

# **UN/ECE International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forest**

## **13<sup>th</sup> Meeting of the Forest Soil Expert Panel**

Alton, UK, 29-30 March 2006

### **Minutes**

Nathalie Cools, Jari Mikkelsen (FSCC), Elena Vanguelova (Forest Research UK)  
Eric Van Ranst and Bruno De Vos (Chair and co-chair, FSEP)

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**Agenda:** SEE ANNEX 1

**Participants:** SEE ANNEX 2

### **Opening, welcome, adoption of the agenda**

The 13<sup>th</sup> Forest Soil Expert Panel (FSEP) Meeting was attended by 31 delegates from 20 countries, the Programme Coordinating Centre (PCC), the European Commission (EC) and the Forest Soil Coordinating Centre (FSCC). The chairman of the Forest Soil Expert Panel (FSEP), Prof. E. Van Ranst, welcomed the participants and apologised for the Joint Research Centre, Raquel Mano (Portugal) and Lorenz Walthert (Switzerland), who were not able to attend the meeting. Professor Peter Freer – Smith from Forest Research, Alice Holt, UK, welcomed the participants. The chairman presented the agenda for adoption and highlighted the objectives of the meeting.

### **Introduction: Future cooperation between EC and ICP Forests**

Georg Becher from PCC, Hamburg presented the plans of the future cooperation between the EC and ICP Forests. The current ICP Forests strategy and the EC regulation ‘Forest Focus’ will expire at the end of this year. The new ICP Forests strategy, which is being developed this year, will continue to meet the Long-term Strategy of the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and the medium-term Workplan of the Working Group of Effects (WGE).

In 2007 the new EC regulation “Life +” will be implemented (2007 – 2011). Life+ will concentrate all environmental funding under one financial instrument. Life+ will support the implementation of the 6<sup>th</sup> Environmental Action Programme which includes: (1) Sustainable use of natural resources, (2) Nature and biodiversity (NATURA 2000), (3) Climate change and carbon sequestration, (4) Transboundary air pollution, (5) Soil Strategy and (6) Water Framework Directive. Although, forest monitoring is related to several of these areas, there will not be any legal obligation anymore to finance forest monitoring in the EU-Member States (MS).

The EC does not expect routine forest condition assessments from MS anymore but expects coordinated and streamlined assessments of policy relevant data, such as the Ministerial Conference on the Protection of Forests in Europe (MCPFE)- indicators, based on existing monitoring systems within the (co-funded) national programmes. It is obvious that ICP Forests can contribute to these MCPFE indicators. The FSEP can contribute to deliver the MCPFE indicators on soil condition which are chemical soil properties (pH, CEC, C/N ratio, organic carbon and base saturation) of forests stratified according to main soil types. An Ad Hoc Expert Group on the Preparation of the ICP-Forests strategy has been established.

John Derome (Finland) notes that also at the EC two working groups have been set up (Level I and Level II) to develop a forest monitoring strategy under Life+. They follow the recommendations made by the Forest Focus review team and will present the proposals for the working programmes to the MS at the Standing Forestry Committee in June 2006. The national programmes will be developed by different departments within one country which means that the foresters will have to be active and compete with other disciplines within their own country. Therefore joint forces with other MS can be very important.

## **Adoption of the minutes of the 12<sup>th</sup> FSEPM**

To provide a State of the Art of the work of the Expert Panel on Soil, Nathalie Cools (FSCC) presented the minutes of the 12<sup>th</sup> FSEPM in Brussels on 29-30 November 2004. The minutes of the 12<sup>th</sup> FSEPM were adopted subsequently.

## **Update of the Manual on Sampling and Analysis of Soil**

Nathalie Cools (FSCC) presented the report of the testing phase of the Manual on Sampling and Analysis of Soil (Part IIIa, version 2003). FSCC encountered some issues which need some clarification or further specification before the start of the fieldwork for BioSoil, because the EU Forest Focus BioSoil demonstration project will be based on this version of the manual. The adapted manual was presented and discussed during the meeting. Following corrections by the FSEP, the manual will be proposed to the Task Force meeting in Talinn, Estonia (May 2006) for adoption.

