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## **Strengthening Nuclear Forensic Capabilities and Partnership through Collaborative Science in Ukraine**

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Globally, the production, transport and storage of nuclear materials, and interdiction of illicit materials, have led to serious concerns over illegal trafficking and the potential use of such materials in a nuclear terrorism event. Ukraine stands at one of the geographical crossroads of such activities and contains the largest uranium ore reserves in Europe. Moreover, Ukraine retains significant waste from Soviet-era uranium production and enrichment activities, as well as radioactive materials accumulated from the Chernobyl catastrophe, and maintains a significant nuclear energy production infrastructure. Lawrence Livermore National Laboratory (LLNL) has initiated multiple cooperative projects within Ukraine with support from the Department of Energy NA-242 GIPP (Global Initiatives for Proliferation Prevention) and CBM (Confidence Building Measures) programs, and the Department of State. These projects engage expert Ukrainian scientists and institutions in collaborative nuclear forensic research and training in order to strengthen nuclear forensic capabilities and partnerships.

The Ukrainian and United States-based technical collaborations derive from existing capabilities, current needs, and scientific interests of both parties. Ongoing projects include: (1) analytical and capacity building for nuclear forensics through nuclear forensic research; (2) participation, leadership, and training through regional nuclear forensic workshops including engagement with Georgia, Azerbaijan, Moldova and Armenia; (3) analytical quality assurance and cooperation through the development and co-analysis of relevant standard reference materials; and (4) development of the architecture, as well as open-source population of a Ukrainian database of nuclear materials. Collectively, these projects have strengthened Ukraine as a regional leader in combatting nuclear smuggling and have enhanced regional nuclear forensics capabilities and security. This strong commitment to regional nuclear security is complemented by separate but synergistic support through the European Commission's Joint Research Centre.

We will discuss the process, current status and successes of these collaborations including new research developments, infrastructure improvements, the development of country-specific and regional training, and progress in development of a nuclear materials database and library. We will also present insights gained in the course of forging these relationships and discuss how such engagements can positively impact nuclear security not only within a country, but also beyond borders.

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