IAEA EMRAS, Tritium and C-14 Working Group

EMRAS: Modelling the Transfer of Tritium and C-14 to Biota and Man Notes of Working Group Meeting, Vienna (2-4 September 2003)

EMRAS, Tritium and C-14 Working Group, Meeting Report 1

Notes of the IAEA EMRAS Tritium and C-14 Working Group Meeting, Vienna (2-4 September 2003)

HISTORY:

The EMRAS Tritium and C-14 Working Group meeting was held in Vienna, Austria. The meeting was hosted by the IAEA.

These Meeting Notes have been prepared by: A. Venter (Technical Secretariat), P Davis (Working Group Leader) and M Balonov (Scientific Secretariat). In addition, the following people who attended the meeting contributed to the discussions and decisions documented in these Meeting Notes:

Name	Organisation	Country
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C Barbeau	Laval University	Canada
F Baumgartner	Munich Technical University	Germany
Y Choi	KAERI	Republic of Korea
S Conney	Food Standards Agency	UK
D Galeriu	IFIN-HH	Romania
P Guetat	CEA	France
Y Inoue	NIRS	Japan
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1. INTRODUCTION

The first meeting of the EMRAS Tritium and C-14 Working Group was hosted by the IAEA in Vienna, Austria, from 2-4 September 2003, as part of the first EMRAS Plenary Meeting. The objectives of the meeting were the following:

- Presentation of data sets
- Discussion of data sets and decision as to which to develop into scenarios
- Development of the first scenario
- Discussion of the need to develop hypothetical scenarios and how this might be done
- Discussion of the need to develop additional data sets
- Discussion of other approaches the WG might take (invited speakers, preparation of review documents, etc)
- Actions and future activities

Participants were welcomed to the meeting by Mikhail Balonov, the IAEA Scientific Officer for this Working Group. Participants introduced themselves and briefly described their background and interest in the working group. Phil Davis, the Working Group Leader, gave the background as to why a Tritium WG was established as part of the EMRAS programme. The Working Group will initially focus on improving models of OBT formation and translocation in plants, animals and fish.

This focus is appropriate because:

- OBT contributes significantly to human dose in all tritium exposures, particularly in the case of short-term releases
- OBT plays a significant role in dose to non-human biota, an area of strong current research interest
- an understanding of the behaviour of OBT in tree rings can help in the reconstruction of past tritium releases at a given site
- unexpectedly high OBT concentrations that have recently been observed in fish must be understood
- the uncertainties in predicting OBT concentrations are large
- data sets involving OBT formation are available
- the issue of OBT meshes well with the interests and capabilities of participants in the WG.

The WG will necessarily have to consider HTO as well, since an understanding of environmental HTO is needed before OBT can be modelled. C-14 will also be on the agenda since the dynamics of carbon and OBT are very similar.

Where possible, the WG will carry out its work by comparing model predictions with experimental data. It is expected that most of the calculations will be undertaken with existing models, although new models may also be developed by some participants. Where data are not available, model intercomparison exercises may be undertaken or suitable data may be generated. The most obvious data gap is in OBT dynamics in large animals and fish, and steps have been taken to have data produced in this area. Reviews of previous work on C-14 model testing and on identifying the key processes and pathways that must be considered in estimating tritium doses will also be undertaken.

2. PRESENTATION OF DATA SETS

A questionnaire sent out to participants before the meeting identified 11 data sets that could be used for OBT model testing. All of the data sets were presented and discussed at the meeting. These are summarised in Table 1.

Table 1: Data presented at Plenary Meeting Sept 2003

Person/Institute	Source/Starting point	HTO endpoint	OBT endpoint	Modellers
Aqueous				
Phil Davis AECL 1 yr	Chronic; measured concentration in lake water	aquatic plants; fish; clams; sediments	Aquatic plants; fish; clams; sediments	**5**
Francoise Siclet EDF 1.5 y	Chronic, calculated concentration in river water and measured concentration in marine water	Fish, molluscs, crustaceans, seaweed, sediment, irrigated crops	Fish, seaweed, molluscs, crustaceans, sediment, irrigated crops	River 3-4
Gerassimos Arapis Agricultural University Athens	Measurements in water	Algae, mussel tissue, protein molecules	Algae, mussel tissue, protein molecules	
Paul Marks Amersham	Acute; various OBT in water	Water, mussels plankton	Water mussels plankton	
Atmospheric				
Irv Benovich; OPG 1.5 yr	Continuous; measured HTO concentration in air	Plants, animals; soil water and drinking water (single measurement)	Plants and animals (two measurements in time)	**9**
Hansoo Lee; KAERI 1 yr	Six acute exposures; measured concentration in green house	Soy bean (leaves, stem, shell, seeds)	Soy bean (leaves, stem, shell, seeds)	5
Y.H. Choi KAERI	Nine acute exposures daytime, two acute exposures night-time, measured concentration in green house	Rice plant	Rice Plant	5
Kiriko Miyamoto NIRS 1.5	Chronic, multiple sources	Pine needles, atmospheric HTO, precipitation.	Pine needles, tree rings.	5
Wolfgang Raskob/Alexei Golubev. VNIIEF	HTO vapour in climate chambers	potatoes, carrots, cereals, tomatoes.	potatoes, carrots, cereals, tomatoes.	Data in 12-18 months
Philippe Guetat CEA 3 yrs	Hypothetical acute release (accident)	Dose by pathways	Dose by pathways	6
Others				
Franz Baumgaertner	Source term HTO.	primary hydration sheath	carbohydrate, protein, DNA	
Dr Kovalenko	Exchange of tritium and hydrogen in clay minerals, may have implications for modelling of tritium in other materials			

