



INTERGOVERNMENTAL PANEL  
ON CLIMATE CHANGE

TWENTIETH SESSION  
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ITEM 7.5  
ENGLISH ONLY

## **PROPOSALS FOR SPECIAL REPORTS, METHODOLOGY REPORTS AND TECHNICAL PAPERS**

### **Proposal for a Technical Paper on Levels of Greenhouse Gases in the Atmosphere and Dangerous Anthropogenic Interference with the Climate System**

(Submitted by the Secretariat)

The Panel is invited to consider the outcomes from the expert meeting on:  
“Levels of Greenhouse Gases (GHG) in the Atmosphere Preventing  
Dangerous Anthropogenic Interference with the Climate System”.

## **Levels of Greenhouse Gases (GHG) in the Atmosphere Preventing Dangerous Anthropogenic Interference with the Climate System**

An expert meeting on the: “Levels of Greenhouse Gases (GHG) in the Atmosphere Preventing Dangerous Anthropogenic Interference with the Climate System”, was conducted in Geneva on 21-22 January 2003. The report of the meeting is attached (Attachment A).

2 There was a consensus in the meeting that the levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system is a significant issue that must continue to be addressed by the IPCC in its future work programme. Furthermore there was agreement that whatever process is adopted it should fully involve all of the IPCC Working Group Bureaux in particular the co-chairs of the three Working Groups.

3 The meeting also invited the research community (including such international programmes as IGBP, IHDP, WCRP,...) to consider how its activities can contribute to a greater understanding of the scientific, technical and socio-economic issues associated with Article 2 of the UN Framework Convention on Climate Change.

4 The meeting considered that there are four options available to the IPCC:

- (1) Consider the scientific, technical and socio-economic issues associated with Article 2 of the UN Framework Convention on Climate Change in the context of developing the Fourth Assessment Report, including avoidance of dangerous anthropogenic interference with the climate system.
- (2) In conjunction with Option (1) conduct an IPCC Workshop of acknowledged experts in relevant fields to consider issues relating to the scientific, technical and socio-economic aspects of Article 2 of the UN Framework Convention on Climate Change and distribute widely the Workshop proceedings.
- (3) Based on the existing scoping paper (INF. 2 - Scoping Paper for the Technical Paper) prepare a Technical Paper on scientific, technical and socio-economic issues relating to levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system as assessed in the TAR and other IPCC Reports.
- (4) Prepare a Special Report on the scientific, technical and socio-economic aspects relating to Article 2 of the UN Framework Convention on Climate Change.

5 It was agreed by the meeting that the IPCC Bureau and the Panel should be invited to consider these four options, and, in the full knowledge of the IPCC's principles and procedures, entire work programme and available resources, commit to the most appropriate way to proceed.

**LEVELS OF GREENHOUSE GASES IN THE ATMOSPHERE  
PREVENTING DANGEROUS ANTHROPOGENIC INTERFERENCE  
WITH CLIMATE SYSTEM**

**Report of the IPCC Expert Meeting,  
Geneva, 21 – 22 January 2003**

**1. Working Arrangements**

1.1 The meeting was chaired by Prof. Yuri Izrael, vice-chair of the IPCC, and attended by 32 experts as listed at Annex A.

1.2 Prof. Izrael opened the meeting at 10am and it was agreed that the working hours would be 10.00 to 13.00 and 14.30 to 18.00 with tea/coffee breaks in the sessions as determined by the chairman.

1.3 The meeting adopted the provisional agenda (Annex B), noting that it could be changed at any time as determined by the meeting.

**2. Background**

2.1 The meeting commenced with Prof. Izrael reviewing the history, in the IPCC of the issue of levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system

2.2 Prof. Izrael noted that Article 2 of the UN Framework Convention on Climate Change (UNFCCC) states, *inter alia*, that:

"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

2.3 Thus, Prof. Izrael noted that the issue of safe limits for greenhouse gas content in the atmosphere is of high importance with respect to practical implementation of the Convention. However, he felt that there is essentially a lack of knowledge on what is a "dangerous anthropogenic interference with the climate system".

