AGA 3: Non-Proliferation und Safeguards

Zeit: Mittwoch 17:00–19:00 Raum: HSZ-04

AGA 3.1 Mi 17:00 HSZ-04

Can State-level Safeguards be applied in Nuclear Weapon States? — •Clemens Listner[1], Morton J. Canty[1], Arnold Rezniczek[2], and Gotthard Stein[3] — [1]Forschungszentrum Jülich — [2]UBA GmbH, Herzogenrath — [3]Bonn

Acquisition Path Analysis (APA) is a key element of IAEA's State-level concept. Currently, this process is mainly based on expert judgment. However, the requirements from the IAEA state that the process must be objective, reproducible, transparent, standardized, documented and as a result non-discriminatory. A formal approach fulfilling these requirements has been set up by the authors in the past (see [1]).
In this paper, the refined methodology is presented. Improvements have been made in the interface definition between the three stages, the general network model has been updated, and the automatic visualization of acquisition paths has been accomplished. Furthermore, a prototype implementation will be shown.
Based on this methodology, a test case example is presented which models a hypothetic nuclear weapon State not having signed the NPT. For this case, it will be shown how APA can be implemented using the proposed methodology.

[1] C. Listner, M.J. Canty , A. Rezniczek, G. Stein, I. Niemeyer
A Concept for Handling Acquisition Path Analysis in the Framework of IAEA's State-level Approach
Proceedings of the INMM Annual Meeting, **2012**

AGA 3.2 Mi 17:30 HSZ-04

Thorium for Nuclear Energy - a Proliferation Risk? — •Wolfgang Rosenstock and Olaf Schumann — Fraunhofer-Institut für Naturwissenschaftlich- Technische Trendanalysen, Euskirchen, Deutschland

Thorium is a potential nuclear fuel for future power plants. Especially in India and China research on Thorium driven reactors is performed since the world wide deposits of Thorium are much larger than those of Uranium. Particularly India has large Thorium deposits but only limited Uranium ore resources. Furthermore, depending on the reactor design, less of problematic minor actinides will be produced.

During reactor operation the fertile Thorium is converted into the Uranium isotopes U-233 and to a small extent the highly radioactive U-232. The fissile U-233 may be diverted to build a nuclear weapon without further enrichment. This poses a high proliferation risk on the use of Thorium. The high radiotoxicity from U-232 and its daughter products might form an effective internal safeguard barrier that prevents the easy use of U-233.

Thorium reactor concepts will be presented and existing safeguards measures as well as their preferable expansion are discussed.

AGA 3.3 Mi 18:00 HSZ-04

Plutonium Production - Back of the Envelope Calculations — •Moritz Kütt, Matthias Englert, and Friederike Fassnacht — IANUS, TU Darmstadt, Germany

Knowledge of the amount of plutonium that has been or could be produced in specific reactors is one of the main facts necessary to assess risks of nuclear proliferation. For different projects, we have been using our own complex computer code (MCMATH) and third-party tools to calculate reactor burnup. They allow for very broad and sophisticated studies of plutonium production, but at the same time require access to fast computers, knowledge of the used software as well as of many physical details.

There exist approaches to estimate plutonium production figures by simpler means. We present simplified models for the calculation of plutonium production, based on extensive burnup calculations. Included are models for typical commercial reactors (PWR, BWR, CANDU) as well as special plutonium production reactors (Hanford-Type, Calder Hall). Besides presenting the models, we analyze the errors made by their application.

AGA 3.4 Mi 18:30 HSZ-04

Plutonium production in Small Modular Reactors (SMR) - the case of Toshiba 4S — •Friederike Fassnacht — IANUS, TU Darmstadt

Small modular reactors are promoted as being a safe alternative to address the world's growing energy demands. To exploit new markets the enhanced proliferation resistance is emphasized by today's developers. An overview regarding current SMR deployment and R&D will be presented. We picked the Toshiba 4S from many design studies for a more detailed examination because this next generation reactor can be considered as prototypical for SMR development especially for sodium cooled fast reactor concepts. The 4S core will have a 30 year lifetime and is beyond conceptional design stage so that sufficient information for a reactor model is available in the open public.

The neutron transport simulation code MCNPX was used to model the reactor core and to conduct criticality and flux analysis. To validate the model we calculated neutron multiplication factors for specific reactor configurations (e.g. first criticality, emergency reflector dropping etc.). The results are in good accordance with results published in the literature. To investigate possible proliferation issues of such SMR reactors we will present the plutonium production rate and isotopic composition of the fuel elements after a certain reactor lifespan based on burn up calculations preformed with VESTA. We discuss the proliferation attractiveness as well as the radio toxicity of the irradiated fuel.