

## SRMs for Organic Contaminants in Human Serum and Milk

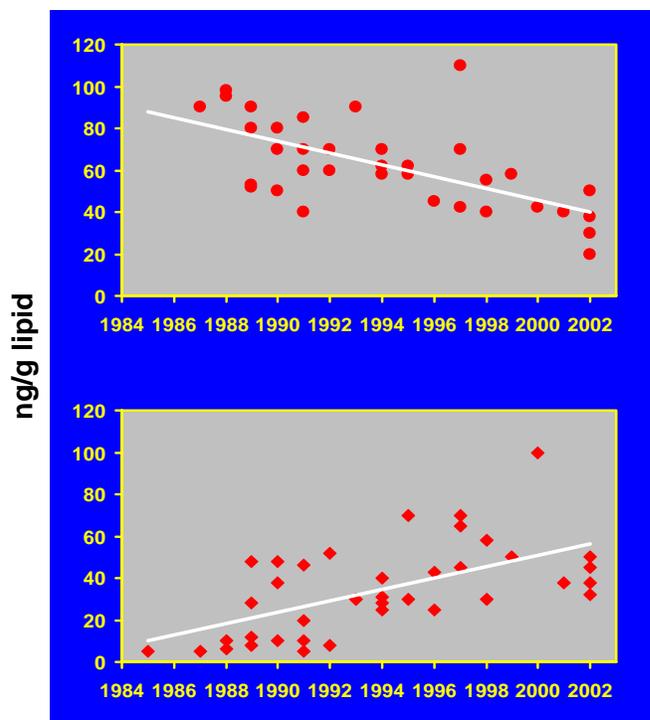
NIST and the Centers for Disease Control and Prevention (CDC) Division of Laboratory Sciences, Analytical Toxicology Branch, are collaborating to develop two new SRMs to meet the expanding needs for the measurement of organic contaminants in human serum; one of these materials, SRM 1957, is a natural level (non-fortified) and the second, SRM 1958, is a fortified material. In addition to the serum samples, CDC and NIST are collaborating to develop two SRMs for organic contaminants in human milk, SRM 1953, a natural level (non-fortified) and SRM 1954 (fortified). Results from measurements made at NIST and CDC as well as data from interlaboratory studies organized by CDC and NIST will be used for value assignment of SRMs 1953, 1954, 1957, and 1958.

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For the past 25 years NIST has developed a number of serum-matrix Standard Reference Materials (SRMs), primarily for measurements of clinically important analytes (e.g., cholesterol, glucose, and creatinine). The first serum-based SRM for the measurement of organic contaminants was SRM 1589 Polychlorinated Biphenyls (as Aroclor 1260) in Human Serum, which was issued in 1985 with certified concentration for total polychlorinated biphenyl (PCB) concentration expressed as Aroclor 1260. SRM 1589 was prepared by fortifying human serum with Aroclor 1260 prior to freeze-drying. This material was replaced in 2000 with SRM 1589a PCBs, Pesticides, and Dioxin/Furans in Human Serum, which contained only natural levels of these constituents, thereby providing users with a more useful material. SRM 1589a has been used extensively by the CDC in human monitoring studies to validate measurements of contaminants in human serum, particularly to support the NHANES program. The Certificate of Analysis for SRM 1589a was recently updated to include concentration values for brominated flame retardants, e.g., polybrominated diphenyl ethers (PBDEs), as well as values for additional polychlorinated biphenyls (PCBs) and pesticides.

The National Health and Nutrition Examination Survey (NHANES) program, conducted since 1971, is designed to assess the health and nutritional status of Americans. The survey combines personal interviews, physical examinations, diagnostic procedures and laboratory tests for approximately 5000 people each year. In addition to measurements of nutrients, recent NHANES samples of blood and urine have also been analyzed for a variety of contaminants.

In the last decade the concentrations of PCBs, pesticides, and dioxins/furans in the U.S. population have decreased by approximately 50% while the concentrations of the PBDEs have increased by a factor of 4: PCB 153 (top) and PBDE 47 (bottom) concentrations over time.



(Sjodin et al., *Retrospective Time-Trend Study of Polybrominated Diphenyl Ether and Polybrominated and Polychlorinated Biphenyl Levels in Human Serum from the United States*, Environ. Health Perspect. 112, 654-658, 2004.)

Because of the changes in contaminant levels in human serum since SRM 1589a was prepared in 1996, a more contemporary serum SRM was requested by CDC. Approximately 200 L of human serum was procured from various locations around the U.S., combined, and homogenized. Half of this serum was dispensed and freeze-dried as SRM 1957. The remaining half was spiked with a solution containing 172 selected chlorinated dioxins and furans, brominated dioxins and furans, pesticides, polychlorinated biphenyls, brominated flame retardants, polychlorinated naphthalenes, halogenated phenols, brominated dioxins/furans, hydroxylated PCBs, and toxaphenes at concentrations approximately 10 times higher than median concentrations found in the US population during the 2003 NHANES study. This fortified serum will be SRM 1958.

CDC and NIST are also collaborating on the development of two human milk SRMs. Approximately 100 L of human milk was procured from a number of milk banks around the U.S., combined, and homogenized.



Half of this milk was dispensed and frozen as SRM 1953 while the remaining half was spiked with a solution containing the same suite of 172 contaminants as used for the serum SRM 1958 (above). This fortified milk material will be SRM 1954.

#### *Impact*

SRMs 1953 and 1954 will be the first human milk reference materials available for contaminant monitoring

SRM 1957 and 1958 will be the most characterized serum reference materials developed for contaminant analysis.

**SRM 1957**, with natural contaminant levels, will be representative of a serum with concentrations of contaminants currently found in the U.S. population and will replace the currently available SRM 1589a.

**SRM 1958**, spiked at levels 10 times higher than natural levels, will be useful for the development of analytical methods for emerging contaminants and other classes of compounds, demonstrating that analytes of interest have been properly identified.