The following amendments to the manual have been agreed:

<h3><b>Pedological characterisation</b></h3>
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#### **1. Humus Classification**

The proposal of the European Humus Research Group (Englisch et al., 2005) will be adopted on the second level which distinguishes between mor, moder, mull, amphi for the terrestrial humusforms and anmoor, peat (histomor, histomoder, histomull, histoamphi) for the semi-terrestrial humusforms. The definitions of the humus forms and subhorizons of the organic and mineral master horizons will be added to the Annex III Explanatory Items.

Note that there is still an inconsistency for the boundary between the mineral and the organic layer. The ICP Forests manual follows the FAO definition where the boundary depends on the clay content. The humus classification system defines the boundary at the 17% OC line.

## 2. Soil Classification

- It is mandatory to classify the soil profile according to the most recent official version of the World Reference Base for Soil Resources. At the 13<sup>th</sup> FSEPM this is the version of 1998. The reference to 2001 should be removed from the Manual. At the World Congress of Soil Science in Philadelphia the new WRB version of 2006 will be presented. After its publication, this will become the most recent official version. In the DAR-Q the applied version of WRB should be given.
- All qualifiers should be reported.
- Note that for soil classification only, the 0 cm line is at the contact between air and “soil” which can be organic or mineral in origin.

## 3. Location of profile pit

In contrast to what is written in the protocol of the Biodiversity part of BioSoil, the location of the profile pit should be representative for the dominant soil type in the plot area but is not necessarily located within the plot area.

If the profile pit has already been described before but essential information is lacking, the pit has to be reassessed, preferably at exactly the same location. In case all the information is available from the previous survey, the existing data should be reported using the new reporting forms.

## 4. Parent material codes

The Coding system of the Soil Geographical Database for Eurasia & The Mediterranean (Lambert et al. 2003) will be applied. Annex 2 (forms) and Annex 3 (explanatory items) will be adapted (by FSCC).

## 5. Georeferencing

The georeferencing will be applied as agreed on the 12<sup>th</sup> FSEPM (see Minutes 12<sup>th</sup> FSEPM).

## Sampling at fixed depths

### Standard procedure

- Both on Level I and II there should be at least 5 m interdistance between two subsample locations (12<sup>th</sup> FSEPM).
- When sampling sub-depths 20 – 30 cm and 30 – 40 cm, the recalculated values should be reported and the calculation method has to be clarified in the DAR-Q.
- In BioSoil: F and H can be sampled & analysed together.

## Stony soils

Level I: It is recommended to make 5 pits (recommended till 80 cm; min. depth 20 cm) if not limited by a lithic or paralithic contact.

## Peatlands

The proposed sampling design of peatlands, proposed by FSCC was accepted. This design is based on the WRB definition of Histosols (= peat soils) which is based on the 40 cm boundary. As long as the peatlayer is less than 40 cm the existing sampling design for mineral forest soils shall be applied (separate sampling of the organic layers and mineral soil according to the fixed depth layers). From the moment the peat is  $\geq 40$  cm, the peatlayer shall be sampled according to the peatland sampling design. This means that the peatlayer is sampled at fixed depths, mandatory 0 – 10 and 10 – 20 cm and optionally at 20 – 40 and 40 – 80 cm. In the reporting forms a new name for the peatlayers shall be used, namely H01, H12, H24 and H48 in the records for the organic layer. If the conditions allow (lower water table), the mineral soil below the peat soil ( $> 40$  cm) can be further sampled according to the standard depths (M01, M12, M24, M48).

When there is a litter layer on top of the peat, it should be counted with minus values.

