Invitation for Proposals for the IPCC 2006 GHG Inventory Software

Contents

Glossary

2006 Guidelines[1]	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan
AFOLU	Agriculture, Forestry and Other Land Use, one of the 4 main sectors of the 2006 Guidelines
EFDB	The IPCC's Emission Factor Database
GHG or Greenhouse Gases	Greenhouse Gases. Here it refers, as a minimum, to all the gases for which methods are given in the 2006 Guidelines. Users should be able to add additional gases if they wish.
GPG 2000[1]	*Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventorie*s. 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). IPCC/OECD/IEA/IGES, Hayama, Japan
GPG LULUCF[1]	*Good Practice Guidance for Land Use, land-Use Change and Forestry* Penman J., Gytarsky M., Hiraishi T., Krug, T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F., IPCC/IGES, Hayama, Japan
GWP	Global Warming Potential, an index that approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere relative to that of a unit mass of carbon dioxide.
IGES	The Institute for Global Environmental Strategies, Hayama, Japan
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use – one of the 4 main sectors of the 2006 Guidelines
KCA	Key Category Analysis
NEU	Non- Energy Use of Fuels – e.g. fuels used for non-combustion purposes such as lubricants and as feedstocks
NGGIP	The TFI's National Greenhouse Gas Inventory Programme
PDF	Probability Distribution Function.
Revised 1996 Guidelines[1]	*Revised 1996 IPCC Guidelines for National Greenhouse Inventories*. Houghton J.T., Meira Filho L.G., Lim B., Tréanton K., Mamaty I., Bonduki Y., Griggs D.J. and Callander B.A. (Eds). IPCC/OECD/IEA, Paris, France.
TFB	Task Force Bureau of the TFI
TFI	The IPCC's Task Force on Inventories
TSU	Technical Support Unit of the TFI
UNFCCC	United Nations Framework Convention on Climate Change

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[1] Electronic copies of all the IPCC Guidance referred to here can be downloaded from:
http://www.ipcc-nggip.iges.or.jp/public/public.htm

1 Aim

This invitation invites proposals to produce software that automates the Tier 1 and 2 methodologies in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[2] (hereafter "2006 Guidelines"). A phased approach is anticipated. The party providing the successful proposal (hereinafter "the contractor") will be offered an initial contract for Phase 1. While future phases are anticipated they will require a decision by the IPCC plenary and so cannot be guaranteed.

This software will not impose any additional requirements onto users beyond those specified in the 2006 Guidelines to ensure a good practice inventory.

1.1 Background

This software is being produced by the Task Force on Inventories (TFI) in accordance with its mandate to:

- to develop and refine an internationally-agreed methodology and software for the calculation and reporting of national GHG emissions and removals;

- to encourage the widespread use of this methodology by countries participating in the IPCC and by Parties of the United Nations Framework Convention on Climate Change (UNFCCC)

The IPCC at its 25th Session in Mauritius approved a budget for this work to take place in 2007. It is expected that further funds will be available in later years subject to a decision by the IPCC Plenary.

The IPCC's TFI has just completed the production of the 2006 IPCC Guidelines on National Greenhouse Gas Inventories. This work has consolidated previous guidelines[3] and inventory good practice guidance[4] together with new scientific and technical information to form a complete and up-to-date guidance for compiling national greenhouse gas inventories.

This guidance gives methods, generally in three tiers in increasing complexity. The software will focus on the simplest method for each category - generally Tier 1 - as well as Tier 2 methods which are the same as Tier 1 but use national factors rather than the default parameters included in the 2006 Guidelines.

The Revised 1996 Guidelines were also accompanied by software, "IPCC Greenhouse Gas Inventory Software for the Workbook" which can be downloaded from our web site at: http://www.ipcc-nggip.iges.or.jp/public/gl/software.htm. The new software is intended to fill the same role but to improve a number of shortcomings in the earlier software.

1.2 Objectives

The objectives of the software are to:

- facilitate preparation of national GHG inventories according to 2006 Guidelines either for complete inventories or for separate categories or groups of categories.

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[2] **2006 IPCC Guidelines for National Greenhouse Gas Inventories**, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

[3] Houghton J.T., Meira Filho L.G., Lim B., Tréanton 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.

[4] 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. and

Penman J., Gytarsky M., Hiraishi T., Krug, T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F., **Good Practice Guidance for Land Use, land-Use Change and Forestry** IPCC/IGES, Hayama, Japan

- assist in training and inventory review

- harmonise reporting of greenhouse gas inventories

- archive data and complete inventories (which may consist of estimates for a number of years).

- have a limited working software in time for COP/MOP in Dec 2007.

The greenhouse gases (GHG) to be covered are listed in Table 1 and

Table 2.

Table 1 Gases for which GWP values are available in the TAR[5]

Name	Symbol
Carbon Dioxide	CO_2
Methane	CH_4
Nitrous Oxide	N_2O
Hydrofluorocarbons	HFCs (e.g. HFC-23 (CHF_3), HFC-134a (CH_2FCF_3), HFC-152a (CH_3CHF_2))
Perfluorocarbons	PFCs (e.g. CF_4, C_2F_6, C_3F_8, C_4F_{10}, c-C_4F_8, C_5F_{12}, C_6F_{14})
Sulphur Hexafluoride	SF_6
Nitrogen Trifluoride	NF_3
Trifluoromethyl Sulphur Pentafluoride	SF_5CF_3
Halogenated Ethers	e.g., $C_4F_9OC_2H_5$, $CHF_2OCF_2OC_2F_4OCHF_2$, $CHF_2OCF_2OCHF_2$
Other halocarbons	e.g., CF_3I, CH_2Br_2, $CHCl_3$, CH_3Cl, CH_2Cl_2

Table 2 Additional gases for which GWP are not available in the TAR[5]

$C_3F_7C(O)C_2F_5$
C_7F_{16}
C_4F_6
C_5F_8
c-C_4F_8O

1.3   Users of software

The primary target groups of users are:

- Inventory compilers in all Parties to the UNFCCC with limited resources without their own inventory systems and who wish to apply default methods,

- Trainers and trainees on national GHG inventory compilation,

In additional a range of other potential users has been identified

- Reviewers of national inventories

- Academics/Researchers

- UNFCCC Secretariat

- Project developers

Many of the primary target users may have both limited resources and limited internet access. Users are expected to have some knowledge of 2006 Guidelines and to be computer literate and be familiar with spreadsheets.

