NON-CO_2 GREENHOUSE GAS NETWORK
2nd MEETING
MAASTRICHT, 24th-25th January 2002

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1. Introduction

The second meeting of the non-CO_2 greenhouse gases network was held in Maastricht, the Netherlands, immediately after the conference on non-CO_2 greenhouse gases (NCGG-3) in January 2002.

The network was established by US Environmental Protection Agency (EPA), IEA Greenhouse Gas R&D Programme (IEA GHG) and European Commission Directorate for Environment (EC DG Env). Its purpose is to provide a forum for researchers and policy advisers to compare data, mitigation options, technology analysis and modeling to understand potential abatement of emissions of non-CO_2 greenhouse gases (NCGGs).

This meeting was a joint meeting with EMF Working Group 21. The purpose of the meeting was to compare results and perspective, particularly of top-down modelers with those using bottom-up (technology rich) models. Some scenarios had been proposed by EPA for the modelers to use and first experience with using them was reported.

This meeting was arranged by IEA GHG and sponsorship was provided by EPA for some of the delegates' attendance. 35 delegates attended from Europe, USA, Japan, Australia, Russia and China; from universities, research institutes, government and industry. A list is provided in Appendix 1; the agenda is in Appendix 2. A summary of the workshop is provided below – this is a personal report of the meeting and has not been reviewed or agreed by the individual presenters. Copies of the presentations are given in Appendices 3-20.

2. Workshop summary

The first day was devoted to presentations by "top-down" modellers, describing the results of incorporating NCGGs into Integrated Assessments. The second day also had presentations on technology specific ("bottom up") approaches to estimating marginal abatement cost curves (MACCs) and introduced the perspectives of several new members of the network about emissions and abatement opportunities in their countries.

Day 1 – Top-down modelling

After an introduction and welcome by Paul Freund on behalf of IEA GHG, Francisco de la Chesnaye described the new EMF multi-gas working group and its objectives (Appendix 3), which are to:

1) Conduct a new comprehensive, multi-gas policy assessment to improve understanding of the effects of including NCGGs in short- and long-term mitigation policies. In particular to answer the question: How important are NCGGs in climate policies?
2) Advance the state-of-the-art in integrated assessment / economic modelling
3) Strengthen collaboration between NCGG experts and modelling teams
4) Publish the results e.g. as a special journal issue.

This was followed by a series of presentations from groups running "top-down" models.

EPPA - John Reilly of MIT described the EPPA model and showed how NCGGs had been introduced into it (see Appendix 4). All the Kyoto gases are handled endogenously in the model but other gases have to be introduced exogenously. As each gas is treated separately, it

is possible, for example, to explore different rules for trading. In order to change emissions of, for example, CH_4, it is necessary to substitute some other input (e.g. energy or capital); this is different from the treatment of CO_2 in this type of model (where CO_2 is treated as being fully substitutable by coal). NCGG emissions in 5 distinct sectors have been modelled: fossil fuel, energy production, agriculture and land use, industrial processes, sewage and landfills. An example of the MACC for agriculture was shown – there was good fit with the IEA GHG and EPA curves at the high cost end but there was divergence at the low cost end (<$100/tC-equivalent) because of different assumptions about which measures to include. John described the results of various runs using the initial scenarios proposed for the EMF group and commented on the implications. In the early years, more than 90% of the emission reductions would come from NCGGs – further out in time, more of the reductions would come from CO_2 (e.g. 70% of the reduction in 2040). More information/work was needed on MACCs for developing countries, inventory data and better understanding of what is happening in the reference case. The assumptions about growth in the reference case and the MACC are completely interrelated. This will be important for comparing models.

EDGE - Jesper Jensen of Copenhagen Economics (see Appendix 5) explained how he had examined the possible gains from a multi-gas strategy using the EDGE model (when this work was done, it had been assumed the US would meet its Kyoto targets). The MACCs were introduced exogenously. Inclusion of non-CO_2 gases in the EU's measures would reduce the cost of meeting the Kyoto targets by 30%. He also flagged the need for comprehensive inventory data covering all countries. There was also a need to agree a treatment for baselines, since some countries included the effects of anticipated measures in their baselines. It would be useful to have a set of consistent baselines for different countries. He saw that, if there was need for aggressive measures on CO_2 in the long-term, then action on CO_2 is important in the near-term. For this reason, his model shows major reduction in CO_2 in the near term, rather than reduction in NCGGs. As with the EPPA model, welfare loss is reduced by inclusion of NCGGs.

