AGA 3: Nuclear Verification and Disarmament Research

Time: Thursday 9:30–13:00 Location: H3

Invited Talk AGA 3.1 Thu 9:30 H3

Next Steps Toward Verified Nuclear Disarmament: A Research Agenda for Physicists without Security Clearances — •Alexander Glaser — Princeton University, Princeton, NJ (USA)

More than 70 years after the first use of nuclear weapons in Hiroshima and Nagasaki there still exist more than 16,000 nuclear weapons. Progress toward nuclear disarmament in the years after the end of the Cold War has slowed down dramatically. Along with a lack of political commitment and public attention to this issue, there remain substantial technical gaps in effective international verification of any treaty that would seek deep reductions in the nuclear arsenals.

It is often assumed that nuclear weapon states need to take the lead in this area of research and development because only they have the infrastructure and the experts to understand the technical requirements and constraints of eliminating the weapons. Despite decades of technical work, however, nuclear classification concerns have yielded ever more complex verification approaches that serve to raise concerns whether nuclear disarmament could in fact be reliably verified.

This talk proposes an agenda for unclassified cooperative research on nuclear verification approaches as a way to bring new ideas and perspectives to this field. It highlights some recent developments and reviews some of the possible paths forward on three key nuclear verification questions: how to confirm the authenticity of nuclear warheads; how to confirm numerical limits on nuclear warheads; and, how to confirm the absence of undeclared stockpiles of nuclear weapons and nuclear-weapon materials and the means of their production.

Invited Talk AGA 3.2 Thu 10:30 H3

Methods and Challenges for Disarmament Research — •Ole Reistad — Institute for energy technology, Kjeller, Norway/ University of Oslo, Oslo, Norway

In an arms control environment it is vital to ensure that inspection data are accurate, genuine, and that any measurements recorded are indeed the products of the item being measured. At the same time sensitive information * which might be sensitive for national security or non-proliferation reasons * must be adequately protected, and host confidence must be maintained. It is also important to understand what verification measurements actually mean in an operational context. This presentation summarises recent insights into the development of trusted technologies and managed access techniques for nuclear disarmament research. The results demonstrate that it is possible to jointly design verification equipment that can detect the presence of weapons-suitable plutonium, without compromising national security or non-proliferation obligations. Our main conclusion is that, in order to successfully design and implement verification technologies, the context and the purpose of the proposed measurement and the whole lifecycle of the equipment should be considered.

AGA 3.3 Thu 11:30 H3

Designing a Template Information Barrier Based on Low-resolution Gamma Spectroscopy — •Malte Göttsche and Alex Glaser — Program on Science and Global Security, Princeton University

Passive gamma-ray spectroscopy has been employed to uniquely identify unique items containing special nuclear materials such as plutonium and highly enriched uranium. This project assesses the performance of a gamma spectrometry warhead authentication system that is based on low-resolution measurements, which by design reduce the extent of revealed sensitive information. Standard gamma spectrometry can, however, only confirm that the interrogated item's surface corresponds to a pre-recorded radiation signature or "template." In order to also assess whether the characteristics of the item's mass corresponds to the mass of the template, a polyethylene plate can be placed in front of the detector. This produces 2.22 MeV gammas from (n,g) reactions in hydrogen in addition to the gamma spectrum of the inspected item. This presentation examines the system's capabilities to detect various evasion attempts.

AGA 3.4 Thu 12:00 H3

Draft of a verification regime for the detection of clandestine reprocessing plants — •Michael Schoeppner — Princeton University, Program on Science and Global Security

Nuclear reprocessing plants are likely to emit krypton-85 in the process of separating plutonium from spent fuel. The capability to find clandestine facilities is of great interest for the verification of the NPT, a future FMCT, or a future regional nuclear-weapon-free zone, e.g. in the Middle East. In this work the emissions from known facilities are compared to emissions that would most likely be emitted from clandestine facilities. From this analysis it is derived how it is possible detect the krypton-85 fluctuations from clandestine facilities in the atmosphere. Different scenarios and boundary conditions are explored to assess the requirements for a global verification regime.

AGA 3.5 Thu 12:30 H3

Minimizing Civilian Use of Highly Enriched Uranium - FRM II and Global Developments — •Matthias Englert — Öko-Institut e.V., Rheinstr. 95, 64295 Darmstadt

The need to use highly enriched uranium (HEU) in civili nuclear applications is shrinking due to international efforts worldwide in the last three decades. Today low enriched uranium (LEU) that is not suitable for nuclear weapon purposes can be used instead in almost all civil applications. An overview of the current HEU use worldwide will be presented before focusing more on the use of HEU in research reactors and the conversion of existing reactors to LEU. Specifically interesting is the case of the German research reactor in Munich, the FRM-II. The reactor operates since ten years after intense national and international discussions over the use of weapon usable HEU to fuel the reactor. Since its construction the reactor is therefore obliged to convert to lower enrichment levels as soon as a suitable fuel becomes available. Despite huge international efforts to develop new fuels it is still not clear if and when the reactor can be converted.