ISO Technical Committee 229 "Nanotechnologies"

Dr. Vladimir Murashov

Chair, ANSI-Accredited U.S. TAG to ISO/TC 229

ANSI

American National Standards Institute

Background on ISO/TC 229 *Nanotechnologies*



- ISO Technical Committee 229, *Nanotechnologies*
  - Established in June 2005
  - Led by the British Standards Institute (BSI)
    - Chaired by Dr. Denis Koltsov, UK
  - U.S. is one of 40 participating member bodies and 17 observers
  - September 2024 – 111 documents published (IS, TS, TR)
  - September 2024 – 25 Projects in progress (not including 17 Preliminary Work Items under development)

Complete list of published works here

Scope

- Understanding and control of matter and processes at the nanoscale, typically, but not exclusively, below 100 nanometers in one or more dimensions where the onset of size-dependent phenomena usually enables novel applications

- Utilizing the properties of nanoscale materials that differ from the properties of individual atoms, molecules, and bulk matter, to create improved materials, devices, and systems that exploit these new properties



ISO/TC 229 Organizational Relationship to ANSI and the U.S. Technical Advisory Group (TAG)

ISO

ANSI

US Experts

ANSI-ACCREDITED U.S. TAG
ISO TC 229 - NANOTECHNOLOGIES

How Is ISO TC 229 Organized?


Sustainability, Consumer and Societal Dimensions TG
(Chaired by the U.S.)

ISO/TC 229 Nanotechnologies
Secretariat: United Kingdom
Chair: Dr. Denis Koltsov

ISO/TC 229 Chairman's Advisory Group (CAG)

40 Participating Countries
17 Observing Countries

ANSI-ACCREDITED U.S. TAG
ISO TC 229 - NANOTECHNOLOGIES

JWG 1
Terminology and Nomenclature
Leadership: Canada (SCC)

JWG 2
Measurement and characterization
Leadership: Japan (AIST)

WG 3
Health, safety and environment
Leadership: USA (ANSI)

WG 4
Materials specifications
Leadership: China (SAC)

WG 5
Products and applications
Leadership: Korea (KATS)

Update on recently added ISO/TC 229 Projects

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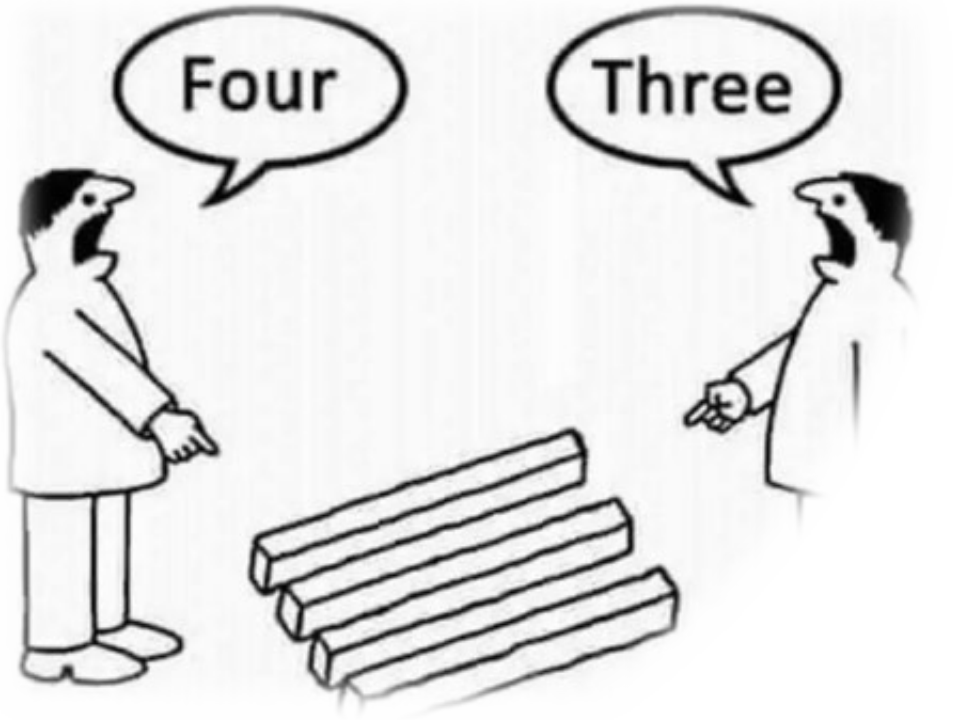
Why Terminology?