2.4 Prof. Izrael noted that at the final stage of preparing the TAR (particularly in addressing Questions 1, 6 and 9 of the Synthesis Report) it was admitted by the Panel that this question requires comprehensive and integrated investigations since the issue has substantial scientific component in addition to the political one.

2.5 As a part of the process toward addressing the issue the IPCC Session requested the preparation of a scoping paper for a possible Technical Paper. As a consequence Prof. Izrael chaired a group that prepared a scoping paper entitled: "Levels Of Greenhouse Gases in the Atmosphere Preventing Dangerous Anthropogenic Interference with the Climate System". This scoping paper was submitted to the 19th Session of the Panel (Document IPCC-XVIII/INF.8) but time did not allow for a discussion of the matter. Prof. Izrael presented the scoping paper to the meeting.

2.6 Prof. Izrael also noted that at the 27th Session of the IPCC Bureau (Geneva, August 2002) the issue was reconsidered, and that during the Session the Chairman of the IPCC, Dr Pachauri, had

advised that he considered the problem must be properly addressed in the preparation of the IPCC's Fourth Assessment Report (AR4). Dr Pachauri had further noted that issue of the levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system could be considered as a "cross-cutting" issue for all three Working Groups of the IPCC, and requires effective coordination. In this connection he suggested vice-chairman of the IPCC, Prof. Izrael, might coordinate this work within the IPCC.

### **3. Scientific Discussions**

3.1 After these introductory remarks ten experts gave brief presentations on the scientific, technical and socio-economic issues related to assessing what might be dangerous levels of greenhouse gas concentrations for the climate system. A brief synopsis of these presentations is attached (Annex C).

### **4. Meeting Outcomes**

4.1 There was a consensus in the meeting that the levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system is a significant issue that must continue to be addressed by the IPCC in its future work programme. Furthermore there was agreement that whatever process is adopted it should fully involve all of the IPCC Working Group Bureaux in particular the co-chairs of the three Working Groups.

4.2 The meeting also invited the research community (including such international programmes as IGBP, IHDP, WCRP,...) to consider how its activities can contribute to a greater understanding of the scientific, technical and socio-economic issues associated with Article 2 of the UN Framework Convention on Climate Change.

4.3 The meeting then considered what advice it might provide to the next Session of the Panel on how best to progress the issue.

4.4 In essence it was considered that there are four options available to the IPCC:

- (1) Consider the scientific, technical and socio-economic issues associated with Article 2 of the UN Framework Convention on Climate Change in the context of developing the Fourth Assessment Report, including avoidance of dangerous anthropogenic interference with the climate system.
- (2) In conjunction with Option (1) conduct an IPCC Workshop of acknowledged experts in relevant fields to consider issues relating to the scientific, technical and socio-economic aspects of Article 2 of the UN Framework Convention on Climate Change and distribute widely the Workshop proceedings.
- (3) Based on the existing scoping paper prepare a Technical Paper on scientific, technical and socio-economic issues relating to levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with climate system as assessed in the TAR and other IPCC Reports.
- (4) Prepare a Special Report on the scientific, technical and socio-economic aspects relating to Article 2 of the UN Framework Convention on Climate Change.

4.5 It was agreed that the IPCC Bureau and the Panel should be invited to consider these four options, and, in the full knowledge of the IPCC's principles and procedures, entire work programme and available resources, commit to the most appropriate way to proceed.

## ANNEX A

### IPCC expert meeting on the Levels of Greenhouse Gases (GHG) in the Atmosphere Preventing Dangerous Anthropogenic Interference with the Climate System 21-22 January 2003, Geneva

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**IPCC expert meeting on the  
Levels of Greenhouse Gases (GHG) in the Atmosphere Preventing Dangerous Anthropogenic  
Interference with the Climate System**

(21-22 January, 2003, Salle B of the WMO Building, 7 bis, avenue de la Paix, Geneva;  
contact in Geneva: IPCC Secretariat, phone: 41 22 7308208/8254,  
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**AGENDA**