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[5] C*limate Change 2001: The Scientific Basis. Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change*. Houghton, J.T., Ding, Y., Griggs, D.J., Noguer,M., ven der Linden,P.J., Dai,X., Maskel,K., Johnson,C.A., (eds.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp

The software is expected to fill the same role as the "IPCC Greenhouse Gas Inventory Software for the Workbook" as updated by the UNFCCC for non-Annex 1 countries[6]. It will need to be able to export the estimated emissions into UNFCCC reporting software i.e. the "CRF Reporter" (see Section 2.2.4.v and footnote 14).

1.4   Technology

The proposal should specify the software technology to be used. This should be the best solution to the requirements outlined in this document. While the software for the Revised 1996 Guidelines was based on MS Excel there is no expectation that this would be the best solution for this new software which could, for example, use a database system.

This document refers to "worksheets". These are the printed tables in the 2006 guidelines that can be filled in to complete the calculations of emissions. This is NOT intended to indicate a spreadsheet should be used. Similarly reference is made to spreadsheets that accompany the 2006 Guidelines. These may be implemented as believed to be most appropriate, not necessarily as a spreadsheet.

2 Detailed Specification

The software is expected to be developed in phases (Figure 1).

- o *Phase 1a*. Development of a detailed design for the complete system covering software environment, structure, features, and data flow as well as detailed software requirements. This will cover all items in Phase 1 and Phase 2 as well as potential future requirements listed in section 3.4.

- o *Phase 1b*. Development of a fully working system but including only the Energy input module. It is expected that the TSU will organise a review meeting before the end of Phase 1 to consider progress and plan for phase 2.

- o *Phase 2*. Completion of all input modules. The continuation of the project into phase 2, the start date and duration all depend on a successful outcome of Phase 1 and the conclusions of the review meeting.

- o *Additional Phases*. May be needed to add additional features, depending on feedback from users.

Figure 1 Overview of this contract and possible future developments

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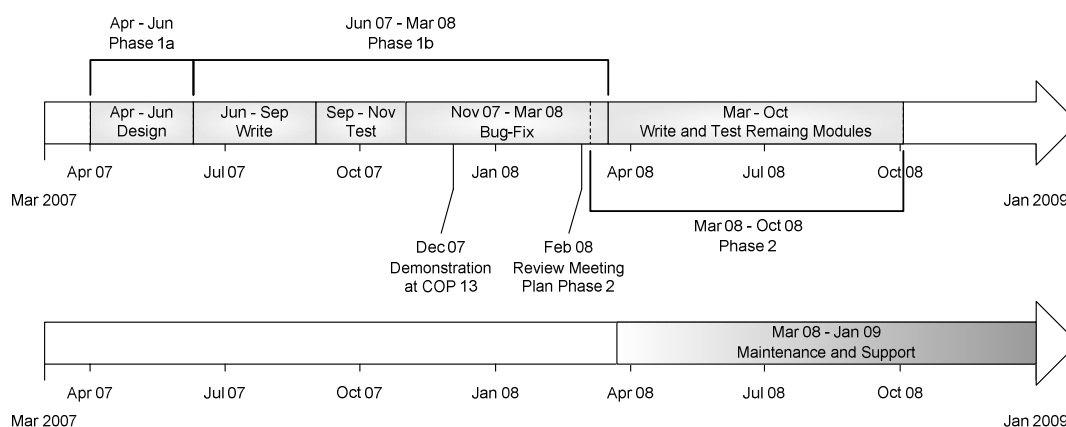
[6] The UNFCCC non-Annex I Greenhouse Gas Inventory Software Version: 1.3.2. Software and manual available from the UNFCCC at:
http://unfccc.int/national_reports/non-annex_i_natcom/training_material/methodological_documents/items/349.php

It should be noted that as yet, the IPCC has not approved funding beyond the first phase so the product to be delivered should be fully working (though with only an Energy input module) as a stand-alone product but also one that is extendable in potential future phases. To this end this document describes some features which are not part of this first phase but which may be needed later, to assist in the development of a flexible, extendable system. This contract is therefore for Phase 1, (1a & 1b). "Phase 1" refers to items that should be included in the software produced by the successful contractor in 2007/8. Should the contractor believe that some proposed features in phase 1 are impossible to include in this first phase they should indicate this in their proposal.

2.1   Concept

This section describes the overall concept of the software. The following section will discuss the features in more detail.

2.1.1   Transparent Calculations

There is an overall requirement that the system should not be a "black box". That is, all the calculations and emission estimation methods should be open and transparent to the user, not hidden away in the software. This is important as it both increases the educational nature of the software and it increases understanding and ability to check the calculations. This will be possible by the calculation pages (where data is entered and emissions or removals estimated) appearing similar to the printed worksheets in the 2006 Guidelines.

2.1.2   Modular structure

The system should have a modular structure. There will be a central data management core (see Figure 2). To input data there will be a set of modules covering all the emission and removal categories in the 2006 Guidelines. Further modules deal with features that assess the completed inventory such as uncertainty analysis, key category analysis, output functions, QA/QC and data output.

This approach will enable different users to input data and estimate emissions using different[7] input modules simultaneously (perhaps in widely separated locations) then bring the different inputs together into one system. The central data management part should check and flag any conflicts between different modules when they are brought back together and force the user to solve them.

This will also allow additional modules to be added at later stages and should make the system easier to update and modify.

