ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

Nuclear Energy Agency

Nuclear Science Committee

**Working Party on Nuclear Criticality Safety**

**THE THIRD MEETING OF THE EXPERT GROUP ON**

**ADVANCED MONTE CARLO TECHNIQUES (EGAMCT)**

Friday October 25, 2013

Kurchatov Institute, Moscow

Russian Federation

**SUMMARY RECORD**

Under the auspices of the Working Party on Nuclear Criticality Safety (WPNCS), the Expert Group on Advanced Monte Carlo Techniques for criticality safety assessment was formed in 2010 ([www.oecd-nea.org/science/wpncs/amct](http://www.oecd-nea.org/science/wpncs/amct)). The goal of the Expert Group is to transfer new Monte Carlo technology to criticality safety practitioners by establishing benchmark exercises to compare the different Monte Carlo codes and methods used by EG members, and suggest guidelines for applying Monte Carlo techniques to problems of importance to practitioners.

The Expert Group meets once a year, usually in the autumn, at NEA Headquarters in Paris. In 2013, the 3rd Meeting of the EGAMCT was exceptionally held in Russia, hosted by the Kurchatov Institute, on October 25, 2013.

**Introduction and Welcome**

The Chair of the Expert Group, Mr. Joachim Miss of IRSN, France opened the meeting and welcomed the participants. Mr. Miss and Mr. Michel-Sendis, on behalf of the OECD NEA, extended their thanks to Kurchatov Institute for hosting the meeting and noted this was the first time WPNCS meetings were hosted in Russia, after Russia became a full member of the NEA.

**Approval of the previous Summary Record and Review of Actions**

The summary record of the 2012 meeting ([EGAMCT-2012/SR](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2012/EGAMCT2012_SR.docx)) was approved without modifications. Actions from the previous meeting were reviewed and discussed. Outstanding actions are discussed under the specific agenda item.

**Approval of the agenda**

The presentation by G. Hordosy on *Subcriticality analysis for a spent fuel pool with heterogeneous fuel loading* was cancelled. The agenda (appendix A) was approved with these changes.

**Progress of mandated deliverables**

The Chair, J. Miss gave an overview of the activities of the Expert Group ([EGAMCT-2013/01](http://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_01.pdf)), which is currently working on Benchmark (Phase I) some aspects of which are still being defined. It is foreseen that the EG will issue a guidance report following the lessons from this benchmark.

**Phase I Benchmark** *On quantifying the Effect of Undersampling Biases in Monte Carlo Reaction Rate Tallies*

Of interest in the EGAMCT is the effective use of Monte Carlo depletion, especially as related to burn-up credit, for instance. Phase I benchmark is designed to investigate issues that affect the accuracy of Monte Carlo-calculated reaction rate tallies. Undersampling occurs when the neutrons in one generation do not interact with all regions in a problem and results in generational eigenvalue estimates that have not incorporated information from all regions in the system, reaction rate tallies are “skipped” and not scored for an entire generation; because of these reasons, undersampling can lead to inaccurate eigenvalue and reaction rate tally and tally variance estimates.

The following on Phase I benchmark presentations took place :

* [EGAMCT-2013/02](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_02.pdf) , Benchmark Phase I specifications, J. Miss
* [EGAMCT-2013/03](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_03.pdf) , Benchmark Phase 1 : IRSN Preliminary results on case R1, J. Miss
* [EGAMCT-2013/05](http://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_05.pdf) , Benchmark Phase 1 : ORNL Preliminary results, C. Perfetti
* [EGAMCT-2013/04](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_04.pdf) , Benchmark Phase 1 : GRS Preliminary results on cases S1 to S3, M. Stuke
* [EGAMCT-2013/06](http://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_06.pdf) , Benchmark Phase 1 : ENEA Preliminary results on Case R3, K. Burn

A discussion was held where participants pointed out some exercises within the benchmark were

in need of simplification. It was agreed a revision of the benchmark would take place. Such revision would be led by B. Rearden and C. Perfetti (ORNL).

Review of the latest technical developments in different codes and methodologies was also held.

