

Analytical Quality Control

In analytical chemistry the determination of small or trace amounts of elements or compounds in different types of materials is increasingly important. The results of these findings have a great influence on different fields of science, and on human life. Their reliability, precision and accuracy must, therefore, be checked by analytical quality control measures.

Quantitative analysis in the chemical sense means the determination of the amount or the concentration of a material (usually an element or a chemical compound) in a matrix different from that material. It is necessary in such fields as industry, medicine and law enforcement. In the atomic industry analysis is needed from the uranium prospecting stage all the way through fuel processing and reprocessing, down to waste disposal operations and to environmental protection from contamination by radionuclides. Radionuclides, however, do not only constitute an analytical problem, but may also be used as very valuable analytical tools which have revolutionized analysis in the extremely low concentration range.

To be able to use analytical data for any of these purposes, it is essential to know their accuracy. Such a control is necessary since results of analytical activities may be the basis upon which economic, administrative, medical or legal decisions are taken; they must, therefore, be documented to be sufficiently reliable. For most analytical laboratories it is not an easy task to check this accuracy internally.

The International Atomic Energy Agency (IAEA) set up an Analytical Quality Control Service (AQCS) in 1962 to assist laboratories in Member States in the assessment of their reliability in radionuclide analysis, and in other branches of applied analysis in which radionuclides may be used as analytical implements. For practical reasons, most analytical laboratories are not in a position to check accuracy internally, as

- frequently resources are available for only one method;
- standardized sample material, particularly in the case of trace analysis, is not available and can be prepared by the institutes themselves only in exceptional cases;
- intercomparisons are organized rather seldom and many important types of analysis are so far not covered.

AQCS assistance is provided by the shipment to laboratories of standard reference materials containing known quantities of different trace elements or radionuclides, as well as by the organization of analytical intercomparisons in which the participating laboratories are provided with aliquots of homogenized material of unknown composition for analysis. In the latter case the laboratories report their data to the Agency's laboratory, which calculates averages and distributions of results and advises each laboratory of its performance relative to all the others.

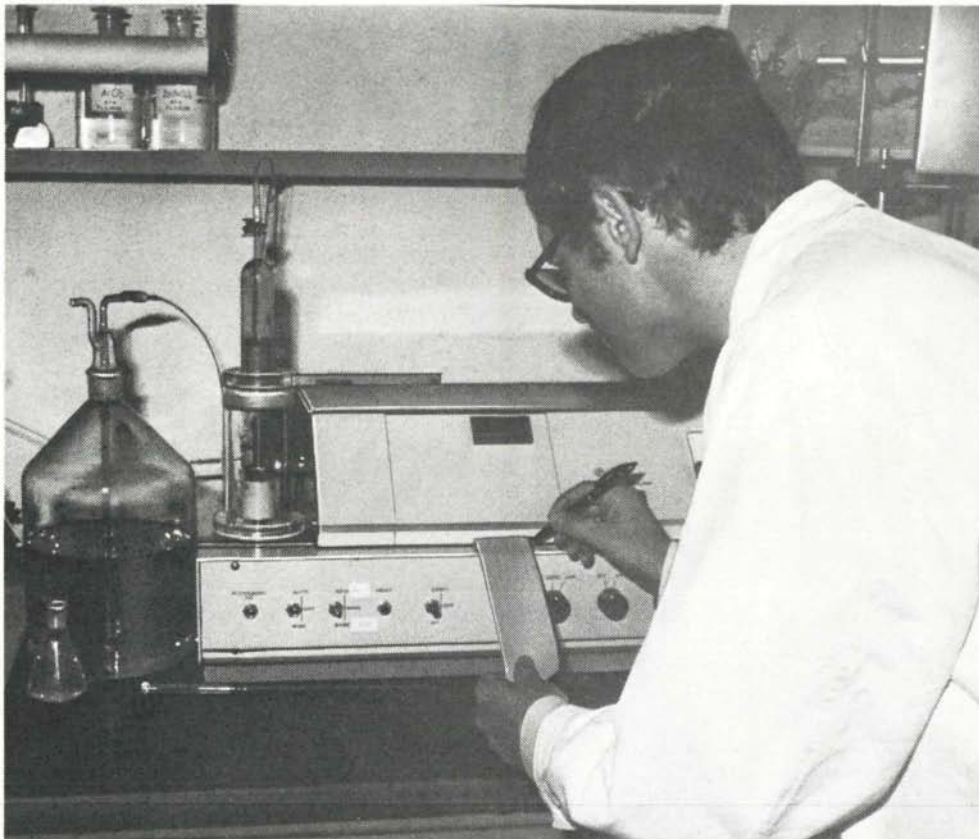
Throughout the years several dozens of intercomparisons have been organized and many thousands of samples provided.

The service offered, as a consequence, has grown enormously.

The programme for 1973 and 1974, which is currently being distributed to Member States, will contain 31 different types of materials.

IAEA ANALYTICAL QUALITY CONTROL SERVICES 1973

Matrix	Elements or nuclides	Concentration or activity	Intercomparison I Reference material R Standard material S
1. Uranium oxide	U	87% U	I
2. Uranium nitrate solution	U	200 g/l	I
3. Uranium nitrate solution	U - isotopic composition	1,5 - 5% U-235	I
4. Various uranium ores	U	0,471% U_3O_8 - 0,313% U_3O_8 low grade 0,01 - 0,05% U_3O_8	S S
5. Fresh water	fission nuclides	10 times higher than in natural water	I, S
		1000 times higher than in natural water	I, S
	trace and pollution elements	10 - 100 times greater than in natural water	I
6. Sea water	low level fallout radioactivity	—	I
	fission products and Pu	0,5 - 300 pCi/l	I
7. Calcinated animal bone	Sr-90 and Ra-226	5 and 0,5 pCi/g	R, I
8. Fish solubles	trace multielement analysis	natural content	I
9. Milk powder	some principal element and Sr-90, Cs-137	natural content	R
10. Liquid milk	Sr-90, Sr-89, Cs-137	0,5 - 2 nCi/l	I, S
11. Urine	U, Th, Pu	Standard suitable for determination in human urine	S
	trace multielement analysis	natural content	I
12. Muscle	trace multielement analysis	natural content	I
13. Blood serum	iodine	100 ng/g	R
14. Soil	trace multielement analysis	natural content	I
15. Various marine sediments	fission and activation products	1 - 100 pCi/g	I
16. Corn and wheat flour	iodine and mercury	5 - 10 ppb	R



An automatic potentiometer titrator for the determination of uranium, used for the Analytical Quality Control Service at the IAEA Seibersdorf Laboratory.

The Table summarizes the programme for the current year. Three different types of materials will be distributed:

- intercomparison materials (I) which can be used in analytical laboratories working in the field of nuclear technology. This set consists of uranium ore standards and of special substances of interest in nuclear fuel technology;
- reference materials (R) with known content of uranium, thorium and/or transuranium elements or fission products for the determination of environmental radioactivity or control of nuclear safety;
- standard materials (S) which are well defined materials from the chemical as well as from the physical point of view. Radiochemical methods such as neutron activation or isotope dilution analysis are often used in the determination of such trace elements and constitute an important contribution of nuclear techniques to applied science. Standards are expensive to prepare and a charge of \$10 or \$15 (or their equivalence in local currency) will be made for each sample to recover part of the cost.

More details are available from:

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