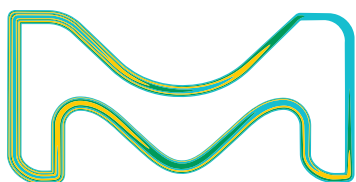


MERCK

pesticide standards

**For Food &
Environmental
Analysis**



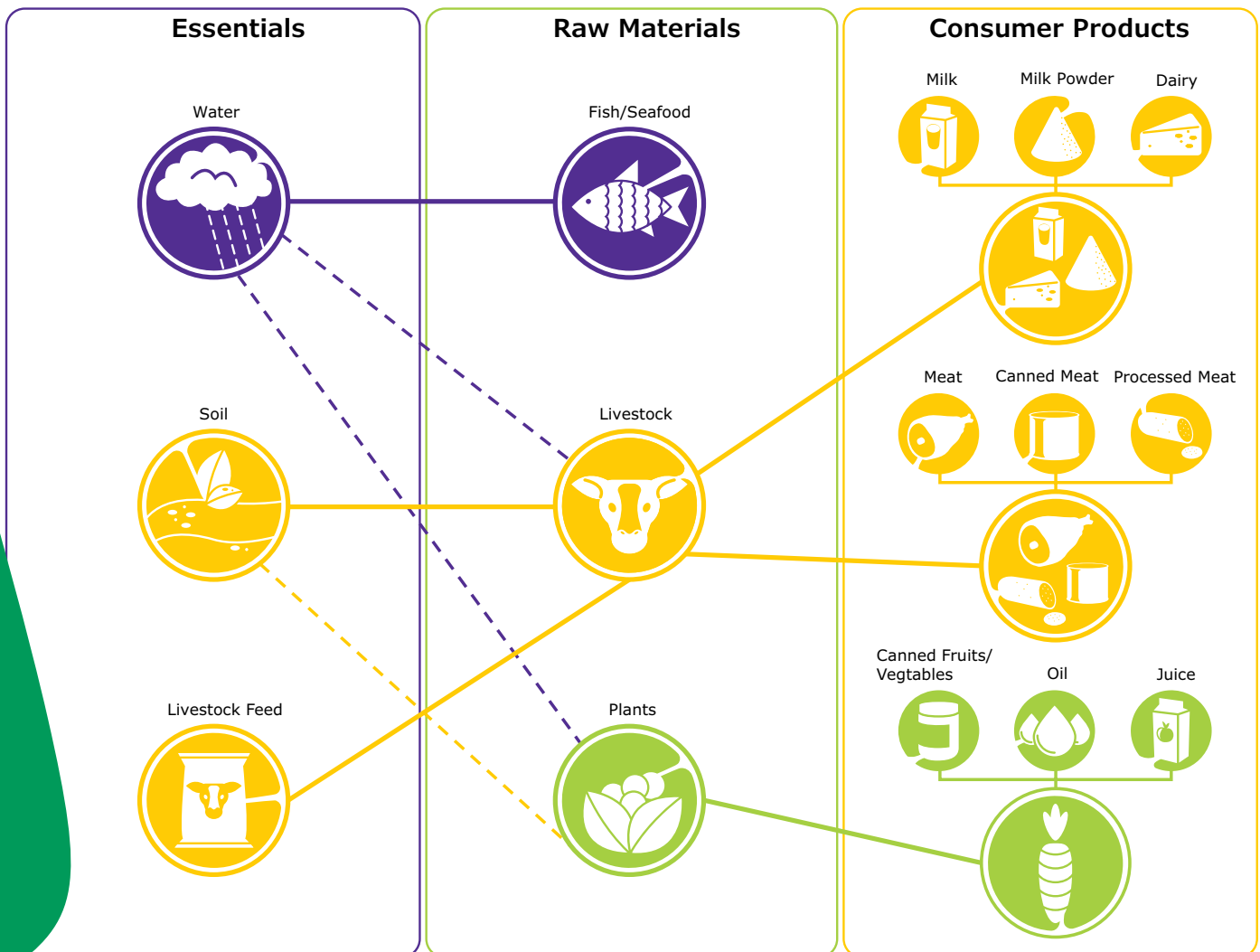
The Life Science business
of Merck operates as
MilliporeSigma in the
U.S. and Canada.

Supelco®
Analytical Products

pesticides in your path

Pesticides are substances, biological or chemical, or mixture of substances intended to prevent, destroy, repel or mitigate pests. They also include substances used to regulate plant growth or defoliate unwanted plants. Targeted pests include insects, rodents, weeds, plant pathogens, and mollusks. Basically, pesticides are used to control organisms that destroy, cause nuisance, spread disease or are vectors for disease.

Pesticides are released into the environment in order to eliminate pests, but residues can also end up in the air, water, soil, and even in our food. Our pesticide standards can support you in accurately monitoring the safety and quality of soil, water, and food in compliance with national and international standards.