* [EGAMCT-2013/08](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_08.pdf) , Latest developments and Overview of Scale 6.2, B. Rearden
* Optimizing Variance Reduction in Monte Carlo Eigenvalue Calculations with the Source Iteration Approach, K. Burn

Two other additional presentations at the meeting took place, that illustrate the use of Monte Carlo methods for in other areas of study:

* [EGAMCT-2013/07](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_07.pdf) , Statistical algorithm verification for high concentration microfuel pebbles, M. Gurevich
* [EGAMCT-2013/10](https://www.oecd-nea.org/science/wpncs/amct/workingarea/meeting2013/EGAMCT2013_10.pdf) , Prospective use of Monte Carlo techniques for the evaluation and the optimization of an electric mix in a territory, J. Miss

With no other business to discuss, the meeting was adjourned.

**List of Actions arising from the 3rd EGAMCT meeting**

1. C. Perfetti and B. Rearden with J. Miss, *To review/narrow down Phase I specifications*
2. NEA Secretariat – *To distribute revised specifications*
3. All: *To submit results of Phase I benchmark to NEA/J.Miss*

**APPENDIX A**

**ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT**

**Nuclear Energy Agency**

**Nuclear Science Committee**

**Working Party on Nuclear Criticality Safety**

**3rd Meeting of the Expert Group on**

 **Advanced Monte Carlo Techniques for Criticality Safety Assessment (EGAMCT)**

Friday October 25 2013

Kurchatov Institute, Moscow

Russian Federation

**AGENDA**

**Meeting venue : Kurchatov Institute “Building 3”**

*Proposed Meeting Schedule: 9h00 – 18h00*

1. Welcome – *J. Miss*
2. Approval of the agenda, review of actions from past meeting and approval of summary record - *Secretariat*
3. Presentations
	1. Presentation of activities of the EGAMCT – *J. Miss*
		1. *Benchmark Phase I specifications*
	2. First results for Benchmark Phase I
		1. *Preliminary SCALE results – B. Rearden (ORNL)*
		2. *Preliminary results on the Cases S1 to S3 – M. Stuke (GRS)*
		3. *Preliminary results on Case R1 using various sources sampling methods – J. MISS*
		4. *Preliminary results on Case R3 – K. Burn (ENEA)*
	3. The verification of the statistical algorithm for high concentration fuel pebbles – *M. Gurevich (Kurchatov Institute)*
	4. Subcriticality analysis for a spent fuel pool with heterogeneous fuel loading – *G. Hordosy (Centre for Energy Research)*
	5. Latest ORNL Monte Carlo and data developments – *B. Rearden (ORNL)*
	6. Monte Carlo convergence issues with an application criticality case managed by mathematical algorithms – *Y. Richet (IRSN)*
	7. Prospective use of Monte Carlo techniques for the evaluation and the optimization of an electric mix in a territory – *Y. Richet (IRSN)
	(to be confirmed)*
	8. Optimizing Variance Reduction in Monte Carlo Eigenvalue Calculations with the Source Iteration Approach *– K. Burn (ENEA)*
	9. Additional presentations following approval of the agenda
4. Identification of other activities/studies
5. Any other business (next meeting): *All*
6. Adjourn

**APPENDIX B**

**List of Participants to EGAMCT meeting of October 25th, 2013**

**Kurchatov Institute, Moscow**

|  |  |
| --- | --- |
| Name | Email address |
| Joachim MISS | joachim.miss@irsn.fr |
| Chris PERFETTI | perfetticm@ornl.gov |
| Alain SANTAMARINA | alain.santamarina@cea.fr |
| Matthias BEHLER | Matthias.Behler@grs.de |
| Yann RICHET | yann.richet@irsn.fr |
| Marco PECCHIA | marco.pecchia@psi.ch |
| Paul N. SMITH | paul.smith3@amec.com |
| Alexander VASILIEV | alexander.vasiliev@psi.ch |
| Kenneth William BURN | kburn@enea.it |
| Mikhail GUREVICH | gur.m@mail.ru |
| Gabor HORDOSY | hordosy.gabor@energia.mta.hu |
| Evgeny ZHEMCHUGOV | bnab@ippe.ru |
| Kirill RASKACH | abbn@ippe.ru |
| Andrei IAKUNIN | ayakunin@ippe.ru |
| Anton PEREGUDOV | peregudov.abbn@inbox.ru |
| Anatoly Kochetkov | akochetk@sckcen.be |
| Ian HILL | ian.hill@oecd.org |
| Franco Michel-Sendis | franco.michel-sendis@oecd.org |
| Tatiana Ivanova | Tatiana.ivanova@irsn.fr |
| Brad Rearden | reardenb@ornl.gov |
| Maik Stuke | maik.stuke@grs.de |