The data management core will have a complete, consistent treatment of time series. (Some of the modules themselves treat one year at a time.) All the data will be stored in one place in the data management core of the system.

The input modules are based on the worksheets[8] in the 2006 Guidelines and, for a few sectors, the spreadsheets that accompany the 2006 Guidelines. The modules foreseen in phase 1 are (proposals may split these modules if this eases software development and use):

- o   Energy (worksheets) (Phase 1)
- o   Fluorinated Gases – Foams (based on existing spreadsheet) (Phase 2)
- o   Fluorinated Gases – Refrigeration (based on existing spreadsheet) (Phase 2)

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[7] There may also be a need to input data into the same module but from different sectors simultaneously, e.g. for croplands and forests in the AFOLU module.

[8] "Worksheets" – the printed tables in the 2006 Guidelines. This does not imply a spreadsheet must be used!

- o Fluorinated Gases – Fire Protection (based on existing spreadsheet) (Phase 2)
- o Remaining IPPU (worksheets) (Phase 2)
- o HWP (based on existing spreadsheet) (Phase 2)
- o AFOLU other than HWP (worksheets) (Phase 2)
- o SWDS (based on existing spreadsheet) (Phase 2)
- o Waste other than SWDS. (worksheets) (Phase 2)

For those modules based on the worksheets:

- o modules will open with a screen to select the sub-category (i.e. the calculation page)
- o the calculation page will open and users input the appropriate data. Help will refer to the appropriate chapter or section in the 2006 guidelines.
- o the calculation page should look like the worksheets in the 2006 Guidelines as much as possible.
- o users be able to enter data, a reference for the data and an optional comment
- o users will then save the data and can select another sub- category (calculation page)
- o each module will contain sectoral QA/QC checks on the data.

For the modules based on spreadsheets from the 2006 Guidelines they should follow the existing spreadsheets as much as possible but should guide the user to enter all the necessary data.

Figure 2 Conceptual Diagram of Modular Structure of Propose Software
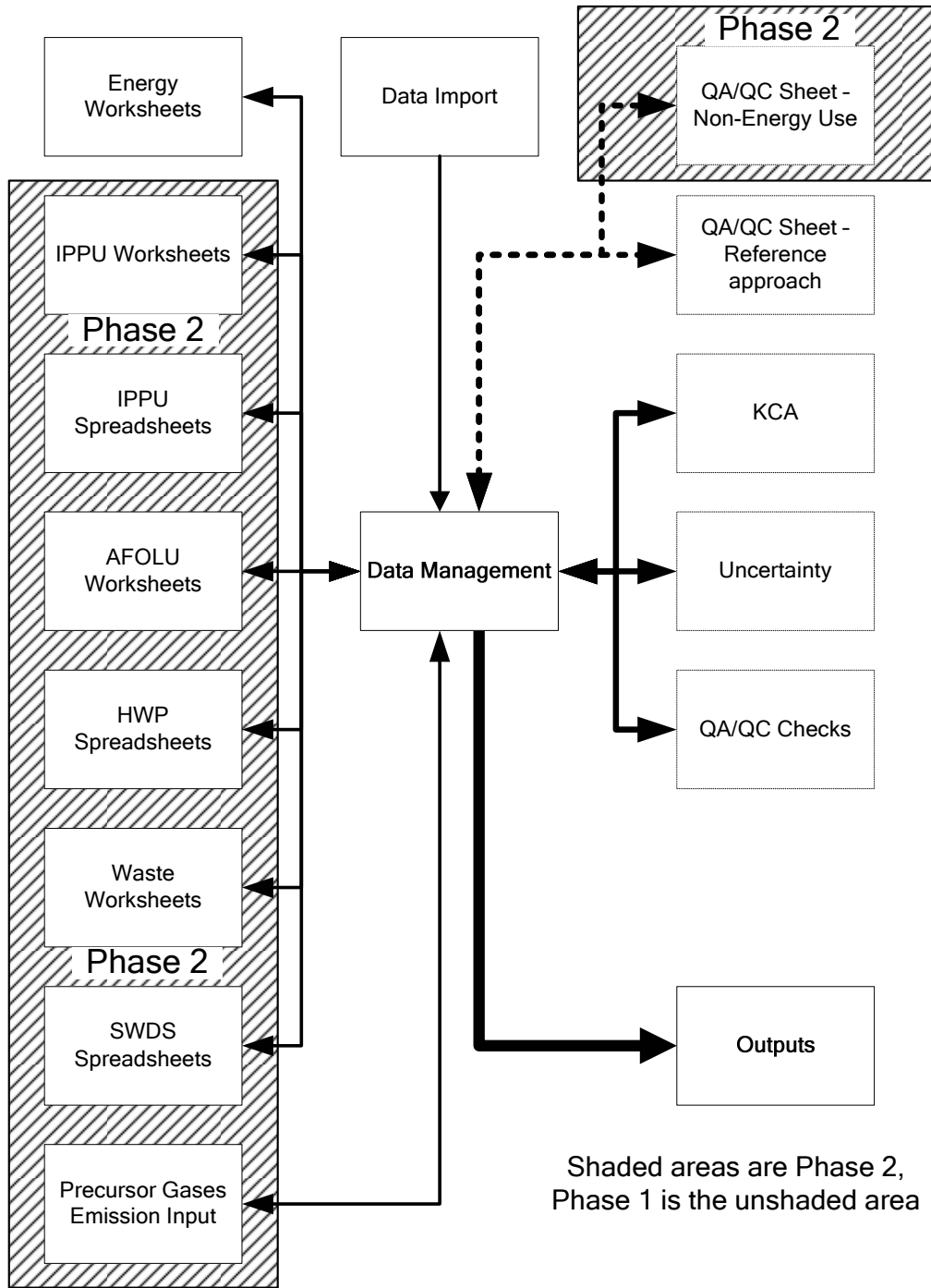
Table 3 Details of Potential Modules (references refer to sec tors in the 2006 Guidelines)

