

Activities of the Tritium Working Group

EMRAS II

Approaches for Assessing Emergency Situations

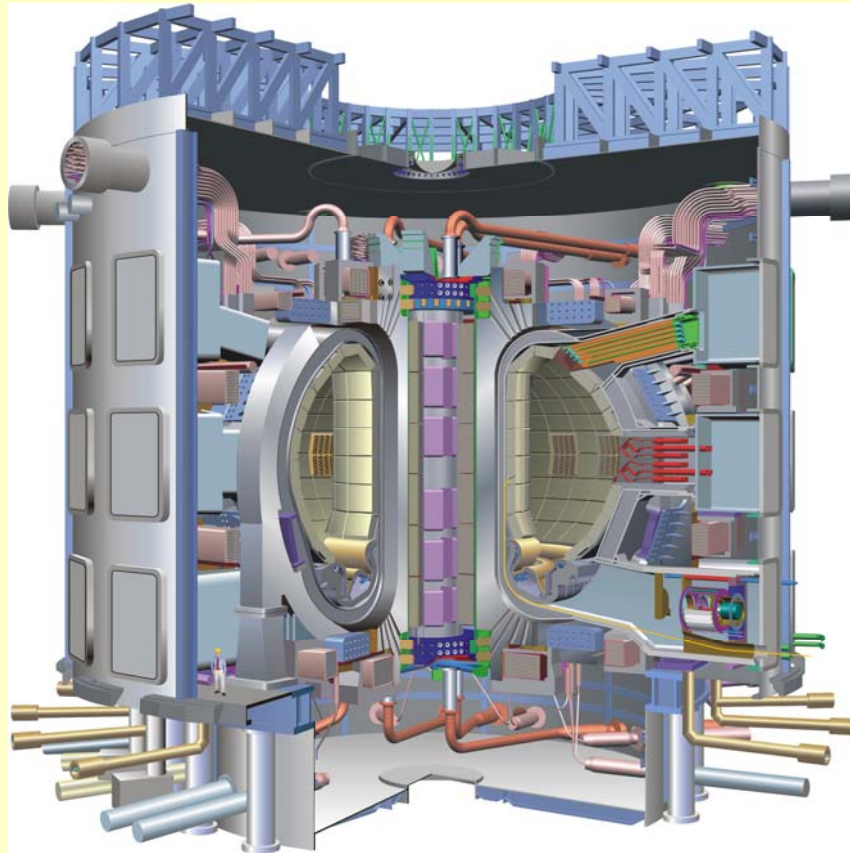
Working Group 7

“Tritium” Accidents

Working Group Leader: Dan Galeriu IFIN-HH Romania

IAEA Scientific Secretary: Volodymyr Berkovsky

Potential accidents involving large tritium emissions



An undated photo shows the nuclear fuel reprocessing plant in the village of Rokkasho, Aomori Prefecture.



And many others as Sarov, Valduc, Savannah, Cardiff

Established January 2009 – 1st EMRAS II Technical Meeting

Develop Dynamic Tritium Model

Tentative Working Group Leader:

Dan Galeriu

Assisted by AECL and CEA

Canada-France-Romania (CFR)

The dynamics of OBT and ¹⁴C concentrations were generally poorly reproduced in scenarios involving short-term releases EMRAS I-TRITIUM & ¹⁴C

END results A new document covering acute release tritium model (Jan 2012)

WG7 Aim and Objectives

- To develop a standard conceptual dynamic model for tritium dose assessment for acute releases to atmosphere and water bodies
- To focus on only starting the new model from the given air or water concentrations (HT or HTO) and the duration of the exposure
- To agree on common sub-models, based on understanding of the processes and agreed key parameters (interdisciplinary approach)
- To define the framework for an operational model
- To obtain quality assured sub-models and harmonize approaches in order to get confidence in the predictions (moderate conservatism)
- To have capability to assimilate real data from measurements

Basic question in January 2009

- Potential participants now in VIC are kindly asked to complete their contact forms and to disseminate our intentions and needs of help

We are only at the beginng and future depends on

YOUR INVOLVEMENT AND POWER OF PERSUASION AT HOME

The second meeting of the IAEA EMRAS II “Tritium” Accidents Working Group was held in Chatou, France. The meeting was hosted by Electricite de France (EDF) [18 participants]

- to discuss and harmonize the views of participants concerning the approaches for developing the conceptual model for tritium accidents (atmospheric and aquatic);
- to agree on the structure and scope of the conceptual model;
- to identify potential gaps in knowledge and expertise, which should be addressed during the model development;
- to define the structure of the technical document and share tasks according to the expertise of each participant and the interests of his/her organization or institute;
- to elaborate the work plan for developing the conceptual model;
- to distribute specific tasks to be accomplished and reported at the next EMRAS II Technical Meeting (25–29 January 2010).