## Methods for soil analysis

<b>SA01: Pre-treatment of Samples</b>	<ul style="list-style-type: none"> <li>○ Mineral soils: 2mm sieving; for Total Organic Carbon (SA08) and Total N (SA09) samples must be further milled.</li> <li>○ The organic samples consists only of the &lt; 2 cm fraction. The samples is dried and further milled to &lt; 2 mm. Note that one should be careful for contamination by the milling equipment.</li> <li>○ Samples should be well homogenised prior to analysis. To take a subsample for the central laboarotory, splitting is recommended.</li> </ul>
<b>SA02: Determination of Soil Moisture Content</b>	<ul style="list-style-type: none"> <li>○ The organic samples will be dried by 105°C. For peat samples the sample should be dried for 24 hours.</li> <li>○ The amount of material can be less than 10 to 15g, e.g. 5 g.</li> <li>○ Automated apparatus for measuring soil moisture content is allowed as long as it is based on the same principle.</li> </ul>
<b>SA03: Determination of Particle Size Distribution</b>	The Pipette method is the only reference method.
<b>SA04: Determination of Bulk Density</b>	<ul style="list-style-type: none"> <li>○ 5 core samples have to be taken, but they can be bulked and 1 mean value can be reported.</li> <li>○ If pedotransfer functions (PTFs) are used, they have to be regionally calibrated and reported to FSCC.</li> </ul>
<b>SA05: Determination of Coarse Fragments</b>	<p>In stony soils, the rod penetration can be used for the size class <math>&gt; 2</math> cm and for the 0-30 cm layer only.</p> <p>The manual should include the combination of different methods to measure the BD and the coarse fragments in stony soils. Germany will help FSCC to develop a new proposal which shall be included in the 2006 version of the manual.</p>

<b>SA10: Determination of Free Acidity and H<sup>+</sup>, Exchangeable Cations</b>	<ul style="list-style-type: none"> <li>○ It was agreed to change the naming “exchangeable” acidity in to “free” acidity.</li> <li>○ The single extraction with BaCl<sub>2</sub> will be standard, instead of the triple extraction according to the ISO method.</li> <li>○ The German calculation method is allowed as an alternative for the titration method for free H<sup>+</sup> and free acidity. Germany will send the translation of the method to FSCC.</li> </ul>
<b>SA11: Aqua Regia Extractant Determinations</b>	<ul style="list-style-type: none"> <li>○ Should be done on the &lt; 2 mm fraction without further milling</li> <li>○ In order to avoid false 0 values in the reporting forms, more digits after the comma will be foreseen for Hg (3 digits) and for Cd (2 digits).</li> <li>○ Table 5: S should be measured by ICP or CNS analyser</li> <li>○ In the 4<sup>th</sup> FSCC Interlaboratory Comparison only 5 of the 52 laboratories were able to determine Hg following the reference method (cold vapour AAS). In the BioSoil project, this parameter become mandatory to report. The FSEP suggests to the BioSoil project to keep Hg optional for the MS. However, the central laboratory should analyse Hg on the benchmark sites.</li> </ul>
<b>SA13: Acid Oxalate Extractable Fe and Al</b>	158 ml of acid ammonium oxalate solution has to be used for the 20 x diluent solution.

### Forms

- The data forms will be updated taking into account the agreed changes to the manual (see above) and will be included in the final draft for adoption at the Task Forces Meeting in Tallinn.
- The FSCC will now revise the Data Accompanying Report Questionnaire. Here a method coding system will be applied, built on the well developed coding system used by the Foliar Expert Panel.

FSCC will make the agreed changes to the manual. Germany will try to provide translation of (1) the method for bulk density and coarse fragment determinations in stony soils and (1) the “German” calculations method for free H<sup>+</sup> and free acidity by the 20<sup>th</sup> of April. FSCC will distribute this updated version to all members of the FSEP for final comments by the end of April.

## 4<sup>th</sup> FSCC Interlaboratory Comparison

Nathalie Cools (FSCC) presented the results of the 4<sup>th</sup> FSCC Interlaboratory Comparison. 52 laboratories participated in the 4<sup>th</sup> FSCC Interlaboratory Comparison 2005-2006. Seven laboratories were found to report outliers and stragglers for more than 20 % of the analyses, based on the between-laboratory variability, and six laboratories based on the within-laboratory variability. Problem parameters are (1) the heavy metals and S extracted by Aqua Regia, (2) the exchangeable elements, (3) carbon content in samples with low organic carbon content and (4) the calcium carbonate determinations. Three years after the 3<sup>rd</sup> FSCC Interlaboratory Comparison 2002-2003, more laboratories use the reference methods, have a higher experience with these reference methods, make more use of reference material and control charts but less laboratories are accredited for the reference

methods. The coefficients of variation of all groups of analysis have improved except for the total nitrogen which could be explained by the very low nitrogen content of three test samples.

