FDA Total Diet Study (TDS): Analytes and Analytical Methods

FDA Total Diet Study (TDS) Main Page (/food/reference-databases-and-monitoring-programs-food/fda-total-diet-study-tds)

As part of the modernization of the FDA Total Diet Study (TDS) we moved from single-analyte to multi-analyte methods to analyze TDS samples. The move to multi-analyte methods has provided us with more sensitive methods (able to detect lower concentrations), more accurate methods (these methods are prone to less interference and are therefore considered more robust) and more efficient methods (cost effective).

We group the analytes measured in the TDS into three broad categories: elements (both nutrient elements and toxic elements), pesticides and radionuclides.

Elements (nutrient elements and toxic elements)

We measure naturally occurring nutrient and toxic elements that have historically been of potential concern in the food supply.

Analytes	Method
Calcium (Ca) Copper (Cu) Iron (Fe) Magnesium (Mg) Phosphorus (P) Potassium (K) Sodium (Na) Strontium (Sr) Zinc (Zn)	EAM 4.4

Analytes	Method
Arsenic (As) Cadmium (Cd) Chromium (Cr) Lead (Pb) Manganese (Mn) Mercury (Hg) Molybdenum (Mo) Nickel (Ni) Selenium (Se) Uranium (U) Vanadium (V)	EAM 4.7
Antimony (Sn) Arsenic (As) Barium (Ba) Beryllium (Be) Cadmium (Cd) Chromium (Cr) Copper (Cu) Iron (Fe) Lead (Pb) Manganese (Mn) Mercury (Hg) Nickel (Ni) Selenium (Se) Thallium (Tl) Uranium (U) Zinc (Zn)	EAM 4.12
Inorganic arsenic (iAS) Dimethylarsinic acid (DMA-organic form of As) Monomethylarsonic acid (MMA-organic form of As)	EAM 4.10 EAM 4.11

Analytes	Method
Iodine (I)	EAM 4.13

Elemental Analysis Method (EAM) (/food/laboratory-methods-food/elemental-analysis-manual-eam-food-and-related-products):

Elemental Analysis Method (EAM) 4.4 – Inductively Coupled Plasma-Atomic Emission Spectrometric Determination of Elements in Food Using Microwave Assisted Digestion

EAM 4.7 – Inductively Coupled Plasma-Mass Spectrometric Determination of Arsenic, Cadmium, Chromium, Lead, Mercury, and Other Elements in Food Using Microwave Assisted Digestion

EAM 4.10 – High Performance Liquid Chromatography-Inductively Coupled Plasma-Mass Spectrometric (HPLC with ICP-MS) Determination of Four Arsenic Species in Fruit Juice

- *We use HPLC with ICP-MS to measure inorganic arsenic concentrations in some TDS samples (rice-containing foods, juice, and wine) when the total arsenic concentration exceeds a specified level. We use HPLC to separate the inorganic and organic arsenic species, and measure the concentrations of inorganic arsenic using ICP-MS.*

EAM 4.11 - Arsenic Speciation in Rice and Rice Products Using High Performance Liquid Chromatography-Inductively Coupled Plasma-Mass Spectrometric Determination

EAM 4.12 – Draft Method for Analysis of Bottled water for 18 Elements by ICP-MS

EAM 4.13 – Inductively Coupled Plasma-Mass Spectrometric Determination of Iodine in Food Using Tetramethyl Ammonium Hydroxide Extraction

Pesticides

We look for over 400 pesticides, as well as many metabolites and degradates related to pesticides that may be present in the food supply. Many of these are pesticides for which the EPA has established tolerance levels (health protective, maximum concentrations of pesticides in or on food).

Analytes	Method
GC-MS/MS Pesticide list (211 analytes)	Gas chromatography with tandem mass spectroscopy (GC-MS/MS)
LC-MS/MS Pesticide list (247 analytes)	Liquid chromatography with tandem mass spectroscopy in positive ion mode (LC-MS/MS)
Acid herbicides list (36 analytes)	Liquid chromatography with tandem mass spectroscopy in positive and negative ion mode (AcH)

Radionuclides

For TDS, we are primarily concerned with measurement of radionuclides in foods from fallout related to weapons testing and naturally occurring radionuclides. We use a radionuclide analysis approach that measures the radionuclides expected to give the greatest health risk from radiological events. A very broad-based gamma-ray analysis (WEAC.RN.METHOD 3.0, Winchester Engineering and Analytical Center (https://www.fda.gov/science-research/field-science-and-laboratories/winchester-engineering-analytical-center-weac), "Determination of Gamma-Ray Emitting Radionuclides in Foods by High-Purity Germanium Spectrometry") is performed that covers nearly all relevant radionuclides. A separate analysis is conducted for strontium-90 (WEAC.RN.METHOD 2.0, "Determination of Strontium-90 in Foods by Internal Gas-Flow Proportional Counting"), because this can be a significant contributor to mixed-radionuclide events, such as those involving nuclear power reactors, and radiological dispersal devices (also known as "dirty bombs"). These analytical methods detect radioactive contaminants at trace levels, far below levels that would be of health concern.

Analytes	Method
^{137}Cs ^{40}K	WEAC.RN.METHOD 3.0
^{90}Sr	WEAC.RN.METHOD 2.0

If you have questions about the FDA Total Diet Study, email TDS@fda.hhs.gov (mailto:TDS@fda.hhs.gov).

Was this helpful? Yes No