

NATIONAL DOSE ASSESSMENT WORKING GROUP

PAPER 5-06: REPORT BACK FROM SUB-GROUP ON UNCERTAINTY AND VARIABILITY IN DOSE ASSESSMENTS

Progress Report from the NDAWG Sub-Group on Uncertainty and Variability

1. At the 3rd meeting on 18 March the members of the sub-group agreed the new terms of reference. A work programme for the future activities of the group in the medium term was agreed. A review of the work that the sub-group had previously carried out was also performed.
2. As suggested by the main group the sub-group will initially concentrate on the first two items in the terms of reference. The sub-group has agreed a work plan for the production of a short (10-12 page) document describing the issues relating to uncertainty and variability in dose assessments. Responsibility for the drafting of sections of this paper and the co-ordination of the paper were agreed at the meeting. It is intended to discuss and agree the paper at a meeting of the sub-group to be held on 28 September. The paper will then be tabled at the subsequent full meeting.
3. The group will then move on to drafting a paper giving advice as to when it is desirable to carry out a probabilistic assessment. Members will prepare lists of topics for inclusion in this paper. The list of topics will be discussed at the September sub-group meeting and responsibility for drafting sections will be agreed. It is intended to table this paper at the spring 2005 meeting of the NDAWG

David Webbe-Wood
Chair of NDAWG Uncertainty and Variability Sub-Group
26 March 2004

Record of 3rd meeting

3rd meeting held on 18 March 2004, Aviation House London.

Present

Chair	David Webbe-Wood	FSA
Regulators/agencies	Cathy Griffiths	RWMAC
	Ray Kowe	NRPB
	Jane Simmonds	NRPB
Specialists/NGOs	Kate Charles	Westlakes Scientific Consulting
	Marcus Grzechnik	CEFAS
	Mike Thorne	Consultant

Apologies: John Titley (EA)

1. Minutes of previous meeting 13 March 2003

Actions from previous sub-group meetings superseded by establishment of new sub-group and terms of reference.

2. Introduction

David introduced new members of the sub-group. The steering group felt that the terms of reference for the sub-group needed to be reviewed and the sub-group should focus on what has been done on the use of uncertainty in radiological assessments. A change of name of the sub group to "Sub group on uncertainty and variability in dose assessments" was recommended. The purpose of the meeting was to prepare a work programme with timescales to report to the next NDAWG meeting in April.

3. Review of past activities of the sub-group

Cathy and Mike gave a brief overview of the work of the previous sub-group. Mike stated that although a lot of issues related to uncertainty and probability had been discussed, no documentation had been brought forward from the sub-group to NDAWG. The sub-group had not discussed specific uncertainty and variability studies and had not considered formal techniques that may have been used or those being considered for future use. Kelly Jones' internal NRPB report on the distinction between uncertainty and variability had been circulated for comment amongst the previous members and the group had considered incorrect use of parameters. They had also talked briefly about the issue of model complexity. Mike issued a note on uncertainty and variability he had sent to the previous chairman. David stated that the paper describing FSA's possible and probable dose methodology was currently being developed and will be presented at the next main NDAWG meeting. Jane informed the sub-group that as well as the paper on distinction between uncertainty and variability, Kelly had prepared a

paper on compliance with dose limits. Mike gave the opinion that conceptual model uncertainties should be considered as well as parameter uncertainties. There was then a brief discussion of models and their inherent uncertainty. David said that the details of designing probabilistic models are not a priority for discussion.

4. Discussion of how we meet the first two issues in the terms of reference

Terms of Reference

The aim of this sub-group is to consider issues relating to uncertainty and variability in dose assessments. In particular it will:

- Consider issues and studies relating to uncertainty and variability in dose assessments, including the availability of input data.
- Consider the extent to which assessments should be probabilistic, i.e. a range of doses is estimated rather than a single value.

At a later date the sub-group will also:

- Consider issues relating to compliance with dose limits and constraints when probabilistic assessments are carried out.
- Consider how probabilistic results can be presented to the public.

Members discussed the new terms of reference for the sub-group.

Cathy said that the new terms of reference adopted a straight-forward approach that fits in with the main NDAWG programme, and would seem to address the CEDA recommendations. She would welcome on behalf of small users more help on informal uncertainty analysis as well as advice on formal probabilistic calculations. Mike stated that in terms of other studies, uncertainty and variability is an integral part of solid waste management performance assessments in assessing radionuclide transport to and through the biosphere and in dosimetric calculations. Jane felt that the sub-group should not advocate that an uncertainty analysis should be carried out with every assessment. David added that there are other ways of assessing uncertainty such as 'up and down' assessments. However, there are problems with presenting a wide range of estimates with such methods. Kate said that issues relating to compliance were important to operators. However, some regulators such as the Environmental Agency feel that such issues are secondary.

The members were happy with the terms of reference for the sub-group.

It was felt that there should be some liaison with the Habits sub-group to avoid duplication of effort and that this could be achieved through the members who were common to both subgroups.

Action U&V_Subgroup 3.1 David to report back to the main NDAWG group that the members of the sub-group have agreed the terms of reference.

Term of reference 1

Members then considered the first term of reference, which was expanded upon in Jane's discussion note for the meeting, and the issues identified by the previous sub-group. Jane said that first topic identified the need to try and prepare help for people, not necessary experts in the field, to carry out uncertainty and variability analyses. She stressed the need for definitions in key areas of variability and uncertainty. There was some discussion on parameter distributions and the pitfalls of choosing particular distributions. The IPSN Nord-Contentin uncertainty analysis was cited as an example of this.