### **Follow up: quality assurance and quality control action plan**

The FSEP defined the need for a follow up programme to be coordinated by the FSCC:

1. The poor performing laboratories should be contacted by the FSCC and will have to fill in a questionnaire to trace back the problem(s).
2. For each region, FSCC should indicate 1 well performing lab (can depend on analysis). This laboratory will be asked whether they are prepared to help the poor performing laboratories.
3. FSCC will bring the laboratories in contact with each other. Further initiatives and/or meetings (or exchange of personnel) rely on the motivation of the laboratories.
4. It was suggested to study the results of the 14 German labs. In Germany QA/QC measures were taken by organising separate meetings for laboratory responsables. If their results are much better, it could mean that this method of quality improvement is working and should it be organised at EU scale.
5. The poor performing laboratories can receive material from the 4<sup>th</sup> FSCC ring test to be reanalysed.
6. Laboratories should make better use of control charts. Reference was made to a variety of publications:
  - ISO 8258 (1991) Shewart control charts
  - ISO 7870 (1993) Control charts – General Guide and introduction
  - ISO 7873 Control charts for arithmetic average with warning limits
  - ISO 7966 Acceptance control charts
  - ISO 7871 Cumulative sum charts – Guidance on quality control and data analysis using CUSUM techniques – technical report
  - Internal Quality Control, Handbook for Chemical Laboratories, NT Technical report, TR 569, 2005, revised for the demands of ISO/IEC 17025 standard. Handbook available at [www.nordicinnovation.net/nordtest.cfm](http://www.nordicinnovation.net/nordtest.cfm) (choose Rapporteur/NT tech 569)
7. In order to be able to follow the quality of the analyses during the survey, FSCC wants to distribute FSCC reference material (sample B of the ring test) to the laboratories (max 5 kg dry soil/laboratory). Laboratories should use this reference material to make control charts which should be reported to the FSCC. FSCC will try to homogenize this sample as much as possible in order to reach an acceptable homogenisation level for such large amounts.
8. The moisture content should always be reported together with the analytical results. This rule should be included within the data integrity expert rules.
9. FSCC will try to have an internet platform organised as soon as possible to post questions, organise discussion for a, and improve the exchange of information.

### **Co-chairmanship of the Expert Panel on Soil**

The chairman clarified the need for a co-chairman. Eric Van Ranst has many commitments in his present job whereby he is not always able to be present at all important meetings. He is proposing Bruno De Vos (BE) for the co-chairmanship, who is already supervising the FSCC team at the

Research Institute for Nature and Forest in Geraardsbergen. Bruno De Vos accepted the invitation and received the support of the FSEP. Bruno De Vos is honoured and explained that his first task is to assure the continuation of the FSCC in order to further support the FSEP. The election of the co-chairman will become official after the approval by the Task Force in Talinn.

## **Guidelines for forest soil profile description**

Jari Mikkelsen (FSCC) presented the guidelines for forest soil profile description adapted for optimal field observations within the framework of the EU Forest Focus Demonstration Project “BioSoil”.

The ICP Forests Soil Manual (2003 and 2006) asks for a soil profile description following FAO guidelines of 1990 and for a soil classification following WRB 1998. Since the FAO 1990 guidelines 1) are out of print, 2) are developed especially for agricultural land and do not take into account typical forest soil characteristics such as the forest floor, 3) do not provide all necessary information to allow for WRB 1998 soil classification and 4) since the updated FAO guidelines (4<sup>th</sup> edition of the Guidelines for Soil Profile Description and Classification) will not be published before July 2006, FSCC drafted guidelines for soil profile description of forest soils. Within the BioSoil project, these guidelines serve as a recommended method but are not mandatory to follow. The guidelines are mainly based on the FAO 1990 guidelines and includes three types of parameters:

- 1) Set of parameters which are necessary for WRB soil classification
- 2) Set of optional parameters important for soil profile characterisation
- 3) Set of parameters which are required by the Soil Geographical Database of EurAsia and the Mediterranean (Lambert et al., 2003).

The guidelines have been presented at the two training courses organised within the framework of the BioSoil project this autumn in Austria (3 – 7 October 2005) and in Belgium (21-25 November 2005) and at the BioSoil meeting in Ispra on 1 – 2 December 2005. The BioSoil project will be the opportunity to test these guidelines, which eventually can be included in the next version of the ICP Forests Manual on Sampling and Analysis of Soil.