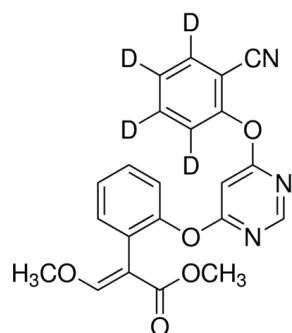


Application Workflow

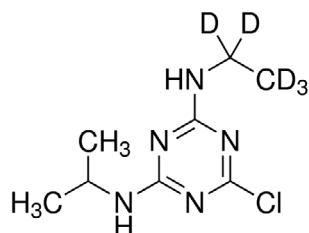
sample preparation & internal standards

Internal Standards: Isotope labeled pesticides

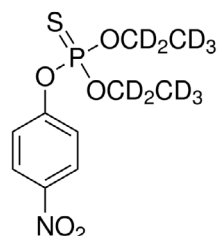
- Added to samples before and/or after extraction to allow for quantitation by MS or MS/MS. The use of internal standards can often compensate for matrix interferences and/or loss of analyte during sample preparation.
- Our offering of isotope labeled pesticides includes ^{13}C , ^{15}N and deuterium (D) labeled



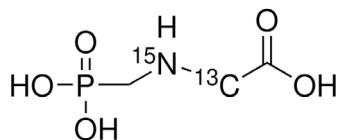
51949 Azoxystrobin-
(cyanophenoxy- d_4)



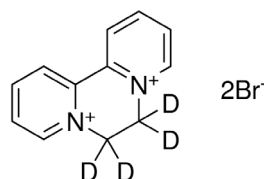
34053 Atrazine- d_5



33452 Parathion-ethyl- d_{10}



94079 Glyphosate-2- ^{13}C , ^{15}N



03627 Diquat dibromide-(ethylene- d_4)

Sample Prep - Reliable Results

The right SPE products and accessories are essential to both extraction and cleanup within pesticide testing workflows. Our offering can support every step with method-specified SPE tubes and disks, such as our ENVI™ SPE and Supel™ QuE QuEChERS lines of products. For QuEChERS we offer extraction and cleanup products for both AOAC 2007.1 and EN 15662 methodologies. For improved sample cleanup, our Z-Sep zirconia coated silica material is designed to further reduce interference from co-extracted fatty compounds while maintaining analyte recovery. We also offer accessories for optimizing both SPE and QuEChERS sample prep workflows, including our PTFE-free VisiPrep™ SPE manifold, and QuEChERS shaker.

For a complete listing of products, please visit:
[SigmaAldrich.com/SPE-and-quechers](https://www.sigmaaldrich.com/SPE-and-quechers)

Solid-phase microextraction (SPME) is a solvent-free extraction technique that is suitable for both direct and headspace extraction of a variety of analytes and matrices. As the first company to introduce commercial SPME and market leader, we offer the most comprehensive line of SPME fibers and accessories available. This includes unique fiber configurations such as our dual-layer DVB/Carboxen®/PDMS fiber suitable for analytes in a wide molecular weight range, and overcoated DVB fiber for semivolatile compounds from complex matrices by direct immersion extraction.

For the complete listing of SPME products, please visit:
[SigmaAldrich.com/SPME](https://www.sigmaaldrich.com/SPME)

Our complete workflow solutions for analysis of pesticides includes labware, sample vials, solvents, reagents, and HPLC and GC columns.

sample Analysis & calibration

Choose the Pesticide Standards to Fit Your Needs **TraceCERT®** Certified Reference Materials (CRMs) & Pestanal® Analytical Standards Neats, Solutions & Mixes

TraceCERT® Certified Reference Materials (CRMs)

For ISO/IEC 17025 accredited labs, it is mandatory to show metrological traceability of all measurement results to an appropriate reference (such as the International System of Units or SI), therefore certified reference materials (CRMs) must be used for calibration. Our expanding **TraceCERT®** product portfolio includes CRMs for pesticides. They are produced and tested at our ISO 17034, ISO/IEC 17025 accredited facilities. This double accreditation is the highest achievable quality level for reference material producers, ensuring the quality of the products we provide to you.

Our neat CRMs are certified by quantitative NMR (qNMR), a relative primary technique with high precision and low associated uncertainty, and are traceable to NIST standard reference materials (SRM). CRM solutions are produced gravimetrically using NIST traceable weights for balance calibration. With **TraceCERT®** CRMs, you can expect:

- A comprehensive reference material certificate (RMC, also known as a "CoA") with per ISO 33405:2024 (formerly ISO guide 35) properly calculated uncertainties – taking into account homogeneity and stability. An expiration date stated on the RMC/CoA
- Convenient packaging, optimized for better stability
- Fit-for-purpose for use as calibration standards, internal standards, surrogates, spiking solutions or laboratory control samples.
- A variety of formats: neat, single-component solutions, or multi-component solutions

Pestanal® Analytical Standards

For routine analytics, the Pestanal® portfolio of analytical standards offers:

- >800 neat standards, including metabolites and isotopically labeled compounds
- An RMC/CoA with an expiration date and chromatogram

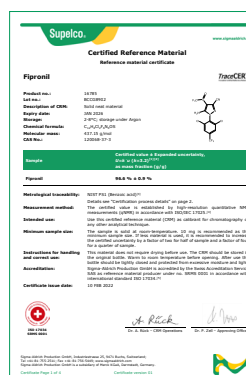
Click here to learn more:

Pesticide Analytical Standards

Pesticide Metabolites

An active pesticide compound may be converted by the target insect or plant, or may be degraded in the environment. Thus, monitoring of these transformation compounds is important to ensure accurate measurements.

