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INVITED LECTURE - Neutron Activation Analysis and Reference Materials –Development and Perfection

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This review of a 40-year practice in neutron activation analysis (NAA) is intended to illustrate the mutual benefits drawn from the values of a unique analytical tool and the enabling properties provided with the reference materials. During this period NAA transitioned rapidly to instrumental multi-element procedures based on high resolution gamma-ray spectrometry with germanium detectors. On the side of the reference materials substantial development of biological and environmental SRMs by the National Institute of Standards and Technology (NIST) (then the National Bureau of Standards) had begun in the early 1970s. Starting with the production and certification of the first ever, natural matrix, multi-element botanical SRM 1571 Orchard Leaves, issued in 1971, and followed by SRM 1577 Bovine Liver in 1972 the determination of key biological and contaminant elements, including Ca, Mg, Fe, Cu, Zn, Se, Cr, Cd, As, Pb, and Hg could be validated. The certification had been accomplished using a broad array of analytical methods, with NAA having contributed to the majority of certified values. The need for more diverse and extensively characterized SRMs to fulfill the ever-growing demands in analytical chemistry for life science research and applications has been the driving force for refinement and expansion of the NAA procedures. The development of more sophisticated procedures with detection limits down to 0.1 µg/kg enabled the recent establishment of new materials as benchmarks for current analytical investigations. NAA procedures provided critical analytical data in several recent SRM developments such as 1577c Bovine Liver, where Ag, As, Cr, and V were determined at several to tens of µg/kg levels. NAA's performance as a primary method of measurement contributed to the certification of arsenic in SRM 955c Toxic Metals in Caprine Blood, SRM 2668 Toxic Elements in Frozen Human Urine, SRM 3262 St. John's Wort Aerial Parts, SRM 3532 Calcium Dietary Supplement, SRM 3280 Multivitamin/Multielement Tablets, SRM 3233 Fortified Breakfast Cereal, SRM 1845a Whole Egg Powder, and SRM 2383a Baby Food Composite.

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