The FSEP noted that some of the site description parameters are already available in the level I Database with the Crown Condition data such as the exposition of the slope. So is it necessary to report these parameters again?

Stefano Carnicelli (Italy) defined the need to make some horizon description parameters mandatory, as they are necessary in soil classification, such as the structure grade. The guidelines should further specify how the length of the slope has to be determined.

Lars Lundin (Sweden) noted that the determination of the parent material should go into more detail than the first level.

## Country reports

### **German Experience in bulk density and coarse fragments measurements (Nicole Wellbrock)**

There is generally no optimal approach for taking undisturbed samples in stony soils. A relatively good correlation exist between the bulk density from the root auger and the 250 cm<sup>3</sup> bulk density sampler. The conclusion was that a combined algorithm gives the best estimation of the fine earth fraction:

Undisturbed samples (100 cm<sup>3</sup>) with stones of size 2-20 mm

Disturbed samples (2-5 kg) for stones 20 mm up to 63 mm

Estimation at the profile itself, on stones larger than 63 mm

### **Swedish experiences in soil inventory and plans for BioSoil 2006 (Lars Lundin)**

Lars Lundin (Sweden) stressed the problem of the continuous updating of the manual which makes comparisons over time very difficult. Sweden combines the BioSoil survey as much as possible with the ongoing national soil inventory. The latter started in 2003 and relied on the ICP Forest Manual on Sampling and Analysis, version 2003, for the parameters which should be reported internationally.

In Sweden the 770 Level I plots will be divided into core plots, which are the benchmark plots, and other plots. The core plots are studied more in detail, which will make up around 70-100 plots or 10-15% of the total amount. Some new plots have been defined. Where old plots are located in clear cut zones, new plots areas are allocated. The country will be studied with different intensity of plots, 16x16 km<sup>2</sup>, 16x 32 km<sup>2</sup> and 32x32 km<sup>2</sup>, with the most intensive grid in the southern parts, and the least intensive grid in the northern part of Sweden (Lapland).

During the survey, descriptions on the humus type is important. In the Swedish survey the depth 55-65 cm is sampled. Lars Lundin asks the FSEPM whether this sample can be submitted to BioSoil for the 40-80 cm sampling depth because Sweden did not include the 40 – 80 cm depth in its BioSoil proposal. The texture is assessed by the finger test method. 8 Reference Soil Groups are identified in the field, the qualifiers are added later. Lars also noted that the accuracy of the rod penetration method is maximum 10 %. He compared different regression equations: 1) the original Viro1 2)Viro2, 3) Tamminen and Starr and 4) Eriksson and Holmgren. The disadvantage of the latter is that 0% stones cannot be reached using the rod penetration method. Sweden will measure the bulk density on all plots in the topsoil. On the core plots they will go deeper.

### **Austrian experience in the BioSoil project: BioSoil Austria considerations and experiences (Franz Mutsch)**

Austria started last autumn with its preparations of the BioSoil survey. Five plots have been sampled and chemical analysis were conducted. Franz Mutsch showed the “Sand method” for measuring the bulk density which is an excavation method. This method was very well illustrated. On the five plots, chemical analysis of the newly taken samples and of the old stored samples were compared with the

data of the first soil inventory. Interesting results were obtained. The comparison showed that it is very important to reanalyse the old samples. For Pb in the surface layer (= organic layer) lower concentrations were measured, and this on all 5 plots. Concerning the base saturation, in the first survey one single extraction was made and measurement with AAS. Now a triple was made and measurement by ICP. Both methods gave similar results. Austria also concluded that the BS determination is rather unstable in the range 40 – 70 %, therefore limit of 50 % for BS in soil classification makes no sense.

For calcareous soils normally a correction for Ca and Mg is made by back exchange. This is however not described in the manual. Therefore the original measured data should be reported to the manual.