| Module	Annual or Time series[9]	Number of Calculation pages	Notes
Energy	Annual	11 (4 additional for Reference approach QA/QC)	Provide Annual Total Fuel Use from sum of fuel consumption data input by fuel type for QA/QC. Energy Balance Data can be entered into the Reference approach QA/QC sheet for comparison by users. "abandoned underground coal mines" should allow time series data entry For CCS use Reporting Table 1.4b as there is no worksheet in the 2006 Guidelines
Fluorinated Gases – Foams (2F2)	Time Series	1	
Fluorinated Gases – Refrigeration and Air Conditioning (2F1)	Time Series	1	Default data from global database to be provided
Fluorinated Gases – Fire Protection (2F3)	Time Series	1	
IPPU other than fluorinated gases above	Annual For 2F4, 2F5, 2F6, 2G2 and 2G3, users need to input data for two different years.	69 (2 additional for QA/QC checks on Non-Energy Use of Fuels)	Note spreadsheet to check Non-Energy Use of Fuels for QA/QC checks For "2B5 Carbide Production" and "2B7 Soda Ash Production", users should choose one from two calculation pages. (Users should not use both of those two pages.) For "2G1 Electrical Equipment" and "2G2c Other", users should be able to duplicate the tables to calculate emissions of different gases using the same calculation procedure as needed. There are no worksheets in the 2006 guidelines pages for the following source/sink categories: 2A5, 2B10, 2C7, 2D3, 2D4, 2E5, 2G4, 2H so the calculation page will be for data input only.
HWP	Time Series	1	Time series default activity data from FAO entered by user.
AFOLU other than HWP	Annual and time series	66	Provide annual total land areas as sum of individual land types as a QA/QC check Provide annual total numbers of livestock as QA/QC check Time series is needed for lands converted.
SWDS	Time Series	1	Spreadsheet contain default data
Waste other than SWDS	Annual	18	Provide annual total waste and waste per capita (including SWDS) as QA/QC check
Import Precursor Gases	Time Series		This facility is to enter data from other inventory estimates for these gases for reporting - not to do any calculations. The gases are: SO_2, NO_x, NH_3, NMVOC and CO.

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[9] For some sectors, emissions depend on activities in earlier years (e.g. emissions from waste placed in landfills can continue for many decades). This column indicates where a user should be able to enter time series data to estimate an emission in the current year. For these sectors, if time series data is not available, the simple default is for earlier years to be estimated from the current year's data and some surrogate (e.g. population) or other information (e.g. date of introduction). The details are given in the 2006 Guidelines. Thus the calculation sheets will need to deal with time series data in these cases. In the other cases, the calculation sheets will be for a single year, though the data import facility will need ot ba able to import time series.

2.1.3   Appearance

The proposal should indicate the general appearance of the screens used by the user to select the appropriate calculation page[10] or other functions and can propose their own approach. One possible approach is that on starting the software an introduction screen will give the user a choice of data entry, data import/export or QA/QC (including KCA and Uncertainty), (note that accessing QA/QC choices before data entry is complete may not be meaningful so there should be a warning that the input data is incomplete.). This is followed (for data input) by screens to select the sector (Energy, IPPU, AFOLU or Waste) or the QA/QC action (KCA, Uncertainty, QA/QC checks etc.) (see Figure 3).

Figure 3 One Possible approach to the Software menus to select module
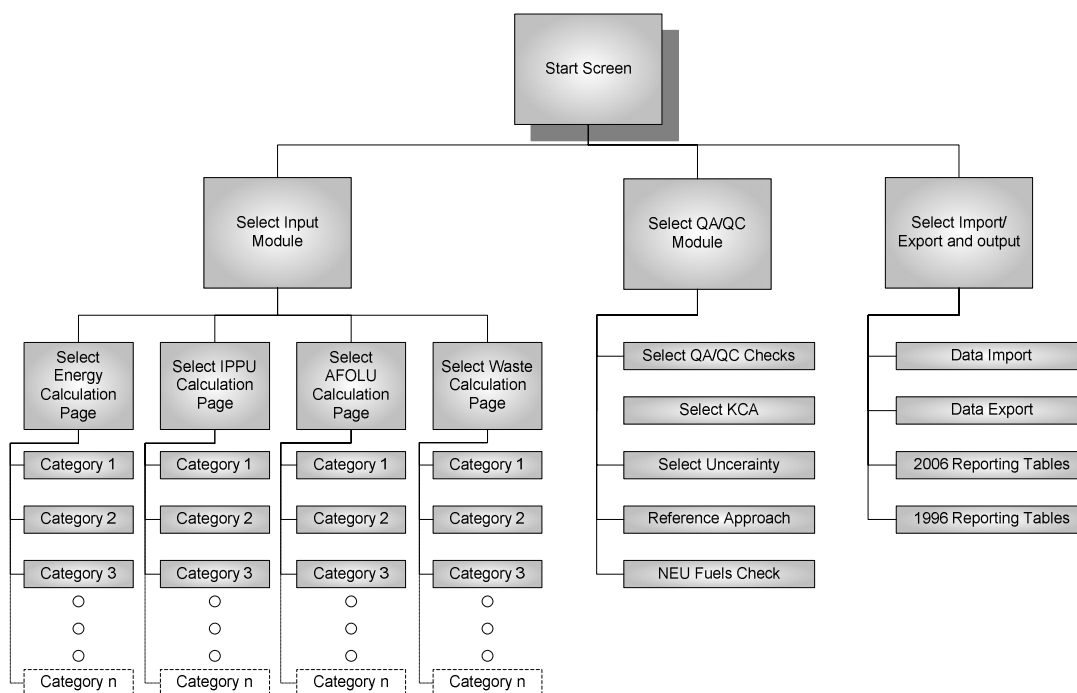
Whatever the introductory screens and module selection menus look like, the calculation interface must have a similar appearance to the printed worksheets contained in the 2006 Guidelines. Whatever software is used, the interface for the calculation page should have a spreadsheet-like operation with users able to enter/delete/change data in individual cells.