Jane gave the opinion that expert elicitation was very difficult. Mike said this was often the case, but that long standing expertise should be utilised where possible and that the formal techniques of elicitation are directed to minimising biases in the procedure. The topic of the number of parameters used in a model subject to uncertainty analysis was discussed. Jane said that correlation of parameters should be considered as, for example, interception and yield are closely related and cannot be treated independently. Kate said that people carrying out uncertainty analyses should be warned a priori that such analyses might lead to implausible results. Mike said it was possible to give specific examples of good and bad practices in uncertainty analyses and that this would be complementary to a high-level report on the issues involved.

Cathy recommended that topics one and two should be expressed as plain bullet point guidance. A deterministic analysis may often be sufficient unless some pre-set criterion is being approached. Even then it may be more pertinent to review parameters rather than carry out a formal uncertainty analysis. Ray queried whether the sub-group were going to recommend particular datasets. The members agreed that it was not the role of the sub-group to recommend use of specific data sources.

Mike said that topic 5 should include a point that whereas input data for physically based models can be measurable quantities, the data required for assessment models are often not even measurable in principle. This gives rise to issues as to whether values for input parameters of assessment-level models can properly be elicited from experts, or whether they should be computed from quantities that can more reasonably be elicited. An extra topic might cover the proper level of model complexity, 'physically based' versus 'assessment' models. Jane pointed out that there are other techniques other than Monte Carlo, for example fuzzy logic analysis, and sensitivity studies to underpin model development may employ these techniques. It was felt that the sub-group did not wish to pursue the use of these techniques, as this is more a research and development than an assessment issue.

David said that Jane's topics would provide the outline of a short paper (10-12 pages) with a bullet point format. Mike's paper on initial thoughts on uncertainty and variability might be a good starting point or at least provide some content to the paper.

Action U&V_Subgroup 3.2 NRPB to draft topics 1 to 3 for the subgroup paper

Action U&V_Subgroup 3.3 Mike to write section on expert elicitation

Action U&V_Subgroup 3.4 NRPB to draft topics 5 to 7 for the subgroup paper. Sub-group members to add additional information to it.

Action U&V_Subgroup 3.5 All sub-group members to write draft on topic 8.

Action U&V_Subgroup 3.6 David to edit contributions and write introduction to the paper.

The time-scale for the first draft of the paper will be the end of July so that we can discuss in the next sub-group meeting in September, with the aim of presenting it to the main NDAWG meeting in November.

Term of reference 2

Jane said that aim of the second term of reference is to give some guidance on when a probabilistic assessment or some semi-quantitative uncertainty analysis is required. There was a discussion on the circumstances when a probabilistic assessment may be required. Probabilistic analyses are not carried out routinely but usually when some criterion such as a dose target, bound or constraint has been assessed as having been exceeded. They may also potentially be used to indicate when additional measurement programmes may be necessary for key parameters.

David suggested that the sub-group should produce another paper on the second term of reference, this will be considered at the fourth sub-group meeting in September with the aim of presenting it at the first main NDAWG meeting in 2005.

Action U&V Subgroup 3.7 Members to forward to David suggestions for items to be included in the paper on when probabilistic assessments are desirable.

Action U&V Subgroup 3.8 David to collate suggestions from members into a contents list for the paper on when probabilistic assessments are desirable to be discussed at the next meeting of the subgroup

The third and fourth terms of reference will be discussed at future meetings of the sub-group.

5. Agreement of Discussion of how we meet the first two issues in the terms of reference

The production of the two papers will provide a provisional work programme for the sub-group.

Action U&V_Subgroup 3.9 David to prepare a work plan for the sub-group to put forward to the main NDAWG meeting in April.

6. Discussion of methods of working

Members will contact each other through email. There will be a further meeting in September and another meeting (February/March) before the first main NDAWG meeting in 2005.

7. AOB

Mike gave a brief outline of the PRISM model he is developing for the FSA. PRISM is an interface to the AMBER modelling system. The model currently utilises new animal models and the soil-plant models from SPADE. A new version is under development that will integrate the new animal models with a new, hydrologically based soil-plant model. An independent set of parameters are sampled which are then mapped onto the parameters that drive the model. This provides a physically based representation of the correlations of parameters. Tritium and carbon-14 are dealt with in a separate sewage sludge model and there are plans for incorporating heavy metals into the new soil-plant-animal model. Marcus asked in what form the software presented the statistical results. Mike commented that tabular and graphic views are available through PRISM and that the AMBER output files are also available for export into other statistical and visualization packages. He noted that he has been working with NNC Ltd on a Visual Basic/Access database system that provides a flexible way of manipulating datasets with many-to-many connections to underlying documents.

There then followed a discussion on presentation of data. David said that this issue was to be covered by the fourth term of reference. Jane informed the sub-group that there will be a talk about presentation of doses to the public by David Collier a subcontractor to Greenstreet Berman at the next main NDAWG meeting in April 2004. Mike commented that modern software tools facilitate the presentation of data in numerous different ways, as appropriate to different users and audiences.

8. Date of next meeting

The 28th of September was suggested as the date for the next meeting.

9. Summary of Actions

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Action U&V_Subgroup 3.3 Mike to write section on expert elicitation

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Ray Kowe, 22 March 2004