GRAPE - Atsushi Kurosawa described some of the results he had obtained using the GRAPE model (see Appendix 6). This has 5 main modules, including modules for climate and for land use. CO_2, CH_4 and N_2O are endogenous. Other gases have to be introduced externally. MACC curves are derived from ABARE[1] data. He commented that Japan has cut industrial N_2O emissions by 90% by use of new technology. The Ministry of Environment has initiated bottom up studies on NCGGs similar to those conducted in Europe. In the GRAPE, under the "No action" scenario, the main increase in CH_4 emissions comes from coal mining, and N_2O from fertiliser use, mainly due to economic growth in developing countries. Main uncertainties that he recognised were emissions (e.g. activity indexes and emission factors), reduction potential (technologies, and cost) and the long term scenario to be considered.

GREEN - Jean-Marc Burniaux described work done using the OECD GREEN model (see Appendix 7). An OECD Working Paper (number 270) had been produced in November 2000 on a multigas assessment of the Kyoto protocol. The inclusion of other GHGs reduces the marginal abatement cost of stabilisation for Annex 1 countries, with major change in the first 10-15 years. However, the savings are much smaller than those to be gained by emissions trading. A new project has been started to establish an integrated database for assessing the potential for GHG abatement. This will use land use data from the USDA[2] Economic Research Service. The expectation is that spill-over effects will be significant – e.g. increased land prices as a result of devoting land to carbon sequestration would lead to reduced economic output. The plan is to integrate USDA land use database with the GTAP database already used by many modellers. The response function will be estimated for each type of land use in each region/country.

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[1] Australian Bureau of Agricultural and Resource Economics
[2] US Department of Agriculture

NCGG Metrics – this was not specifically a presentation on a top-down model - Odd Godal examined alternatives to existing GWPs for comparing greenhouse gases (see Appendix 8). The study has looked at the implications for Norway of changing the index used for relating different gases; this could affect compliance cost or time profile of abatement. The results were expressed in terms of MACCs using GWPs over 20, 100 and 500 years. Changing the index can change the relative ranking of the measures – for example, changing to a 500 year horizon shifts the emphasis to long lived gases. The results in the case of the 20 year horizon seem not much different from the 100 year ranking but the overall cost increases by 16%. Future work will cover a larger scale than just Norway, trying to estimate the social cost of using the "wrong" index and looking at the effect of different types of climate agreement.

Minicam - Hugh Pitcher (PNNL) discussed the implications of introducing NCGGs into top-down models, based on his experience with the Minicam model (see Appendix 9). He had estimated emissions of NCGGs for future periods (to 2100) using emission factors (derived from the base period) and a measure of activity. Results were based on the SRES B2 scenario, which is close to IS92a (he noted that SRES had decided to avoid identifying a central scenario).

Various cases were examined – i.e. just relying on CO_2 controls for abatement, or using all gases to achieve the same forcing as the 450ppm and 550 ppm targets, or fixing the CO_2-only price to see what effect this had on non-CO_2 forcing in 2100. He pointed out that, as a spin-off from controlling carbon use, there will be a quite large effect on CH_4 emissions (but not on N_2O as most of those emissions come from agriculture). However, the indirect effects of reducing sulphur emissions can give a significant increase in radiative forcing.

Another case which Hugh considered was the "Hansen proposal" – this aims for zero net forcing from NCGGs in 2050. According to Hugh, this assumes $1W/m^2$ forcing from CO_2 is achieved by the baseline, which is inconsistent with SRES. The treatment of practical issues is partial and unsatisfactory – the ideal approach would be to conduct a good Integrated Assessment.

Hugh commented that most models do not include C-emissions from changing land use from pasture to crops (Minicam for example allows unbridled use of biomass as there is no charge for conversion of land for this purpose). For various reasons, including poor inventory data, the models do not describe the impact of black carbon very well.

Other points he made included:

- MACCs are essentially a view of changes in technical practice (they may or may not involve changes in technology) – thus they are likely to change over time.

- CH_4 is different from other GHGs because its emissions are close to the level of the natural sink, so it should be quite easy to affect concentrations of CH_4.

- The Office of Labour Statistics had found that it takes typically 15 years for best practice to become the norm, which is a salutary lesson for technology transfer.

- Unlike other environmental issues, there is too much uncertainty in climate issues to have much confidence in any "optimum" strategy.

