

IMPROVED CAPACITY IN IONISING RADIATION METROLOGY AT SANAEM

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Turkey is planning to build nuclear power plants in the south and north coasts to supply the ever-increasing energy demand. The nuclear power plants based on old Soviet technology in Armenia and Bulgaria close to Turkey's borders also makes constant monitoring of environmental radioactivity extremely important due to public health and environmental contamination concerns. Increasing the number of radioactivity measurement laboratories and supplying them with the required reference standards and the knowledge of how to use them for getting accurate and traceable measurements, becomes a primary concern. Radiation Metrology Division at SANAEM has been established in 2012 to provide uniformity and reliability of the measurements in the field of ionising radiation metrology by R&D studies and by constituting, developing, keeping and extending internationally accepted reference measurement standards and techniques.

Turkish Atomic Energy Authority is the designated institute (DI) for ionising radiation metrology in Turkey. Although there have been several individual studies in radionuclide metrology at the TAEK-SANAEM in the past, metrology studies began formally in 2009 with the EU project TR080209, “Improving Chemical and Ionizing Radiation Metrology in Turkey.” This three-year project, which allowed seven researchers be trained in radionuclide metrology at the JRC-IRMM (Geel, Belgium), aimed to increase the institutional capacity of TAEK research centers in ionizing radiation metrology. In addition, two national projects run parallel to this project—one to establish a secondary standardization dosimetry laboratory and one to set up a radionuclide metrology laboratory—at the TAEK-SANAEM. Construction of the radionuclide metrology laboratory has been completed, and equipment has been installed. The laboratories were equipped with a Compton suppression spectrometer (Canberra), different sizes of PIPS detectors (Canberra), an ionization chamber (Southern Scientific) and source preparation equipment for the secondary radionuclide standardization methods that are planned for the radionuclide metrology laboratory, including HPGe detectors, high resolution alpha spectrometers, ionization chambers and liquid scintillation counting systems. Some primary activity standardization studies are also being conducted. A high resolution alpha spectrometric system with accurate dimensions was designed and installed for primary standardisation. The design and construction of alpha source preparation systems are ongoing. The CIEMAT-NIST method using a Quantulus ultra low level liquid scintillation spectrometer is being used as a primary standardization method. Other setups, such as $4\pi\gamma$ -counting with a well type NaI (TI) detector system was designed for primary standardisation. Detector was modelled in Penelope and EGS4 Monte Carlo codes for total efficiency calculations. A commercial TDCR (triple-to-double coincidence ratio) system was installed. Validation studies are ongoing. $4\pi\beta\gamma$ coincidence counting systems are still in the design phase.

TAEK-SANAEM participated in the Supplementary Comparison Test (CCRI(II)-S8 on radionuclide activity measurements (Radionuclides: K-40, Cs-137 and Sr-90) in reference materials – Bilberry) which is conducted by CCRI (Consultative Committee for Ionizing Radiation) of BIPM, and submitted 3 CMC claims on Cs-137, K-40 and Sr-90 in foodstuffs to EURAMET. These are under review.

In 2013, the first Proficiency Test “Determination of Activity Concentrations of Naturally Occurring Radionuclides in Soil” has been organized following the workshop on

“Environmental Radioactivity Measurements” held at SANAEM for the researchers and academic staff from universities. Measuring and reporting Ra-226, Th-232 and K-40 radionuclides in soil sample have been asked from the 16 participant laboratory which TAEK donated gamma spectrometers. Over 50% of the 12 laboratories who sent their results passed the proficiency. Since the laboratories and the staff were new, the rate of success was not as high as expected. Nevertheless, this PT was a valuable chance to show the general view of the laboratories and to help them to increase the quality of their measurements.

SANAEM participated in EMRP (European Metrology Research Program) coordinated joint research project “JRC-ENV57 – Metrology for Radiological Early Warning Networks in Europe” and will exclusively take part in the work packet titled “WP2 – Airborne Radioactivity Monitoring Networks”. This three-year project will start in the second half of 2014.

SANAEM proposed a Technical Cooperation (TC) project to IAEA with the objective of strengthening the measurement and calibration infrastructure for radionuclide metrology in Turkey by writing clear procedures for the production of radioactive reference materials, establishing primary radionuclide standardization techniques and organizing comparison and proficiency test exercises. The project is planned to start at 2016 collaboration with BIPM and the experienced metrology institutions in Europe, such as PTB, IRMM, LNH, NPL and CMI.

In addition to the radionuclide metrology laboratories, when the construction of Secondary Standardization Dosimetry Laboratories (SSDL) is completed, SANAEM aims to play a leading role in Turkey, in the Middle-East and among the Turkic Republics as reference radioactivity and dosimetric measurements service and as reference material and PT provider with the well-equipped ionising radiation metrology laboratories and experienced staff through the international collaboration projects, by taking the needs of the region into account.