The operation of the input modules should mirror the printed worksheets in the 2006 Guidelines. This will ensure transparency and make the calculations being performed clear and understandable by the user.

2.1.4   Minimum hardware specification

As this system needs to run in places with limited resources it will need to run on a PC with the following specification (reliable internet connections cannot be assumed):

Hardware: Pentium CPU and 256 MB RAM

Operating System: Microsoft Windows 2000/XP/Vista

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[10] Each "calculation page" is similar to a printed worksheet in the 2006 Guidelines or to one of the spreadsheets in the 2006 Guidelines.

2.1.5   Software - freely distributable

The system should be freely distributable and should avoid any financial burden on users. This is important given the limited resources of some of the target users.

The system should be a standalone system. It should not depend on web access as this may be unreliable in some users' locations.

The proposal should indicate the software platform they intend to use.

2.1.6   Help

A help system should be available in each module. The proposal is expected to be a user-friendly system that has information both on the operation of the software and technical help on the methodologies based on text of the 2006 Guidelines. If the text from the guidelines is not available from the TSU the developer should leave space for this text, indicating it is under development. Once the design is finalised the TSU, in conjunction with a group of authors of the 2006 Guidelines will develop the required text. It should also be possible to link to the appropriate section of the 2006 guidelines.

2.1.7   Languages

Previous 1996 IPCC Inventory software has not run on many non-English versions of MS Windows®. This system should be capable on running independently of the language version of the operating system.

While it would be desirable for the interface to work in the various UN Languages this is not mandatory. However the system should be language-enabled so that in the future it could be easily modified to operate in different languages. User manuals will ultimately need to be in all UN languages though not as part of phase 1.

2.1.8   Workflow

It is expected that users will follow a similar pattern in using the software. This is not mandatory but the software should be developed considering this workflow

1. Enter data in all input modules. This may be done by one user sequentially or by multiple users in parallel. The data modules will then need to be brought together and reconciled with the central data management module.

2. QA/QC Checks. These will be mechanical checks such as completeness performed by the software. Users may also wish to review inputs and consistency as part of their own QA/QC process.

3. Uncertainty Analysis is performed.

4. KCA. This will result in a set of Key Categories. The software will flag any source or sink category which uses Tier 1 if it is a Key Category.

5. Users may repeat from item 1 (e.g. where Key Categories indicate that a method be upgraded to Tier 2 or where other errors or omissions are detected or where additional data or information could improve the estimates).

6. Output data.

7. Archive final inventory.

Most of the input modules deal with all the data for one year rather than a time series of one data item, however some sectors will require users to input time series. Data import facilities would allow users to import complete time series of particular data-sets (emission factors, activity rates etc.).

2.2 Functionality

This section describes the detailed operation of the software.

2.2.1 Data Input by user

Users will enter the following items into input modules.

Numerical Data:

- o Activity Data and its uncertainties.

- o Emission Factors and other parameters as described in the printed worksheets in the 2006 Guidelines and the uncertainty of each.

Additional Information

- o Choice of Tier

- o Data Reference (source of data)

- o Comments

Numerical input data can be:

- o A number

- o A notation key (limit input to those specified in the 2006GL (see below))

- o Uncertainties are expressed as +/- 95 percentiles. Typically users write this as +/- x, +x and - y. Data may be expressed in absolute terms or as percentages and users should have flexibility on how to express inputs.

The system should have a data version control. This will record the user name of who made changes to the database and the date of the change.

It is expected that, in phase 1, users will input data in standard units (see printed worksheets in 2006 Guidelines). At a later stage this may be adapted to allow alternative units to be used with software unit conversions, proposals should allow for this in their design.

Some input modules will have text references to external databases but no direct hyperlinks.

2.2.1.i Global Warming Potentials

Global Warming Potentials (GWP) are weighting factors that, multiplied by the mass of a gas, convert it to an equivalent mass of CO_2 with the same climate impact. The IPCC does not specify which GWP to use. GWP are only needed by users in two places: to perform KCA and to total some of the fluorinated gases.

There should be a data entry form where users can either enter their own values for these parameters or chose between several sets of defaults. The TSU will advise the successful proposal on these values.

2.2.1.ii Notation Keys

These are specified in the 2006 Guidelines, Volume1, Chapter 8, page 8.7 (see Table 4, below).

In reporting tables, where sectors are aggregated to national totals, entries with these notation keys are treated as zero.

Where the notation key "IE" or "C" is entered the user should be prompted to specify the sector where the emission is included.

Table 4 Notation Keys

Notation Key	Definition	Explanation
NE	Not estimated	Emissions and/or removals occur but have not been estimated or reported.
IE	Included elsewhere	Emissions and/or removals for this activity or category are estimated and included in the inventory but not presented separately for this category. The category where these emissions and removals are included should be indicated (for example in the documentation box in the correspondent table).
C	Confidential information	Emissions and/or removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.
NA	Not applicable	The activity or category exists but relevant emissions and removals are considered never to occur. Such cells are normally shaded in the reporting tables.
NO	Not occurring	An activity or process does not exist within a country.

2.2.2   Emission calculations

The modules will calculate emissions and removals for:

- o   all sectors and gases;
- o   all reporting tables, printed worksheets in the 2006GL and any spreadsheets in the 2006 GL;

Each module shall display transparently all the calculations, including emission factors, activity data and other parameters used, following the layout of the printed worksheets in the 2006 Guidelines. The system should have comprehensive time series management for consistency checking. Each module shall have export/import capabilities. Features with a lower priority (and therefore potentially may not be part of phase 1) include:

- o   unit conversion;
- o   charts of input data, results and outputs.