Data sets on OBT dynamics in large animals and fish may become available through the Greek and Canadian participants in the WG respectively. Data sets for testing C-14 models will be solicited through a questionnaire to be sent out to participants shortly.

3. DEVELOPMENT OF SCENARIOS

Four scenarios were identified from the data in Table 1 that will be suitable as a starting point for model intercomparison and testing. Two of these address continuous releases of HTO to air and water. Acute releases, which are more difficult to address, will be approached through one model-data scenario for a specific process and one comprehensive hypothetical scenario. Brief descriptions of the four scenarios follow:

- a scenario based on data collected in Perch Lake at CRL. Starting point will be HTO concentrations in water and end points will be OBT concentrations in aquatic plants, sediments, clams and fish.

- a scenario based on data collected in a greenhouse, where soybeans were exposed to elevated HTO concentrations in air for 1 hour. The end points of the calculations will be OBT concentrations in various parts of the plants as a function of time.

- a scenario based on data collected near Pickering Nuclear Generating Station in Ontario. The starting point will be HTO concentrations in air and end points will be OBT concentrations in plants and animal products (beef, chickens, eggs).

- a hypothetical scenario involving the calculation of doses following short-term releases of HT and HTO to the atmosphere. This will not be a model intercomparison exercise per se, but an application of modelling tools to provide practical advice to decision makers within the first 24 hrs. OBT would not be modelled since the impact of OBT is longer term and can be determined by measurement. The contribution of HT vs HTO will be compared. The end points of the calculations will be total dose by exposure pathway.

The other data sets listed in Table 1 are available for developing into scenarios in the future.

4. DISCUSSION ON C-14

A scenario on a short term release of C-14 to a small lake (tracer study) was included in BIOMOVSII.

There is still considerable interest in C-14, mostly because of release from nuclear power plants, though the reprocessing plant in Japan that will become operative in the near future will also release C-14. Seven to eight participants expressed an interest in modelling C-14.

A questionnaire will be distributed to determine the status of C-14 data that could be used for modelling. A draft C-14 scenario will be discussed at the next meeting.

5. OTHER APPROACHES THE WG MIGHT TAKE (INVITED SPEAKERS, PREPARATION OF REVIEW DOCUMENTS, ETC)

Review of Amersham source compounds: Amersham plc discharge literally thousands of different chemical compounds that contain OBT. They have classified these compounds into twelve groups and would like a review to assess which of these would have the greatest impact in terms of dose to humans. They also asked if the WG could provide a definition of OBT, and a method to analyse OBT in liquid form.

General discussion: The release/bioavailability of tritiated compounds in sediments is of importance.

There was also discussion on generation of a conceptual model that would set out the processes that need to be considered and rank in order of importance with the aid of an interaction matrix. The consensus was that, although this has been done previously for tritium, it is probably worthwhile revisiting and could be undertaken as part of the hypothetical scenario.

6. FUTURE WORK PROGRAMME

ITEM	ACTION	PERSON	DATE
Perch Lake Scenario	Issue draft scenario	P Davis	7 Nov 2003
	Comments on scenario	Modellers	15 Dec 2003
	Issue final scenario	P Davis	12 Jan 2004
	Submit results	Modellers	1 March 2004
Soy bean scenario	Issue draft scenario	H Lee	7 Nov 2003
	Comments on scenario	Modellers	15 Dec 2003
	Issue final scenario	H Lee	12 Jan 2004
	Submit results	Modellers	1 March 2004
Hypothetical scenario	Review of information	P Guetat, W Raskob, D Galeriu	19 April 2004
	Issue draft scenario	P Guetat	19 April 2004
C-14 literature/data	Distribute questionnaire	P Davis	1 Feb 2004
	Return questionnaire	Participants	1 April 2004
	Review published data	D Galeriu; A Venter	19 April 2004
Pickering scenario	Issue draft scenario	I Benovich / P Davis	19 April 2004
New data on OBT dynamics	Investigate possibilities of large animal data through ISTC	M Balonov	19 April 2004
	Investigate possibilities of animal data from Greek laboratories	K Ioannides / G Arapis	19 April 2004
	Investigate possibilities of aquatic data from Perch Lake	P Davis	19 April 2004

7. NEXT MEETING

The next meeting will be hosted by Lawrence Livermore National Laboratories (LLNL; USA) and will take place from 19 to 21 April 2004.

8. FURTHER INFORMATION

Information on the activities within EMRAS generally and on the Tritium and C-14 WG in particular (including the scenarios being used for model testing), can be obtained from the following people, respectively:

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