Day 2 Completion of Top-down models

IMAGE - Tom Kram (RIVM) opened the proceedings with a description of the IMAGE model (see Appendix 10). Although labelled "top down", this model does have a lot of "bottom up" details in it (e.g. land use). IMAGE takes historic emissions data from the EDGAR database also held at RIVM. Work is in progress to incorporate reductions in NCGGs (in a similar way to EPPA). As well as anthropogenic emissions of CO_2, CH_4 and the high GWP gases, IMAGE includes all N_2O sources (natural and anthropogenic) as they are all expected to increase over time, as well as CO, NO_x, SO_2, VOCs. Tom illustrated a number of outputs from the model. The variation between IPCC scenarios in terms of effects of NCGGs is much less than the variation in effects of CO_2 because much of the NCGG emissions are determined by land use, which varies less than energy demand between the scenarios. The contribution to radiative forcing by 2100 is dominated by CO_2, with N_2O also rising but short lived gases are relatively minor contributors by then.

He noted the European GECS project will develop MACCs for various sources (but not N_2O from land). For example, CH_4 from landfills was examined using 2 different scenarios – one involved ceasing to put material into landfills (which would result in steady decline in emissions); the other involved capturing the CH_4 (which would result in much more rapid decline in emissions). Another example cited was carbon plantations, concentrating on abandoned agricultural land and areas after clearance by logging. A supply curve had been produced - forests could sequester 1.5 GtC/y (averaged over 50 years), which would need 400 Mha, much of which would be in the northern hemisphere. Even in Western Europe, the MACC showed it should be possible to sequester 90MtC/y at cost less than $100/tC.

Issues for modellers were: how to evaluate (e.g. within the limits of GWPs, are there alternative measures); how to overcome the problems of using bottom up MACCs in models; how to treat uncertainty in MACCs (increases with increasing detail) and regional differences.

Day 2 Bottom-up models

The remainder of the second day was devoted to presentations of bottom-up estimates. EPA work was presented by Elizabeth Scheehle and Casey Delhotal. Elizabeth described work on CH_4 emission inventories, comparing different sources of data (Appendix 11). For example estimates made using the IPCC tier 1 (default) method for coal mining in the US indicated 11.9 Tg/y emissions whereas an approach focussing on specific key sources (IPCC tier 2 or 3 approach) yielded only 4 Tg/y. Similar examples were cited for landfills and agriculture. She recommended use of national inventories, resorting to IPCC's tier 1 method only as needed to fill gaps. As a result, the estimated emissions globally are lower than the earlier IPCC estimate although the emission estimates for the landfill and waste water sectors have increased.

Casey Delhotal (Appendix 12) described MACCs for CH_4 which EPA have developed for 11 countries/regions outside the USA. Detailed assumptions had been made about the applicability of particular technology in each region. EPA's approach to costs includes factors such as depreciation and taxes, which others exclude. As with many MACCs, the curves are constructed from discrete points, one for each technology, so that to an extent these are a mixture of average and marginal costings. The effect of using different approaches (e.g. estimates based on US based assumptions or more site-specific assumptions) can be considerable; generally the more sophisticated assumptions have yielded lower abatement potential at a specific cost.

Jochen Harnisch (Ecofys) summarised bottom-up estimates of fluorinated gases (Appendix 13). After summarising the sources and measures, he pointed that, in terms of their behaviour in the atmosphere, HFCs behave rather like CH_4 whilst SF_6 and PFCs are

essentially permanent additions to the atmosphere. He emphasised the importance of the time profile of the emissions and abatement actions in many sectors e.g. the substantial delay after manufacture before blowing agents and refrigerants may be emitted. Jochen summarised the process of developing a bottom-up MACC; he pointed out the value of involving industry associations at an early stage. The complex nature of the process of developing the curves will influence the final shape (the low cost options are well researched, whereas high cost options, say >\$50/tCO_2e, are not well understood so the curves will be quite uncertain in those regions). Gaps in knowledge included: activity data and emission factors, regional differences and evolving practices in developing countries, as well as unbiased sources of cost data for alternative technologies.

Stephen Anderson (EPA) described lessons relevant to modelling from EPA's experience in forming partnerships between a government agency and industry. The aim of this was to change technology and emissions in a particular sector (Appendix 14). He recognised that, in the short term, the capital stock is fixed and supply/demand functions are relatively stable, which provides a good basis for bottom-up modelling. In the longer-term (which can be as short as 3-5 years in high technology sectors), there are major capital changes and so supply/demand functions will change. Then bottom-up modelling becomes more like projections.

