

EGU22-12872

<https://doi.org/10.5194/egusphere-egu22-12872>

EGU General Assembly 2022

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Drone-Based Investigation of Uranium Mining Legacies – Recent Developments in the DUB-GEM Project

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Uranium mining legacies still pose a significant risk to human health and the environment in certain Central Asian regions. Drone-based methods are well-suited for mapping radionuclides of contaminated sites and for planning, monitoring and quality assurance of remediation measures. In the DUB-GEM project (Development of a UAV-based Gamma spectrometry for the Exploration and Monitoring of Uranium Mining Legacies), which is funded by the Federal Ministry of Education and Research (BMBF), a German interdisciplinary consortium led by the Federal Institute for Geosciences and Natural Resources (BGR) is developing a drone-based detector system for the investigation of contaminated uranium mining and processing legacy sites. The project is co-funded by the Coordination Group for Uranium Legacy Sites (CGULS) program of the International Atomic Energy Agency (IAEA). CGULS coordinates cooperation among IAEA Member States affected by ULS and national and international organizations involved in the management, remediation, or regulatory oversight of ULS. CGULS supports the Central Asian partner countries of DUB-GEM to participate in activities of the DUB-GEM consortium.

The applicability of the system is to be tested in the DUB-GEM partner countries Kyrgyzstan, Kazakhstan, Uzbekistan and Tajikistan. Some of the uranium legacy sites (ULS) in Central Asia, especially those in Kyrgyzstan, are difficult to access due to the mountainous topography. Once fully developed, the system will allow the efficient and safe mapping and monitoring of radioactive contamination at such sites without requiring experts to trek through difficult terrain with heavy equipment, exposing themselves to potential physical and radiological risks.

As part of the DUB-GEM project, two specially designed scintillation detectors were used, each of which can be mounted on the heavy-lift drone which was also custom-built for the project and has a maximum take-off mass (MTOM) of 25 kg. The drone-based gamma spectrometry system was successfully tested at different sites in Germany in autumn 2020 and late summer 2021. In autumn 2021, the system was tested for the first time in Kyrgyzstan (Mailuu Suu) and Kazakhstan (Muzbel'). Despite the technical and logistical challenges, drone surveys with the gamma

spectrometers could be flown at three sites. The count rates of the detectors were transmitted in real time to a ground station so that hotspots could be detected during flight.

The resulting maps presented here show the distributions of dose rates and radionuclides of the uranium-238 series, thorium-232 series and potassium-40. Comparison with samples from the ground was used to calibrate the instruments.

The extensive data sets from both detectors offer a multitude of further evaluation possibilities, which are currently being evaluated.

A further airborne survey campaign in Central Asia is planned for late summer 2022 to map legacies in Uzbekistan.