Of the profile pits digital pictures were taken, where a colour chart was put on the profile surface to be able to correct for the colours later on. Such a Colour Chart and Neutral Wedge are available from the company "Brenner Fotoversand" in Germany. The link is: <http://www.alles-foto.de/default.asp?UIDASP=07042006080646777492193170148128&ARTNR=786018&UG=680&Anzahl=17&Anf=1&Ende=10&SON=5&UE=13.69,680&MENPRO=3&ES=>

## **Report on the training courses in Austria and Belgium (Jari Mikkelsen, FSCC)**

Jari Mikkelsen reported on the field training courses on soil profile description and soil classification according to the World Reference Base for Soil Resources. A first training course was held in Vienna, Austria, from 3 to 7 October 2005. The organisation was in hands of the Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW), FSCC and the JRC. This training course focused on the Boreal and mountainous soils. FSCC organised a second training in Brussels, Belgium from the 21<sup>st</sup> till the 25<sup>th</sup> November 2005 focusing on the (Atlantic) lowland forest soils. From 24 till 28<sup>th</sup> of April 2006, a third training course will be organised on the Mediterranean soils by the Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA) in Madrid in cooperation with the FSCC.

The presentations are available at the FSCC website: <http://fsc.inbo.be>, click on Expert Panel Meetings.

## **Next FSEP meeting**

The FSEP expressed its thanks to the UK for the well organized meeting. The next FSEPM will be organized by FSCC in 2007-2008. Portugal and Italy offered the opportunity to host the next EP in their country. Practical arrangements will be done by FSCC.

**UN/ECE ICP FORESTS**  
**13<sup>th</sup> Forest Soil Expert Panel Meeting**  
**29-30 March 2006, Alton, UK**  
**Alton House Hotel, Normandy St., Alton, GU34 1DW**  
**AGENDA**

**Wednesday 29 March 2006**

9:00 – 9:20 Opening and welcome

- Welcome (*Professor Peter Freer-Smith, Forest Research, UK*)
- Welcome and adoption of the agenda (*Eric Van Ranst, Chairman Expert Panel on Soil*)
- Technical announcements (*Elena Vanguelova, Forest Research*)

9:20 – 10:00 Introduction: Future cooperation between EC and ICP Forests (*Georg Becher, PCC Hamburg*)

10:00 – 10:30 Adoption of the minutes of the 12th FSEPM, Brussels, 29 - 30 Nov. 2004 (*Nathalie Cools, FSCC and Eric Van Ranst*)

*10:30 – 10:50 Coffee break*

10:50 – 12:30 Update of the Manual on Sampling and Analysis of Soil (*Nathalie Cools, FSCC*): Report on the Evaluation of the Manual & Recommendations

*12:30 – 14:00 Lunch break*

14:00 – 14:10 Update of the Manual on Sampling and Analysis of Soil:

- Country report: “German experience in bulk density and coarse fragments measurements” (*Nicole Wellbrock, Germany*)

14:10 – 15:40 4th FSCC Interlaboratory Comparison 2005 – 2006: Presentation of the report (*Nathalie Cools, FSCC*) and discussion

*15:40 – 16:00 Coffee break*

16:00 – 17:30 Update of the Manual on Sampling and Analysis of Soil: Discussion, continued

*Evening programme: Social dinner in Alton*

## **Thursday 30 March 2006**

9:00 – 9:20 Co-chairmanship of the Expert Panel on Soil

9:20 – 10:30 Update of the Manual on Sampling and Analysis of Soil: Discussion, continued

10:30 – 10:50 *Coffee break*

10:50 – 11:30 Country reports: “Swedish experiences in soil inventory and plans for BioSoil 2006” (*Lars Lundin, Sweden*) and discussion

11:30 – 12:30 Guidelines for forest soil profile description (*Jari Mikkelsen, FSCC*)

12:30 – 14:00 *Lunch break*

14:00 – 14:20 Guidelines for forest soil profile description: Discussion

14:20 – 15:00 Country report: “Austrian experience in BioSoil project” (*Franz Mutsch, Austria*)

15:00 – 15:20 Report on the training courses in Austria and Belgium (*Jari Mikkelsen, FSCC*)

15:20 – 15:30 Closing of the meeting *and coffee*

13<sup>th</sup> Forest Soil Expert Panel Meeting - Annex II: List of participants

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13<sup>th</sup> Forest Soil Expert Panel Meeting - Annex II: List of participants

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