

Destructive Analyses of Samples for the Application of Safeguards by the ABACC

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The assessment of defects (small-scale failures) in the application of safeguards is performed by means of destructive analyses in the samples of nuclear materials. These samples are collected in order to establish their uranium contents and the corresponding enrichment.

On the basis of the Quadripartite Agreement (INFCIRC/435), the ABACC and the IAEA must perform joint inspections in the Brazilian and Argentine facilities, reaching their conclusions independently. With regard to non-destructive analyses and to containment and surveillance activities, both agencies share equipment, data and results. In the case of destructive analyses, each entity collects its sample of the item to be verified and performs the analysis independently in its own laboratory.

Since the ABACC does not have its own analytical laboratory for performing the necessary analyses, the Agency makes use of a network composed by four laboratories in Brazil and five laboratories in Argentina, which participate in the nuclear programs of these countries. Since the creation of the ABACC, profiting of the technical capacity in both countries has been part of its working philosophy. This is why the samples collected in Brazilian facilities are analyzed in Argentine laboratories and vice versa.

Both in Argentina and in Brazil, the samples obtained from fuel-cycle facilities are delivered in powder form (UO₂ y U₃O₈), as fluids (organic and aqueous solutions), UO₂ pellets (used in the fuel elements for power reactors), and as a UF₆ gas (in the enrichment and reconversion plants).

The technique that is usually applied in the laboratories for the assessment of the uranium contents in the sampled compounds is the Davies & Gray potentiometric titration. The assessment of the isotopic enrichment of uranium (U²³⁵ contents) is performed by means of mass spectrometry and using thermal ionization mass spectrometers (TIMS) with either a gas (GSMS) or plasma (ICP-NS) source.

Each one of the laboratories in the network has its own procedures and quality management systems, guaranteeing that their analyses are performed in compliance with the standards established internationally. Some of the laboratories already possess their own quality management systems based on the ISO/IEC-17025 standard, while others, in addition to being certified, are permanently submitted to audits carried out by the certifying agencies.

In order to verify this quality and, at the same time, to identify eventual problems in the analyses, one of the activities of the ABACC's Technical Support Sector is a program for intercomparison of measurements, involving the participation of the laboratories in the network. Part of the intercomparison program is performed at the ABACC's headquarters. The Agency manages the other part of the program with the participation of international comparison laboratories, such as the Safeguard Measurement Evaluation (SME) by the Brunswick National Laboratory (NBL) of the United States and the EQRAIN (Programme d'Evaluation de la Qualité du Résultat d'Analyse dans l'Industrie Nucléaire) of the Commission d'Etablissement de Méthodes d'Analyse (CETAMA) in France.

The results obtained by the laboratories in the intercomparison programs show that the quality of the analyses has evolved throughout the years, complying with internationally accepted standards for the application of safeguards (International Target Values – ITV).

In order to cooperate with the laboratories in the network in their analyses of the safeguards sampled materials, the ABACC provides them with primary and secondary patterns obtained from internationally certified laboratories (NBL, IRMM).

By means of an agreement for technical cooperation with the United States Department of Energy, the Agency is also developing projects, coordinated with the NBL, for training, orientation and supply of patterns to the laboratories in the ABACC's network, while the NBL, in turn, does also perform certification analyses of samples for certain specific intercomparison exercises.

The ABACC's Technical Support Sector keeps a database of all the results supplied by the laboratories related to safeguards samples, as well as their comparison with the values stated by the operators when the samplings were made. This allows to perform a detailed analysis of the measurement performance per type of stratum, facility and laboratory. Additionally, the results obtained by the ABACC are compared with those of the IAEA, so as to verify eventual incompatibilities.

The system applied by the ABACC for destructive analyses has been effectively guaranteeing the control of nuclear materials within the framework of the Common System for Accounting and Control of Nuclear Materials (SCCC) between Argentina and Brazil throughout the Agency's 15 years of existence.