2.2.3   Creating a new Inventory

An inventory is typically compiled in a particular year and provides emission or removal estimates for a range of pollutants (here GHG), for all source/sink categories in the region considered, for a number of previous years[11]. When a new inventory is started it would normally be based on earlier years (see Figure 4). This gives rise to some issues:

- The software will start a new inventory by copying all the data from the previous inventory into the new inventory. However, for the latest year there will be no data in the system. Here the system will need to copy data from the latest earlier year with data to the latest year. The user will then need to check this and change the activity rates. Thus the software should check that data has been changed or confirmed.

- Data in earlier years may need to be updated (this is sometimes called "recalculation"). This may be due to revisions of activity data, improvements of emission factors or other parameters or the adoption of a new methodology for a specific sector. The details are given

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[11] While many inventories are compiled annually so there is an estimate for every year this need not be the case so the software should be able to cope with time series that do not have an estimate every year.

in the 2006 Guidelines. The software merely needs to be able to allow these data to be changed.

- When an inventory is completed it will need to be archived. This could be done by copying the system. Here the system would be to export all the information as an XML file which could be re- imported at a later stage. This option is preferred as it would enable the exchange of data and would allow import/export of the data to different systems or software.

Figure 4 Initialisation of a new inventory from an old one.
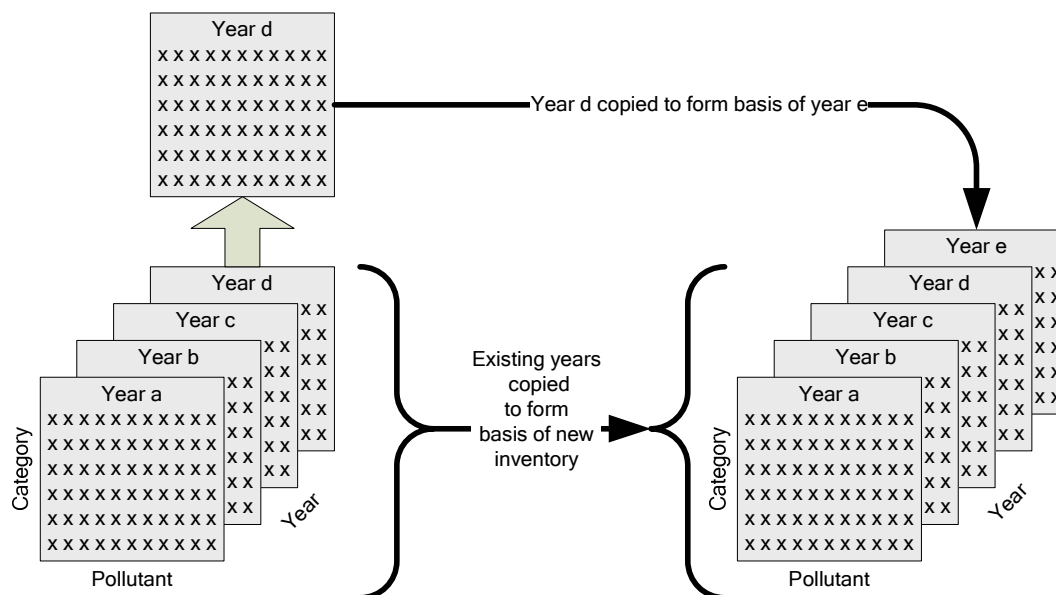
An inventory is a set of estimates of emissions or removals for all categories occurring in a country for a number (>=1) of years for a range of pollutants (here GHG). This example is for a set of pollutants for four years, a,b,c and d.

When a new inventory is formed estimates will be needed for an additional year. This should be initialised by copying the previous inventory and using the latest year as the basis of the new year. If several new years are needed repeated application of this process will initialise the new years. The user will then need to revise all the data in the new year and may need to revise some earlier data as well.

2.2.4   Summary functions

These are modules that work on the complete database.

2.2.4.i   Key Category Analysis (KCA)

Key Category Analysis (level and trend) is a requirement of good practice inventories according to the 2006 Guidelines. They are discussed in Volume 1 Ch 4 of the 2006 Guidelines. Essentially, key categories identify the largest contributors to the total inventory and/or trend, and additional effort should be used to estimate these categories – for example, they should use Tier 2 as the simplest methodology.

The guidelines give a list of aggregated categories for which this should be done and users need to be able to divide some of them into sub-categories. This analysis is not done at the highest level of desegregation of the inventory.

After the Key categories have been identified the software should produce a list of key categories for which Tier 1 has been used as a QA/QC check for consideration by the user.

Users should be able to add manually key categories by qualitative analysis to the list mentioned above (again see Volume 1 Ch 4 of the 2006 Guidelines).

2.2.4.ii Uncertainty

Uncertainty analysis should be performed on the inventory using an error propagation method (Volume 1 Ch 3 of the 2006 Guidelines). The Monte-Carlo method is not needed at this stage. It may be considered as part of a later phase, in which case additional data would be needed (e.g. the shape of the PDF).

2.2.4.iii Completeness

Mechanical checks that each source and sink has been addressed should be included. This can identify which sectors have not been dealt with for consideration by the user. Categories for which there is no data should be completed with the appropriate notation keys to indicate they have been considered.

In the first phase, the completeness check is simply a check that each sector has either an estimated emission or a notation key entered. A list of sectors that have not been address should be provided to the user.

Where a new year is added to an inventory based on an earlier year (see section 2.2.3) the user should be prompted to check each calculation page and the software will only regard a sheet as complete when the user has checked it. In this case, sectors that have not been checked as completed should be regarded as unaddressed and added to the list of sectors that have not been addressed for the completeness check.

2.2.4.iv Check Referencing

Each data item, when entered, has the ability for the entry of a reference to the source of the data. The software should be capable of identifying those data items that do not contain a reference and providing a list of these to the user.