21 of January

**10-00 MORNING PLENARY SESSION**

**1. Opening the meeting**

- 1.1 Chairman of the meeting, Professor Yuri IZRAEL will open the meeting at 10-00 hrs on Tuesday, 21 of January 2003 and make his opening remarks
- 1.2 Welcoming remarks by Dr. Geoffrey LOVE, Secretary of the IPCC
- 1.3 The Chair will confirm the working arrangement: meeting hours of 10-00 to 13-00 for the morning sessions and 14-30 to 18-00 for the afternoon sessions
- 1.4 Approval of the Agenda

**2. Scientific presentations**

- 2.1 Professor Yuri IZRAEL will highlight a history of the problem and present a draft Framework Concept of the levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with the climate system. Background documents (Framework Concept and Scoping paper for the IPCC Technical Paper LEVELS OF GREENHOUSE GASES IN THE ATMOSPHERE PREVENTING DANGEROUS ANTHROPOGENIC INTERFERENCE WITH THE CLIMATE SYSTEM) will be distributed among participants
- 2.2 Participants will present their views on the science-based concepts of the issue
- 2.3 Scientific discussion

**13-00 CLOSURE OF THE MORNING PLENARY SESSION**

**14-30 AFTERNOON PLENARY SESSION**

- 2.4 Continuation of scientific discussion

**3. Establishing the expert groups**

Participants will split into small expert groups for discussing particular issues of the problem, including scientific basis for establishing criteria of dangerous levels of GHG



## **BREAK IN THE AFTERNOON PLENARY SESSION**

- 4. Participants will work in the expert groups on the scientific side of the problem**

## **17-00 CONTINUATION OF THE AFTERNOON PLENARY SESSION**

- 5. Summarising the expert group outputs of 21 January**

- 5.1 Expert groups will report to the Plenary
- 5.2. General discussion on the scientific issues
- 5.3 Remarks by Professor Yuri IZRAEL: guidance for expert group work on 22 January morning
- 5.4 Establishing a drafting group for compiling a Briefing paper for the IPCC XXth Session and the Work Plan for the further work on the issues under consideration within the IPCC

## **18-00 CLOSURE OF THE AFTERNOON PLENARY SESSION**

22 of January

## **10-00 EXPERT GROUP SESSIONS**

- 6. Participants will continue work in the expert groups on the scientific side of the problem**

## **11-45 CLOSURE OF THE EXPERT GROUP SESSIONS**

## **12-00 MORNING PLENARY SESSION**

- 7. Finalizing the scientific considerations**

Expert groups will report to the Plenary  
General discussion on the scientific issues  
Summary by Professor Yuri IZRAEL

## **13-00 CLOSURE OF THE MORNING PLENARY SESSION**

## **14-30 AFTERNOON PLENARY SESSION**

- 8. Possible ways for further work on the problem within the IPCC**

- 6.1 Introduction by Professor Yuri IZRAEL
- 6.2. Participants will present their views on the optimal ways for further work

In particular, possible IPCC documents (Special Reports, Technical Papers, Methodology Reports, Conceptual Papers) as well as various meetings (Workshops, Seminars, Expert Meetings) aiming at elaborating the fundamentals as well as applied aspects of dangerous GHG level problem might be considered.

## **16-00 BREAK**

**Drafting group will prepare the documents**

**17-00 THE AFTERNOON PLENARY SESSION (CONTINUATION)**

**9. Discussion on a draft of the Briefing paper and the Work Plan**

Participants will discuss the documents prepared by the drafting group and elaborate a procedure for finalizing them by the 5th of February 2003

**10. General discussion**

**11. Closing remarks by the Chair, Professor Yuri IZRAEL**

**18-00 CLOSURE OF THE MEETING**

## Summaries of scientific presentations

**1. Prof Yu. Izrael**

1.1 Prof. Yu. Izrael spoke on a scientific basis for understanding the issue of levels of greenhouse gases in the atmosphere preventing dangerous anthropogenic interference with the climate system. He noted that it is known that Article 2 of the UN FCCC is based on a notion of dangerous anthropogenic interference with the climate system, ecological systems and future economic development. He also noted that in the Synthesis Report of the TAR (Q1) this notion is also used.

1.2 Prof. Izrael referred to the monograph (Izrael Yu.A. *Ecology and Control of the Natural Environment*. Kluwer A. Publ., 1983) in which a general scheme for determination and calculation of critical (dangerous) maximal and minimal limits for a state of biotic and abiotic components of the biosphere as well as respective anthropogenic impacts is given.