Terminology has impacts:

- Trade
- Regulations
- Science

But perspective can differ.

Consistency and clarity in communication is essential!

ISO TC 229 Joint Working Group 1 Terminology and Nomenclature

WG 1 Scope: Define and develop unambiguous and uniform terminology and nomenclature in the field of nanotechnologies to facilitate communication and to promote common understanding.

- Project title: *Nanotechnologies—Vocabulary—Innovations in Materials and Technology*
- Country of leadership – United States

Defining Advanced Materials… (contd.)



3.3.4
advanced material
material with significant improvements in properties or performance for a specific application or measure

Note 1 to entry: Some advanced materials gain their improved properties through modification of their internal or surface structure.

Note 2 to entry: Some but not all advanced materials are created by an **advanced technology (3.2.3)**.

Note 3 to entry: Some but not all nanomaterials are **advanced materials (3.3.4)**.

Note 4 to entry: Advanced materials can be, but are not always **complex materials (3.3.3)**.

Note 5 to entry: Materials that are considered to be advanced materials today are anticipated to be displaced or to become conventional materials in the future.

Note 6 to entry: Might include new functionality or emergent properties of a material

Note 7 to entry: significant improvements in performance and properties relate to conventional materials (when they exist)

Note 8 to entry: Commonly used in **advanced technologies (3.2.3)** or **specialty applications (3.2.5)**

Note 9 to entry: improvements in properties or performance can be related to efficiency, sustainability, capability or other measures