Our pesticide metabolite portfolio includes both **TraceCERT®** CRMs and Pestanal® analytical standards.



Looking for a GC or HPLC column for your pesticide method?
Visit us at [SigmaAldrich.com/chromatography](https://www.sigmaaldrich.com/chromatography)



Click on the links below to browse the different pesticide classes in our portfolio of reference materials.

[Herbicides](#)

[Insecticides](#)

[Fungicides](#)

**[Growth
Regulators](#)**

[Acaricides](#)

**[Algicides](#)
[Molluscides](#)
[Bactericides](#)**

[Rodenticides](#)

[Nematicides](#)

[Pesticide Mixes](#)

quality assurance

Matrix CRMs

Organic and inorganic compound matrix CRMs are extremely valuable in the validation of analytical methods. Their primary role is to ensure optimization of the method, however they are also important for use as:

- Quality control tools for assuring ongoing performance of a method and the validity of the associated results.
- A benchmark for comparing measurements between different laboratories

We offer a variety of different natural matrices, including incurred and fortified. Most are method specific, and all are supplied with documentation that provides:

- Measured value plus associated uncertainty
- Expanded uncertainty with confidence level
- A prediction value, in addition to the mean value and standard deviation from the mean



conventions, regulations & testing programs

Conventions

Persistent organic pollutants (POPs) are stable, hydrophobic molecules that are a threat to human health and the environment. They can bioaccumulate through the food chain and pose significant health risks such as cancer, birth defects and reproductive disorders.

In 2001 the **Stockholm Convention** was organized under the guidance of the United Nations Environment Program (UNEP) to eradicate the most dangerous of these chemicals. Its activities commenced in 2004 with the listing of 12 of the most dangerous POPs – often referred to as “the dirty dozen”. Additions have been made continuously to this list since then, and include more pesticides and some brominated flame retardants and PFAS compounds.

Prior to Stockholm, the growth in chemical production and trade during the last 3 decades raised concerns due to the potential risks posed by hazardous chemicals and pesticides. In response, in 1985, the UNEP and the Food and Agriculture Organization of the United Nations (FAO) adopted the “Code of Conduct on the Distribution and Use of Pesticides” to set guidelines on pesticide management, and to encourage government and industry to adopt practices that minimize harm to human health and the environment.

In 1989, a Prior Informed Consent (PIC) procedure from UNEP and FAO was introduced, resulting in a joint convention text known as the **Rotterdam Convention**. The Convention was officially adopted in 1998 and promotes communication and shared responsibility between countries for import and use of hazardous chemicals. Annex III of the Convention lists chemicals that are banned or severely restricted in multiple countries. Additional chemicals have been added to the list over the years, with the last being Acetochlor and Iprodione, added in 2023.

The **Basel Convention** went into effect in 1992, and is an international treaty that regulates the transboundary movements of hazardous wastes, as well as their disposal. The chemical descriptions of the wastes covered under the convention have been continuously amended over the years to cover issues such as plastic waste and e-waste.

Regulations

More than 1000 active ingredients are currently registered as pesticides worldwide. They are heavily regulated by both national and international regulatory bodies. For example:

- European Regulation (EC) No. 1107/2009
- U.S. Environmental Protection Agency (US EPA)
- Brazil Pesticide Law 14785
- Pesticides Management Bill, 2020 (India)

Testing Programs

Testing programs in both Europe and the United States exist to monitor for pesticide residues in commonly consumed foods. In Europe, this program is known as the **Multi Annual Pesticide Control Program (MACP)** and is a requirement for EU member states under Regulation (EC) No. 396/2005. In the United States, a similar program exists, the **Pesticide Data Program (PDP)**, which is conducted by the U.S. Department of Agriculture (USDA).

As a result of these conventions, regulations and testing programs, methods have been developed to test for pesticide residues in food, feed, drinking and waste water, and soil.

We offer pesticide and other organic pollutant reference materials for many of the targeted chemicals.

Click on the links below to learn more.

Supelco®

Analytical Products

Merck KGaA
Frankfurter Strasse 250
64293 Darmstadt, Germany

SigmaAldrich.com

Application Workflow

Are you interested in applications for analysis of pesticides? Visit our website to see detailed workflow applications illustrating the use of our reference materials and other products.

Looking to optimize your testing workflow? Follow the links below to view and download **our guides for sample preparation and chromatographic analysis.**

Sample Preparation

[SPE guide](#)

[QuEChERS guide](#)

[SPME guide](#)

Chromatographic Analysis

[HPLC column selection](#)

[HPLC method development](#)

[GC column selection](#)

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[SigmaAldrich.com/solvents](https://sigmaaldrich.com/solvents)

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