Day 2 Emission estimates and abatement options

Inna Gritsevich gave an overview of a joint project to create a bottom-up inventory system in Russia, which will work to international standards (Appendix 15). One of the aims of this work is to create awareness amongst decision makers, both in Moscow and in the regions. She gave some examples of the results, such as CO_2 and CH_4 emissions data for specific regions. CH_4 emissions from coal mining have dropped by up to 80% in one region since 1990 due to changes in practice, particularly changes in the mines. She also commented on the basis used for future projection of emissions. Natural gas is being developed as an export so its share of domestic fuel consumption has fallen markedly, with consequent increase in carbon intensity of domestic energy consumption.

Lin Erda from the Chinese Academy of Agricultural Sciences described non-CO_2 emissions from the agriculture sector in China and mitigation options (Appendix 16). China is now preparing an inventory of greenhouse gas emissions. 72% of emissions are from the energy sector. Between 1990 and 1998, ruminant animals became the single largest source of CH_4 emissions; statistics on the main classes of animal had been assembled. On the other hand, emissions from rice paddies have remained constant; he noted that the early rice harvest produces less emissions than the later harvest, whilst a single annual harvest of rice yields even more emissions.

He foresaw possible improvements to reduce emissions from enteric fermentation, including improved breeds of animal, feed additives and treatment of straw to improve its digestibility (this could produce 50% increase in weight gain/day so it was in the farmer's interest too). Many waste streams were handled by anaerobic digesters where there was a need to recover the biogas (he noted that small digesters don't work in winter). Options for rice included selection of different varieties, as well as water and fertiliser management; however, given the importance of rice in diet, there may not be much potential for emission reduction in China. His institute is now making field measurements on emissions from rice. He illustrated the overall picture using a combination MACC.

N_2O emissions from soil can be controlled by more precise use of fertiliser, use of inhibitors or grazing control. Measurements are being made of atmospheric concentration at different sites in China, which will give information on CH_4 uptake by soils. He commented that warming might induce release of CO_2 and CH_4 from soils. Opprtunities for transfer of

technology included higher productivity cattle, CH_4-driven generator, advanced composting techniques, and modified animal feed.

Jo Mummery summarised Australian emissions inventory (Appendix 17) – 30% of this is non-CO_2 gases, of which $^2/_3$ comes from livestock so methane is the major gas (77%). The Australian Greenhouse Office has taken the IPCC best practice guidelines and extended them in a number of respects. Other areas where improvements are being sought include N_2O emissions from soils, ruminant livestock, and closer correspondence between agricultural models. She also remarked that vaccine trials indicated 5% productivity improvement in sheep with 17-22% reduction in emissions; greater reduction is expected in cattle but there was need for more trials.

Jochen Harnisch then offered the meeting some suggestions for future activity (Appendix 18). Ozone and aerosols were 2 other contributors to climate change – was it now time to try costing abatement measures for this? Some measures for controlling other gases have knock-on effects, increasing emissions of these gases (e.g. use of diesel engines, foam blowing agents). Costing studies were done in the EU on measures to reduce tropospheric ozone as an air quality measure – these could be adapted for climate protection purposes. At present we can only place limited confidence in estimates of radiative forcing deriving from these gases, especially the indirect effects. He suggested that need to develop a metric for looking at the effects of black carbon – this is likely to be quite complicated and would probably have to use a more detailed (at least regional) metric.

Ronald Flipphi, standing in for Julia Williams Jacobse, of the Netherlands' ministry of housing, spatial planning and the environment, described some experience in the Netherlands with implementing climate protection policies (Appendix 19). As part of an options review, a MACC had been prepared covering all measures applicable by 2010. Significant opportunities had been recognised in non-CO_2 gases. Different situations were found in different parts of the value chain, which would affect how emission reduction policies could be developed and applied. Bottlenecks could be removed by focussing on "pioneers", to support them financially, technically and verbally. Successful action throughout the value chain requires, first, investigation of possible targets followed by development and implementation.