1.3 He noted that for determining tolerable and critical (dangerous) impact on and a state of the climate system and the ecosystems (and further on for economic assessments) two- and three-dimensional "cause-response" systems are constructed for various situations. One should consider dangerous those levels beyond which changes in the elements of climate system and ecological systems are irreversible.

1.4 He further noted that the above approach allows determining a wide range of critical (dangerous) thresholds for impacts on or a state of different elements of the climate system, biosphere, and humans.

**2. Dr Serguei Semenov**

2.1 Dr Serguei Semenov provided an example calculation of critical thresholds for greenhouse gas content in the atmosphere. He noted that establishing limits for greenhouse gas content (GHG) in accordance with Article 2 of the UN FCCC requires:

- selection of key elements of the climate system of different functions (climate-forming, socio-economic, biospheric) and spatial scale (local, regional, global);
- quantifying critical thresholds for climatic conditions exceeding of which is considered unacceptable for the elements; and,
- development of models for calculating changes DELTA(Climate) in climate caused by a given change DELTA(GHG) in GHG content.

2.2 He noted that example model calculations yielded:

$$\text{DELTA}(\text{CO}_2)/300 + \text{DELTA}(\text{CH}_4)/10 + \text{DELTA}(\text{N}_2\text{O})/1.5 \leq 1$$

for not exceeding "critical increase" of 3 °C by DELTA(*Temperature*); according to the TAR (WGI, p. 17) the latter value is a critical threshold for the Greenland ice sheet .

(All DELTA(GHG) are in ppm, DELTA means long-term additions to contemporary level)

**3. Dr Michel Petit**

3.1 Dr Petit noted that the IPCC reports quote precise estimates neither for the costs of impacts for a given stabilisation level nor for the cost of achieving this level. They reflect quite fairly the state

of knowledge. In relation to proposals for a Technical Report on the topic he observed that these cannot, by definition, consider new material.

3.2 He suggested that the IPCC's AR4 should pay a particular attention to any new damages and costs estimates appearing in the literature. Also, early advice that the Synthesis Report will specifically address this subject would induce a special effort from the Lead Authors and to some extent from the scientific community to address these matters.

3.2 Finally, he noted that improving the scientific and technical results relevant to political decisions about a GHG stabilisation level should be a major objective assigned to IPCC and to the scientists in their future studies.

#### **4. Prof. Jean-Pascal van Ypersele**

4.1 Prof. Jean-Pascal van Ypersele suggested that the second part<sup>1</sup> of UNFCCC Article 2, not mentioned by Prof. Izrael, provides three essential policy-relevant criteria to help assess the dangerous character of greenhouse gas stabilisation levels. He recommended that, instead of having a Technical Paper limited (by definition) to scientific literature assessed by IPCC for the TAR, questions 1 and 6 of the TAR SYR be re-asked from the start of the AR4 process, and that the scientific, technical, and socio-economic questions raised by the UNFCCC Article 2 be considered as cross-cutting issues in the full AR4 and its Synthesis Report.

4.2 He also highlighted the need for a new set of reference greenhouse gas stabilisation scenarios with a long-term perspective (beyond 2100) and a multi-gas approach, so that the scientific community is not reduced to use SRES scenarios as surrogates.

#### **5. Dr Bill Hare**

5.1 Dr Hare pointed that the risks of non linear and abrupt changes in key components of the climate system are important to a determination of what is dangerous interference with the climate system. He cited the potential for carbon cycle feedbacks, ocean thermohaline circulation slowdown or abrupt cessation, meltdown or decay of the Greenland West Antarctic Ice Sheets, changes extreme event frequency and severity, such as a shift towards El Nino mode of climate as the world warms.

5.2 Dr Hare also emphasised that the rate of change of climate was also an important determinant of damages hence relevant to Article 2. In determining criteria for what might be dangerous levels of climate change long-term effects such multi-century scale of sea level rise and that the decay of the Greenland ice sheet had to be taken into account. A further criteria for consideration needed to be the proximity of the climate system to thresholds of major increases in impacts. Dr Hare cited the work of Parry et al on abrupt changes in the numbers at risk of water shortage in moving from around a 1.5-2.5°C warming in the 2080s. He argued that criteria relevant to policy decisions as what is dangerous need to include all relevant factors and all relevant time scales, and include critical regional impacts as well as global effects.

