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The Uranium Ore Concentrate Comparative Assessment Database

In 2013, the Government of Canada launched the Canadian National Nuclear Forensics Capability Project (CNNFCP), which undertook various activities aimed at establishing technical and operational frameworks for: (a) a national network of laboratories for undertaking analyses to support nuclear forensics applications; and (b) a national nuclear forensics library (NNFL) cataloguing information and data about radioactive and nuclear (RadNuc) material under Canadian regulatory control.

The task of leading the development of Canada's NNFL was charged to the Canadian Nuclear Safety Commission (CNSC). Building upon the successes of the CNNFCP, in 2016 the CNSC, in partnership with Atomic Energy of Canada Limited (AECL) (with Canadian Nuclear Laboratories (CNL) as the performing organization), the National Research Council (NRC) and the University of Ottawa, launched the Nuclear Material Signature and Provenance Assessment Capability Development Project (NMS/PAC). The NMS/PAC is a whole-of-government R&D initiative led by the CNSC aimed at developing, enhancing and expanding Canada's nuclear material characterization and signature data analytics capabilities to support provenance assessment activities for nuclear forensics operations. The scientific and technical outputs of the NMS/PAC feed directly into the Government of Canada's NNFL, which is maintained and operated by the CNSC.

The nuclear material of focus for the NMS/PAC was uranium ore concentrate (UOC). The objective of the NMS/PAC was twofold: (a) expand the UOC analytical signature reference dataset by producing measurements of a wide range of analytes using various material characterization techniques; and (b) further develop methods to support comparative assessment through the application of data analytics and machine learning techniques. The work of the NMS/PAC has culminated in the establishment of the UOC Comparative Assessment Database (CAD), which is one component of the broader Government of Canada NNFL.

This paper will present an overview of the UOC CAD, including the R&D undertaken as part of the NMS/PAC to support its establishment. Moreover, the paper will outline the rationale behind pursuing an aggressive UOC characterization campaign, as well as the data analytics and machine learning approaches that were developed and incorporated into the UOC CAD to support comparative assessments. The paper will conclude with a discussion regarding the long-term sustainability of the UOC CAD, and how it fits into the broader Government of Canada NNFL concept of operations.

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