Dina Kruger (EPA) drew some common threads out of the discussions, highlighting some questions of interest from a modeller's perspective (Appendix 20). In the Kyoto timeframe, most of the basic questions about including NCGGs had been explored but there was merit in exploring the implications of alternative approaches to policy. There were also important questions about how NCGGs would affect policies in different regions. Another issue was to consider the sensitivity of the results to the assumptions about technological change. How dependent are the results on the chosen metric? She recommended that the future work of the EMF group and the Network should include defining a short, simple set of scenarios as well as helping the modellers understand the implications of their own choice of scenarios.

Francisco de la Chesnaye drew the meeting to close, suggesting that future Network activity should include working on harmonisation of the MACC standard so that the curves are more useful to modellers, and to address the agricultural sector specifically, to define more practicable options and measures, involve more subject specialists and departments interested in those areas specifically (such as EC DG Agriculture).

Areas for improvement

During the meeting, the modellers made various suggestions about areas of greatest uncertainty. There is scope for improvement in information on abatement options:

- Regional data
  - MACCs for developing countries
  - Regional differences.
  - Evolving practices in developing countries
- Inventory data
  - activity indexes and emission factors
- Scenarios
  - Better understanding of what is happening in the reference case. The assumptions about growth in the reference case and the MACC are completely interrelated. This will be important for comparing models.
  - Long term scenario for modelling
- Abatement options
  - Reduction potential (technologies and cost)
  - Unbiased sources of cost data for alternative technologies.
  - How to overcome the problems of using bottom up MACCs in models?
  - How to treat uncertainty in MACCs (which increases with increasing detail)?
- Evaluation measures
  - Within the limits of GWPs, are there alternative measures?

Next steps

The next meeting of the EMF working group will be held on May 9th and 10th in the Washington DC area. Francisco de la Chesnaye has subsequently circulated a list of proposed scenarios and encouraged the modelers to run some of the scenarios listed, or others, so as to be in a position to present results at the May meeting. A few of these scenarios could then be taken up by the whole group as common scenarios. He also identified NCGG data requirements and potential further work in this area.

The Non-CO_2 Network may hold a one-day meeting following the GHGT-6 conference in Kyoto; this could focus on agricultural mitigation options. After this, a meeting is planned in connection with the 3rd Methane & Nitrous Oxide conference, scheduled for June 2003 in China.

APPENDIX 1

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Non-CO_2 GHGs Network Meeting
24th – 25th January 2002, MECC, Maastricht

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APPENDIX 2

AGENDA

Agenda: Non-CO_2 GHG Network and EMF WG 21 Joint Meeting

Thursday, Jan 24: Top-Down, Integrated Assessment	
9:00 - 9:15	Welcome / Introduction to the Network - Paul Freund, IEA GHG
9:15 - 9:45	EMF- Network Multi-gas Working Group Objectives – Fco. De la Chesnaye, Working Group Chair
9:45 - 10:30	Presentations by modeling teams - John Reilly, MIT
10:30 - 11:00	*Break*
11:00 - 12:30	- Jesper Jensen, Copenhagen Economics - Atsushi Kurosawa, IAE Japan
12:30 - 13:20	*Lunch*
13:30 - 15:00	- Jan Fuglestvedt and Odd Godal, CICERO - Jean-Marc Burniaux, GTAP Purdue
15:00 - 15:30	*Break*
15:30 - 17:00	- Hugh Pitcher, PNNL - Group discussion on scenarios and scope of WG analyses
17:00	End of Day 1
19:00	*Dinner* (To be confirmed – participants will be responsible for their own bill.)
Friday, Jan 25: Conclusion of Top-Down, Integrated Assessment. ***Start of Estimates of Non-CO_2 Emissions and Abatement measures.***	
9:00 - 9:45	Conclusion of presentations by modeling teams - Tom Kram, RIVM
9:45 - 10:30	Bottom-up approaches to estimating International Marginal Abatement Costs (1): Methane and HGWP – Elizabeth Scheehle and Casey Delhotal, USEPA
10:30 -11:00	*Break*
11:00 - 11:30	Bottom-up approaches to estimating International Marginal Abatement Costs (2): F-gases – Jochen Harnisch, ECOFYS
11:30 - 12:00	Role of technological change in estimating emission projections - Stephen Andersen, USEPA
12:00 - 13:00	*Lunch*
13:00 - 13:30	Non-CO_2 Emission Projections for Russia - Inna Gritsevich, CENEf
13:30 - 14:00	Non-CO_2 Emission from Agriculture for China - Lin Erda, Chinese Academy of Agricultural Sciences
14:00 - 14:30	Australia's non-CO_2 GHG emissions projections and mitigation estimates - Jo Mummery and Paul Curnow, Australian Greenhouse Office
14:30 - 15:00	Beyond the Kyoto multi-gas world: ozone and aerosols – ready for costing? - Jochen Harnisch, ECOFYS and group discussion
15:00-15:30	*Break*
15:30 - 16:00	No chain (re)action without policy and measures - Ronald Flipphi, Ministerie van VROM
16:00 - 16:30	Group discussion on priorities for further work and long term modeling of non-CO_2 GHGs. – Fco. De la Chesnaye, Paul Freund, IEA GHG
	End of Day 2