2.2.4.v Outputs

The system should produce the following outputs:

- All the reporting tables in the 2006 Guidelines. To form these reporting tables data are aggregated from the individual calculation sheets. The structure of the reporting table is hierarchical with each sector being the sum of all of its sub-sectors (see 2006 Guidelines, Volume 1 Chapter 8 for details). CO_2 emissions from biomass used for energy or form biomass in waste should not be included in the national total but reported separately[12]. The same applies to all emissions from international aviation and navigation[13].

- Time series of individual data items (activity data or Emission factors).

The outputs should be:

- Printable

- For import into MS Excel©

- As XML files in the CRF Data XML Format[14].

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[12] This is because, in principle, the net CO_2 from biomass is included in the AFOLU sector estimates. However the data is presented primarily for QA/QC purposes,

[13] Emissions from international aviation and shipping (sometimes called "bunker fuels") are outside the national total but are reported separately for completeness.

[14] The CRF reporter (v3.1) is software produced by the UNFCCC for parties to report their emissions. Details can be found at http://unfccc.int/national_reports/annex_i_ghg_inventories/reporting_requirements/items/2759.php

The system should output data according to the reporting requirements of the 2006 Guidelines. A facility to report using the Revised 1996 Guidelines Reporting Tables should be included. The TSU will provide information on the mapping between the two systems.

In later phases more output options and formats may be required. Future phases may also ask for graphs of outputs.

2.2.5 QA/QC functions

At the data input level there should be some checks. For numerical input these will limit numbers to reasonable values or a notation key. For emission factors and other parameters, if the input data is outside the range defined by the default value and its uncertainty this should be flagged to the user. Such values should be allowed by the software.

Sector level checks are specified in Table 3.

2.2.6 Flexibility

Within each sub-category the user should have the flexibility to both to:

- Duplicate the calculation page to stratify inputs (e.g. so the same calculations can be made for regions of the country with different parameters used in the estimate).

- Add additional sub-categories.

In these cases the data management part of the software should ensure that these changes are applied consistently to all years in the same time series.

2.2.7 Software documentation

There should be a user manual this will include the following:

1. Installation
2. Getting started
3. Workflow
4. Use
     o Input data
     o Adding new categories
     o Viewing data
     o Import/export
     o Modification of input forms

In addition there should be an on-line help system. This should describe the functions and should also link to text from the 2006 Guidelines (see 2.1.6).

2.2.8 Maintenance

The successful contractor shall produce a report about the maintenance requirements of the software, to be submitted in January 2008.

2.3 Data

The system should contain the default data from the 2006 Guidelines for emission factors and other parameters and their uncertainties. These are being extracted form the guidelines by the TSU for input into the Emission Factor Database (EFDB) and will be provided to the software developer.

2.4   Updatability in future

As indicated above the system should be designed so that it can be updated and extended in the future. Some of the features that may be needed are described so that developers can, in phase 1, allow for such development.

Future versions should be able to completely exchange data with this current phase 1 software.

3 Other Items

3.1   Project Proposals

To submit a proposal for this work the interested parties should include:

1. A project appreciation outlining their understanding of the proposed project.

2. A proposed solution, including software platform, demonstrating how they will meet the requirements.

3. A discussion of the required testing and future maintenance programmes.

4. A summary of their relevant experience.

5. Details and examples of previous work.

6. Separate quotations for Phases 1a and 1b. The quotations should cover all costs required throughout the contract period. The proposals are requested to provide sufficient detailed costs and explanation to enable each task and its quotation to be judged. Costs for travel, software and programming effort should be specified.

7. The timing of the completed Phase 1a and other milestones.

8. Indicative costs for completing Phase 2 and for the additional requirements indicated here.

3.1.1   Questions from parties – responses

Before submitting a proposal, interested parties can address questions to the TSU to be received by 7 May 2007. Responses from the TSU to any such inquiries will be compiled into a single document that will be made available on the NGGIP web site within 2 weeks of this date.

3.1.2   Submission of Proposals

Proposals should be received by the TSU in Japan by 17:00 (JAPANESE TIME) on 22 May 2007.

They should be printed with an attached electronic version. Following receipt of the proposals they will be assessed by a Selection Committee including the TFI TSU and IGES. The successful proposal will be selected according to, inter alia:

- o   The price
- o   The technical solution offered
- o   The understanding of the TFI's needs as demonstrated in their proposal
- o   The relevant experience

The TSU will contact the successful individual/company/entity to discuss the contract.

3.2   Project Management

The overall structure is shown in Figure 5. The contractor will have a contract with the Institute for Global Environmental Strategies where the TSU is hosted. The TSU will manage the project. . Any queries or request for changes should be submitted to the TSU. The TSU is responsible to the TFB who manage the whole TFI work-programme. The TSU may be assisted by an advisory group of experts. This group's sole role is to provide additional expertise to the TSU. A user group will also be set up to assist in testing the software.
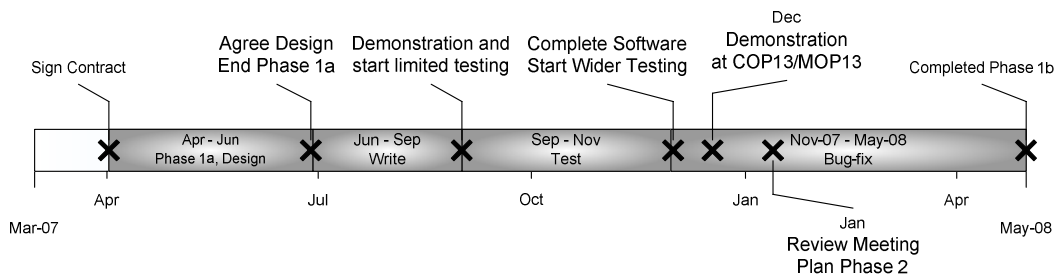
Figure 5 Management of this project
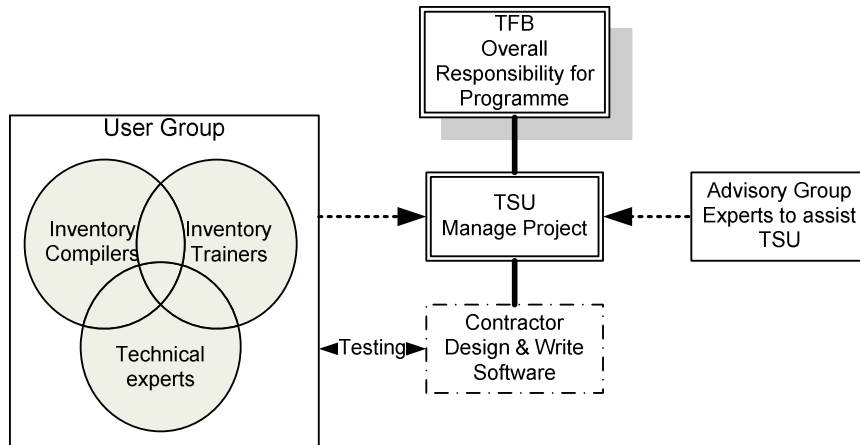
3.3   Timing