#### **6. Dr. Haroon S. Kheshgi**

6.1 Dr. Haroon S. Kheshgi spoke on the climate change science perspective on dangerous levels of greenhouse gases. He noted that currently, there is very little ability to make

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<sup>1</sup> "Such a level should be achieved within a time frame sufficient  
- to allow ecosystems to adapt naturally to climate change,  
- to ensure that food production is not threatened and  
- to enable economic development to proceed in a sustainable manner."

probabilistic forecasts of climate, severely limiting the scientific basis for what may be deemed a safe level of greenhouse gases. For example, the commonly used factor-of-three range of the climate sensitivity parameter results in a broad range of CO<sub>2</sub> levels modelled to give a specified global equilibrium temperature. Obstacles remain for all approaches used in the quest for objective estimates (including the probability distribution) of climate sensitivity. Abrupt climate change evident in paleo-records of climate could lead to serious impacts if they occur in the future, however, research is at an early stage in determining mechanisms and triggers for abrupt change. Continued research and observation hold promise for improving the scientific basis.

## **7. Dr Hans-Martin Fuessel**

7.1 Dr Fuessel noted that the specification of “dangerous climate change” is ultimately a value judgement, and that this fact is recognised on several occasions in the IPCC TAR, including the Synthesis Report and Ch. 19 of the WG II Report. Of course such judgements should be based on a comprehensive analysis of the relevant scientific aspects. The five “reasons for concern” distinguished in the TAR WG II Ch 19 provide a useful structure for thinking about “dangerous climate change”. It was emphasised that the scientific analysis needs to account for the existing uncertainties and knowledge gaps with respect to the link between specific levels of greenhouse gas concentrations, the resulting climatic changes on global, regional, and local scales, and the likely impacts on natural and social systems.

7.2 The framework concept for the scoping paper, in its present form, does not seem to adequately address some important topics:

- (a) the normative aspects of specifying “tolerable” levels of greenhouse gas concentrations;
- (b) the complex relationship between greenhouse gas concentrations and relevant climate variables, in particular in transient analyses; and,
- (c) the uncertainties present in the scientific analysis.

Any publication that the IPCC might produce should clearly address these topics in order to make the scientific analysis most useful for decision makers.

## **8. Dr Klaus Radunsky**

8.1 Dr Radunsky outlined the possible parallels between the specification of different concentration levels of atmospheric pollutants in the field of air quality management and the specification of concentration of greenhouse gasses for avoiding dangerous climate change. In particular he suggested that the IPCC consider developing stages of “alerts” for critical stabilisation levels of greenhouse gasses.

## **9. Dr Martin Parry**

9.1 Dr Parry indicated that the IPCC could address the science underlying the issues related to Article 2 of the Framework Convention by de-coupling the term “dangerous anthropogenic interference” into its scientific elements (eg. linearities versus non-linearities, reversibilities versus non-reversibilities, etc). By developing a matrix of assessed scientific information (for a range of sectors, spatial scales and time frames) the IPCC could provide an information base that could be used by policy makers to infer levels of interference that are relevant to the specific context of their questions.

## **10. Dr Hideo Harasawa**

10.1 We are now developing an integrated assessment model, code-named AIM (Asia-Pacific Integrated assessment Model). This model is composed of 3 major parts; emissions, climate, and

impacts. This model is being used to examine the SRES scenarios and stabilisation levels such as 450, 550, 650, and 750ppm. The higher the stabilisation level, the lower the impacts on agriculture, e.g. winter wheat production in India. So, if a lower level of stabilisation is selected (possibly as a result of effective mitigation), economic losses are increased. Scientific knowledge compiled in the TAR and new information will be of great help for considering stabilisation level scientifically. In addition, integrated assessment models are useful tools for evaluating stabilisation levels in a comprehensive manner that includes the climate, ecosystem, and socio-economic systems.