APPENDIX 3

INTRODUCTION AND WELCOME BY
PAUL FREUND (IEA GHG)
FRANCISCO DE LA CHESNAYE (US EPA)

Non-CO_2 Gases Network
24th - 25th January 2002

Paul Freund

IEA Greenhouse Gas R&D Programme

Introduction

Welcome

- Purpose of the network
- Organisation of the network
- Actions from last meeting
- Conduct of this meeting
- Next meeting

Purpose of the network

Provides a forum for

- Researchers and policy advisers
- Involved in non-CO_2 greenhouse gas analysis

Policy-related issues

Informal

Exchange of information

- Share and compare
  - Data
  - Mitigation and abatement analyses
  - Economic modelling

Organisation of the network

Co-sponsors

- US Environmental Protection Agency (EPA)
- European Commission DG[1] Environment (EC)
- IEA Greenhouse Gas R&D Programme (IEA GHG)

[1] Directorate General

Items arising from 1st meeting

First meeting:14-15 June 2001

- Overview of non-CO_2 gases & their part in climate change
- Opportunities for abatement
- Economic modelling
- Issues outstanding:
  - Agricultural sector
  - Holistic approach to abatement (including all gases)
  - Participation by developing countries in the network
  - Better understanding of economic models
- Joint meeting with EMF working group proposed

Conduct of this meeting

General style = relaxed

- Several presentations planned
- Plenty of opportunity for discussion
- Dinner tonight
  - for your own account
  - do you want to join in?

Future meetings

Side meeting at GHGT-6 conference

- Location = Kyoto, Japan
- Dates of conference: 1st - 4th October 2002
- Date of Network meeting: to be decided
- Possible topics:
  - review what we know
  - decide next activity for Network

Future network meeting

- Date, location and topics?

Further work

Some possibilities

- Agriculture
  - pasture
  - rice
  - animals
- Natural seepages of CH_4
- Abatement of non-CO_2 gases as a strategy (e.g. Hansen)
- Poster about the network at GHGT-6

APPENDIX 4

PRESENTATION BY JOHN REILLY (MIT, USA)

APPENDIX 5

PRESENTATION BY JESPER JENSEN (COPENHAGEN ECONOMICS)

APPENDIX 6

PRESENTATION BY ATSUSHI KUROSAWA (IAE, JAPAN)

APPENDIX 7

PRESENTATION BY JEAN-MARC BURNIAUX (GTAP, OECD)

APPENDIX 8

PRESENTATION BY JAN FUGLESTVEDT & ODD GODAL (CICERO, NORWAY)

APPENDIX 9

PRESENTATION BY HUGH PITCHER (PNNL, USA)

APPENDIX 10

PRESENTATION BY TOM KRAM
(RIVM, NETHERLANDS)

APPENDIX 11

PRESENTATION BY ELIZABETH SCHEELE (US EPA)

APPENDIX 12

PRESENTATION BY CASEY DELHOTAL (US EPA)

APPENDIX 13

PRESENTATION BY JOCHEN HARNISCH (ECOFYS)

APPENDIX 14

PRESENTATION BY STEPHEN ANDERSEN (EPA)

APPENDIX 15

PRESENTATION BY INNA GRITSEVICH (CENEf)

APPENDIX 16

PRESENTATION BY LIN ERDA
(CHINESE ACADEMY OF AGRICULTURAL SCIENCES)

APPENDIX 17

PRESENTATION BY JO MUMMERY (AUSTRALIAN GREENHOUSE OFFICE)

APPENDIX 18

PRESENTATION BY JOCHEN HARNISCH (ECOFYS)

APPENDIX 19

PRESENTATION BY RONALD FLIPPHI (VROM)

APPENDIX 20

PRESENTATION BY DINA KRUGER (US EPA)