Major problems in 2nd meeting

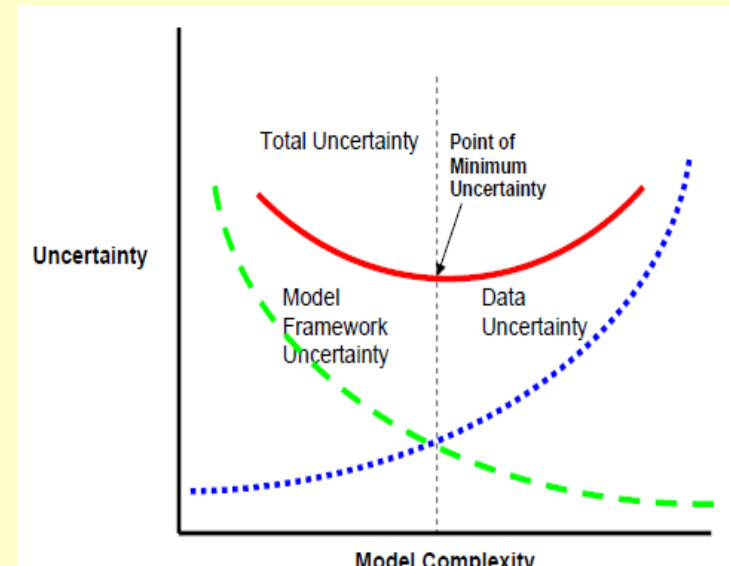
- to identify the main contributors to uncertainty;
- to identify the critical periods during the year in relation to resulting exposures to tritium;
- to identify the important and sensitive parameters, having in mind hourly, daily and annual variations in parameters /processes;
- to explore the practical possibilities in determining those parameters;
- to get an idea about the achievable reliability of tritium modelling under practical, this means under accidental field conditions;
- to get a clear idea for which phases of the tritium accident the application of a tritium model is desirable and useful
- there is interest in both liquid and atmospheric releases as well as HT
- the local climate and soils have a large influence on tritium transfer
- increased interest in process level modelling of minimal complexity;
- the requirement is to be conservative, but with no details on how to control the robustness

Processes involved in terrestrial pathway

- Wet deposition of HTO;
- Deposition in case of snow;
- Dry deposition of HT and HTO;
- Reemission of HTO from soil;
- Reemission of HTO from plants;
- Transfer of HTO from soil to plants;
- Secondary source due to reemission – influences on final plant and soil dynamics;
- Reemission from forest;
- Dynamics of the soil – plant complex;
- Losses in storage – preparation of feed – HTO;
- Losses/concentration in food preparation – HTO;
- Contribution of OBT metabolism to plant HTO at harvest;
- OBT formation in daylight;
- OBT formation in night;
- OBT respiration;
- OBT partition to edible plant part;
- OBT speciation;
- OBT oxidation in feed preparation and storage;
- OBT oxidation in food preparation and storage;
- OBT in litter and soil.

Uncertainty

- Measurement uncertainty;
- Parameter value uncertainty;
- Conceptual modelling uncertainty;
- Computational uncertainty;
- Scenario uncertainty;
- Ignorance – “We don’t know what we don’t know”.
- There is no international standard for uncertainty.
- It was pointed out that it is not possible to have a model very close to the data: a factor 2–3 is good, a factor more than 5 is wrong and a factor more than 10 is catastrophic
- Particularization for tritium were made:
 - Limits in allocation of time and budget;
 - Missing dedication – only a job;
 - Missing peer review;
 - Incomplete use of recent advances in soil water-plant modelling



