AGA 7: Verification and Safeguards

Time: Friday 11:00–12:35 Location: H-HS XVII

Invited Talk AGA 7.1 Fri 11:00 H-HS XVII

Robots, Buddy Tags and a MOS 6502: Innovative Tools for Access-Limited Arms Control Verification — •Moritz Kütt[1], Alexander Glaser[2], and Robert J. Goldston[2] — [1]Institute for Peace Research and Security Policy at the University of Hamburg, Hamburg, Germany — [2]Princeton University, Princeton, NJ, USA

Verification approaches for nuclear arms control agreements inevitably encounter restrictions on access to information, items and sites that states-parties deem sensitive for national security purposes. This talk will present three systems which can achieve credible verification results without the need to lift such restrictions: 1) Robots can inspect sites where inspectors only have limited access. Our neutron-detecting, directionally and spectrally sensitive robot could detect illicit activities in uranium enrichment facilities. 2) Buddy Tags allow to account for treaty-accountable items where identifiying tags cannot be directly attached. We demonstrate a prototype with a highly sensitive motion detection system capable of detecting illicit movements with accelerations of 20-30μg. 3) Information barriers protect sensitive information acquired during warhead authentication procedures. Based on the MOS6502 processor, we demonstrate a "vintage verification" system. The template-based, gamma spectroscopy information barrier allows both parties to simultaneously establish trust in the hardware used.

AGA 7.2 Fri 11:45 H-HS XVII

Prospects for Safeguarding Radioactive Waste with Antineutrino Measurements — •Madalina Wittel, Anike Ohm, and Malte Göttsche — Nuclear Verification and Disarmament Group, RWTH Aachen University

The radioactive waste produced in the past decades contains many significant quantities of plutonium, one of the key ingredients for manufacturing nuclear weapons. Thus, it raises an important safeguarding challenge. For the first hundreds of years after discharge, the dominant radioactivity of the waste comes from long-lived beta-decaying elements, in particular ^{90}Sr and ^{137}Cs. In this talk, we discuss the prospects of safeguarding long-term geological nuclear waste repositories by detecting the low-energy antineutrinos emitted via beta-decays by the waste itself. We investigate whether these antineutrino measurements could be carried out with high resolution imaging liquid-argon (LAr) detectors. This emerging technology could detect antineutrinos even below the inverse beta decay kinematic threshold. Furthermore, due to their imaging properties, LAr detectors could also provide directionality information which may be used for background rejection and potentially for indicating if and where a certain amount of nuclear waste has been diverted. In this talk, we present a preliminary feasibility study for employing LAr detectors for safeguarding geological radioactive waste repositories. We consider a realistic repository layout as a study case and evaluate the detector performance in this context, from first principles. Finally, we address both the challenges and the advantages of employing LAr detectors for safeguards purposes.

AGA 7.3 Fri 12:10 H-HS XVII

Uranium Enrichment, Centrifuges and the Current Situation in Iran — •Matthias Englert — Öko-Institut e.V. Rheinstr. 95, 64295 Darmstadt

Today highly enriched uranium (HEU) is produced with gas centrifuge technology, a technology which is in the reach of the technical capabilities of most countries worldwide. Problematic developments in nuclear proliferation in the last two decades involved the spread and covert acquisition of centrifuge enrichment capabilities by countries such as Iran. After the discovery of the Iranian nuclear program it was mostly frozen since the Iran Nuclear Deal (JCPOA) in 2015. Due to recent tensions and after the withdrawal from the US in 2018, Iran already restarted certain nuclear activities and announced to increase it's activities if European parties (UK, France, Germany) would leave the deal. This talk will give a summary of Iran's fissile material production capabilities based on estimates in the open literature and own calculations. Estimating the separative capacity of gas-centrifuges based on accessible information it is possible to calculate a hypothetical production rate for Highly Enriched Uranium (HEU). The resulting hypothetical production rates depend heavily on the assumption about the enrichment and depletion level, the cascade scheme, on the amount of raw material available and the timescale.