Evaluation of soil samples for ²³⁸Pu, ^{239/240}Pu, ²⁴¹Am and ⁹⁰Sr: An international cooperative training exercise

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A fellow from the Research Institute of Radiology in Gomel, Belarus spent three months with chemists from the Quality Assurance/Metrology Division (EMQ) of EML in training for the evaluation of environmental levels of selected alpha and beta emitting radionuclides. The Institute had developed detailed maps of areas in Belarus contaminated with fission products such as ¹³⁷Cs and ⁹⁰Sr and the goal of training was to provide the Institute's fellow with experience in analyzing soil samples for ²³⁸Pu, ^{239/240}Pu, ²⁴¹Am and ⁹⁰Sr. The fellow was sponsored by The International Atomic Energy Agency through its Department of Technical Cooperation.

The scope of the training schedule included soil sample preparation, followed by chemical procedures designed to solubilize the sample and isolate and purify the analyte, and ending with utilization of appropriate detection and counting instrumentation to quantify each analyte. The EMQ chemical procedures followed were the Standard Operating Procedures (SOPs) used in EML and adapted from the EML's Procedure Manual, HASL-300. The raw analytical data was used to calculate the results through the use of spreadsheet templates, including the equations used for estimating the combined standard uncertainty (CSU) for each result.

After the fellow was trained, two sample sets from different regions within the area contaminated by the Chernobyl accident were analyzed for ²³⁸Pu, ^{239/240}Pu, ²⁴¹Am and ⁹⁰Sr. The first sample set was collected in 1990 in Novozybkov, Russia, by a team from EML. The EML set selected for this exercise came from an unplowed agricultural field near Novozybkov, and represented three cuts of a core 10 cm deep, which had been brought back to the United States and counted on high purity germanium detectors to provide values for gamma emitters only. The samples were then archived at EML. The second set of soil samples was collected in 2001 by the scientists from the Research Institute of Radiology in Gomel, and represented four different agricultural situations.

The results of the determination of ²³⁸Pu, ^{239/240}Pu, ²⁴¹Am and ⁹⁰Sr in these two sets of samples will be presented. The contribution of this data to the process of evaluating the radiological contamination of Belarus regions will also be discussed since many agricultural workers spent their working days in an area with possibly elevated levels of plutonium and americium.