Achievements

- Discussions and presentations on specific needs of selected sites (ITER, Rokkasho, Valduc, Cernavoda), in order to better define the scope of the WG7, as well as the advantages and disadvantages of simple models
- Discussion and presentations on present knowledge: experiments and process level models (Japan experiments, ETMOD, UFOTRI, RODOS-FDMH, SOLVEG)
- Presentation of animal model, process, validation
- Selected presentations in each task group

Task groups

- Task Group I covering
 - Tritium washout
 - HT/HTO deposition-reemission
 - Actual evaporation and transpiration and connected HTO concentration dynamics
 - HTO uptake and retention in plant in rain condition
 - Movement of HTO to deeper soil layers
 - Winter case (particularly deposition on snow and how to deal with snow)

Task Group II covering

- Use of growth models - define the minimal needs
- OBT formation in night
- Translocation of OBT from leaves to edible plant parts

Task Group III

- Modelling the transfer in aquatic food chain (EDF and IFIN models)

Tasks attributed in Chatou and actual status

ACTION	PERSON	DATE	STATUS
Draft on uncertainty and sensibility needed in the quality assurance of the models	J. Duran	25-29 Jan 2010	on going, in term
Potential improvements of plant sub-model in OURSON code: detailed sub-model description and sensitivity tests	F. Siclet	1 Jan 2010 to disseminate to all WG7 members	will be presented in Vienna
Potential improvements of plant sub-model in OURSON code: analysis and discussion for potential improvements	All WG members	25-29 Jan 2010	NOT YET as F SICLET is in delay
Detailed description of expanded MAGENTC for animals and sensitivity analysis	A. Melintescu	25-29 Jan 2010	on going, will be presented in Vienna
Full expanded interaction matrix for terrestrial pathways of tritium transfer	S. Le Dizès-Maurel	25-29 Jan 2010	on going, members must help Severine with suggestions
Availability of soil-water revision done Ph. Ciffroy and dissemination between WG members	L. Marang	20-Dec-09	partial only, briefing in Vienna

Submission for publication of updated AQUATRIT model	D. Galeriu	15-Dec-09	Delayed, partial user approach in Vienna
	A. Melintescu		
OBT formation versus available energy in plants	L. Vichot	25-29 Jan 2010	in term
Review of tritium washout	L. Patryl, A. Melintescu, D. Galeriu	25-29 Jan 2010	IN TERM
Correlation between air and rain HTO concentration (experimental data)	P. Guetat	25-29 Jan 2010	confirmed
Comparison between UFOTRI and CERES models for 1 g of HTO and 1 g of HT	P. Cortes	25-29 Jan 2010	CONFIRMED, PRESENTATION MONDAY 25 afternoon
OBT formation in night experiments and modelling trials	S.B. Kim	25-29 Jan 2010	Confirmed, presentation 26 Jan morning
HTO dynamics using SOLVEG (plants and soil) after an accidental tritium release	H. Nagai	25-29 Jan 2010	Confirmed, not possible to be fully ready
Modelling exercise 1: HTO and OBT in fish.	D. Galeriu	1 Nov 2009 to disseminate to all WG7 members	will be
Modelling exercise 2: Dynamic of tritium in grass following 1 hour air contamination	D. Galeriu	1 Nov 2009 to disseminate to all WG7 members	sended with 6 weeks delay
Results for both modelling exercises	All WG members	1-Jan-10	Still waiting
Upload on the WG7 EMRAS 2 web page of a list of existed documents / papers in each laboratory / site to be circulated between WG members	All WG members	15-Nov-09	ON GOING , please speed up
Proposals for the content of final document to be transmitted to WG Leader	All WG members	1-Dec-09	NO PROPOSAL RECIEVD

Expectations this meeting

- Clarification on sources of discrepancies between CEA and UFOTRI model, agreement on further work
- Compromise between simple and process level models
- Agreement on modeling approach and tecdoc content for wet deposition of tritium and liquid pathway
- More insight on formation of OBT in night
- Harmonization of views on modeling tritium transfer atmosphere-plant soil
- Agreement on modeling the transfer in farm animal
- Tecdoc content and agreement on contributors
- Firm assignment on specific task to be done until next meeting
- Proposal for next meeting guest institute and agenda

Active partners

- France
- Canada
- Romania
- Germany
- Slovakia
- Japan
- India
- Brazil
- NO RUSSIA, USA or CHINA !!