract in English of the technical reference in order to enable EFDB users to better understand the nature
***Upper confidence limit (95% confidence interval):**	+5% ☐ Unknown
***Lower confidence limit (95% confidence interval):**	-5% ☐ Unknown
Data quality:	If data quality ratings have been made by yourself according to your own s
Distribution shape:	(Select distribution shape)
Data quality reference:	Reference should be indicated if it is different from the technical reference
Other info on data quality:	E.g., Are there background supporting data validated and/or verified?

Table 1. EFDB input form (continued).



Usage/Review information

Type of parameter:	Measured
Measurement technique/standard:	E.g., Internationally recognised standard?
Periodicity of measurement:	Periodicity of measurement
External quality control performed:	External quality control performed or not?
Date of measurement:	- - (YYYY-MM-DD format)
Comments from the data provider:	For example, you are highly encouraged to provide here additional description of emission factor development where needed to elaborate.
Comments from others:	

Figure 2. Search Function in the EFDB.