The proposed time line is shown in Figure 6 though this may be adjusted by proposals if necessary.

Figure 6 Contract timeline

Following award of the contract there will be a series of stages. These allow for an initial extensive design phase followed by development and extensive testing. The proposal should indicate in their proposal if they feel they need to adjust these timings. These stages are as follows:

1. ***Phase 1a: (Design)***. The developer will design the software. This will be done in close co-operation with the TSU. The TSU will appoint additional experts to cover specific areas of expertise. The developer should indicate how they will interact with the TSU. Contact with experts outside of the TSU will be by email or teleconference. The design will have to be approved by the TSU and TFB before software can be written. This stage should assist the developer in fully understanding the requirements of the TSU in developing this software. At the end of this stage the developer will present the design to the TSU at its premises.

2. **Start Phase 1b:** The initial development stage will aim at producing a demonstration version showing at least the Energy Module, the Data Management Core and the Output modules, Key Category Analysis, Uncertainty and QA/QC modules and their functionality (see Figure 2).

3. An initial version of the software, demonstrating its operation, should be made available to a small group of tester, nominated by the TSU, to review the software and check its operation and usability.

4. A second version will be developed in association with testing by users. The aim is to produce a complete working version of the software in time for demonstration by the TSU at COP 13/MOP3 in December 2007.

5. **End Phase 1b:** Following COP13/MOP3 there should be further testing and bug fixing before release of version 1 of the software before SBSTA in May 2008

3.3.1 Interaction between contractor, TSU, Testers etc.

The work will be undertaken under a contract between the contractor and the Institute for Global Environmental Strategies, Hayama, Japan, acting for the IPCC. The work will be managed by the TSU at IGES.

For contractual matters the contractor should contact the Head of the TSU, Dr Simon Eggleston.

During the execution of the contract the contractor will need extensive contact with greenhouse gas inventory experts. This will be need during the design phase, while writing the software and while testing the software. This will be arranged thorough contact between the contractor and Head of the TSU or whoever he designates.

3.3.2 Milestones

These milestones will be used to check the progress of the project. In addition the developer should provide monthly reports on progress. The milestones are:

1. Sign contract

2. Agree detailed specification (end Phase 1a)

3. Demonstration of core and modules. Start limited review and testing

4. Revised complete Phase 1b software. Start wider testing

5. COP13/MOP13 (December 2007)

6. Proposed maintenance programme report (January 2008)

7. Completion of Phase 1b in time for release at SB28.

The contractor shall submit monthly progress reports.

3.3.3 Need for contractor to visit TSU

The successful contractor can visit the TSU as required. The proposal should indicate where such a need is foreseen.

3.4 Options for future development

There are a number of features that could be included in future versions of the software. These need to be accommodated in the system design at this stage. They include:

- Further QA/QC checks

- Reasonability checks that need a certain inventory knowledge.

- Unit conversions

- Multi-lingual interface
- Graphics - plots of inputs and outputs
- Presentation of activity and emission factors in time series, by sector gas pool etc
- Detection of unusual step changes in time series

3.5 Contractual Conditions

3.5.1 Term

This Agreement shall be valid 12 months. Delivery of material shall be made in a timely manner. This Agreement can only be modified by consultation and agreement between IGES and the successful contractor.

3.5.2 Payment

The agreed amount of funds for this task will be paid as follows.

On signing contract	30%
On conclusion of phase 1a and agreement of design	20%
On successful demonstration of software at COP13	30%
On conclusion of Phase 1	20%

Each payment will be made after IGES agrees the work has been completed successfully in accordance with the agreed terms.

3.5.3 Copyright and ownership

All intellectual property rights resulting from any work to be performed under any contract related to the IPCC 2006 GHG Inventory Software shall be vested in the IPCC, including, without limitations, the right to use, publish, translate, sell or distribute privately or publicly any item or part thereof. Neither IGES nor the successful contractor nor their personnel shall communicate to any other person or entity any confidential information made known to it by the IPCC in the course of the performance of its obligations under the terms of the successful contractor nor shall it use this information to private or company advantage. This provision shall survive the expiration or termination of any Agreement. The ownership of the products shall reside in the IPCC and the IGES.

3.5.4 Primary contacts

The primary contact for IGES is Mr Hiroyuki Ishitobi.

3.5.5 Application of Law

This agreement shall be construed in accordance with the laws of Japan.

3.5.6 Termination

In the event that IGES judges the successful contractor unable to execute the duties described in above, IGES may terminate this contract with successful contractor. In this case, IGES reserves the right to request reimbursement of all or part of the remuneration already paid to contractor by IGES.

3.5.7 Special Terms

During the course of this agreement both parties may be privy to confidential information and/or trade secrets of the other party, or information that could be applied directly for commercial or

other purposes. Both IGES and the successful contractor will warrant not to disclose any such information gained directly or indirectly as a result of this agreement to any other party at any time.