Quantum phenomena in nanotechnology

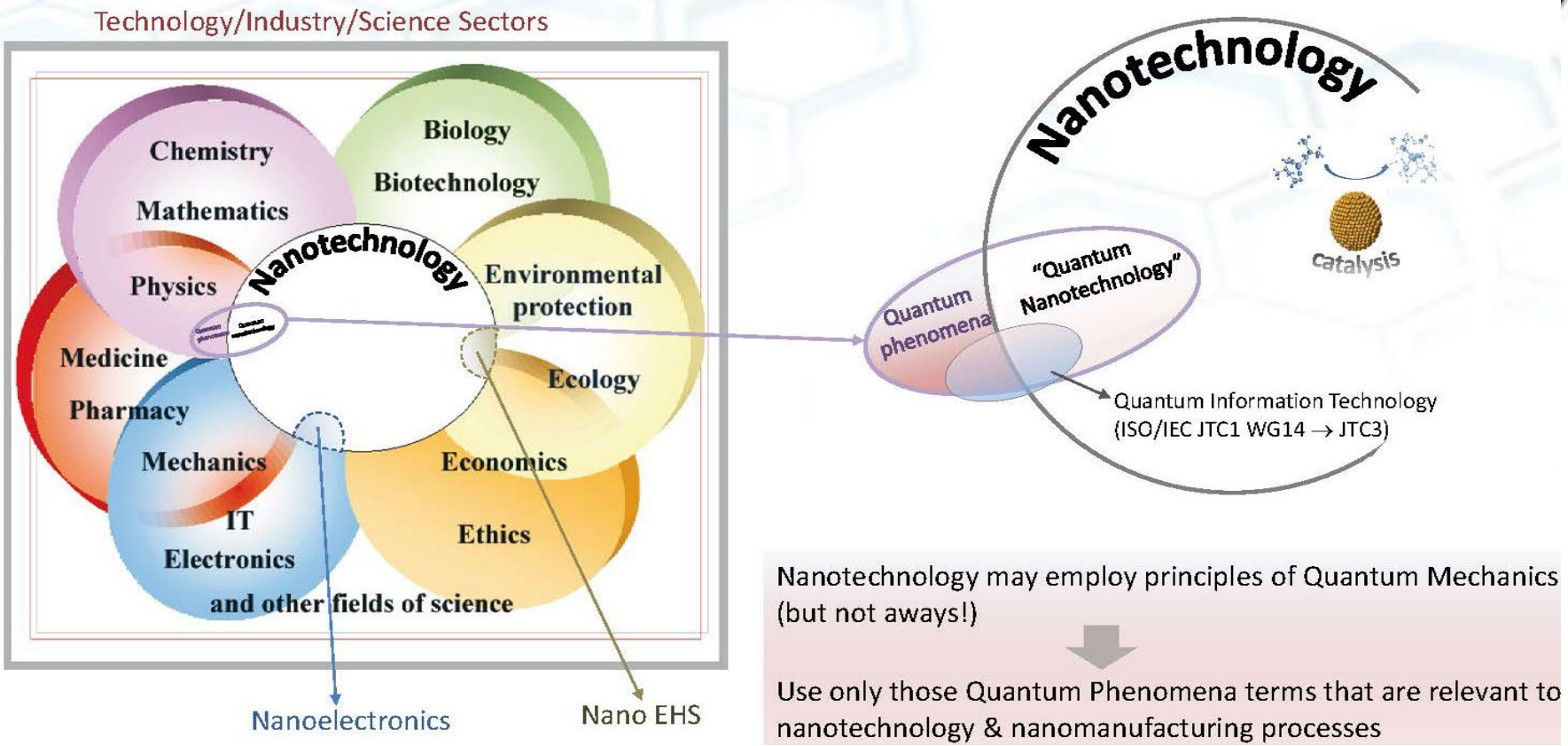


- Project title: *Nanotechnologies — Vocabulary — Part 12: Quantum phenomena in nanotechnology*
- Country of leadership – United States
- Relationship or combination of nanotechnology and quantum effects is important for the identification of nano-enabled products and for the development of nanotechnology

Revision of existing version

How quantum relates to nanotechnology





Nanotechnology may employ principles of Quantum Mechanics (but not aways!)

Use only those Quantum Phenomena terms that are relevant to nanotechnology & nanomanufacturing processes

JWG2: Measurement and Characterization

Strategic Objectives:

- To develop measurement and characterization standards for use by industry in nanotechnology-based products.
- To work closely with all the ISO/TC229 working groups in producing standards of common interest by developing the necessary characterization, measurement and test standards.

ISO TC 229 Joint Working Group 2 Measurement and Characterization

WG 2 Scope: The development of standards for measurement, characterization and test methods for nanotechnologies, taking into consideration needs for metrology and reference materials

- Project title: *Nanotechnologies -- Total and free drug quantitation in doxorubicin hydrochloride liposomal formulations*
  - Country of leadership – United States
  - For liposomal drug products, the drug substance may be encapsulated within the liposome or can be free. Understanding where the drug substance lies is important for understanding drug efficacy.
  - This standard will impact drug producers, drug regulators (FDA) and ultimately end users of liposomal drugs.
  - Status: Draft development in progress and recruiting for interlaboratory studies

ISO TC 229 Joint Working Group 2 Measurement and Characterization

- Project title: *Nanotechnologies - Measurement technique matrix for the characterization of nano-objects*
  - Country of leadership – United States
  - There is a need for a concise document that quickly connects common nano-object parameters with corresponding measurement methods. Also of interest are relevant documentary standards, the generalized cost of the instrumentation, and the time required to do such a measurement.
  - Revision of this document to be a Technical specification

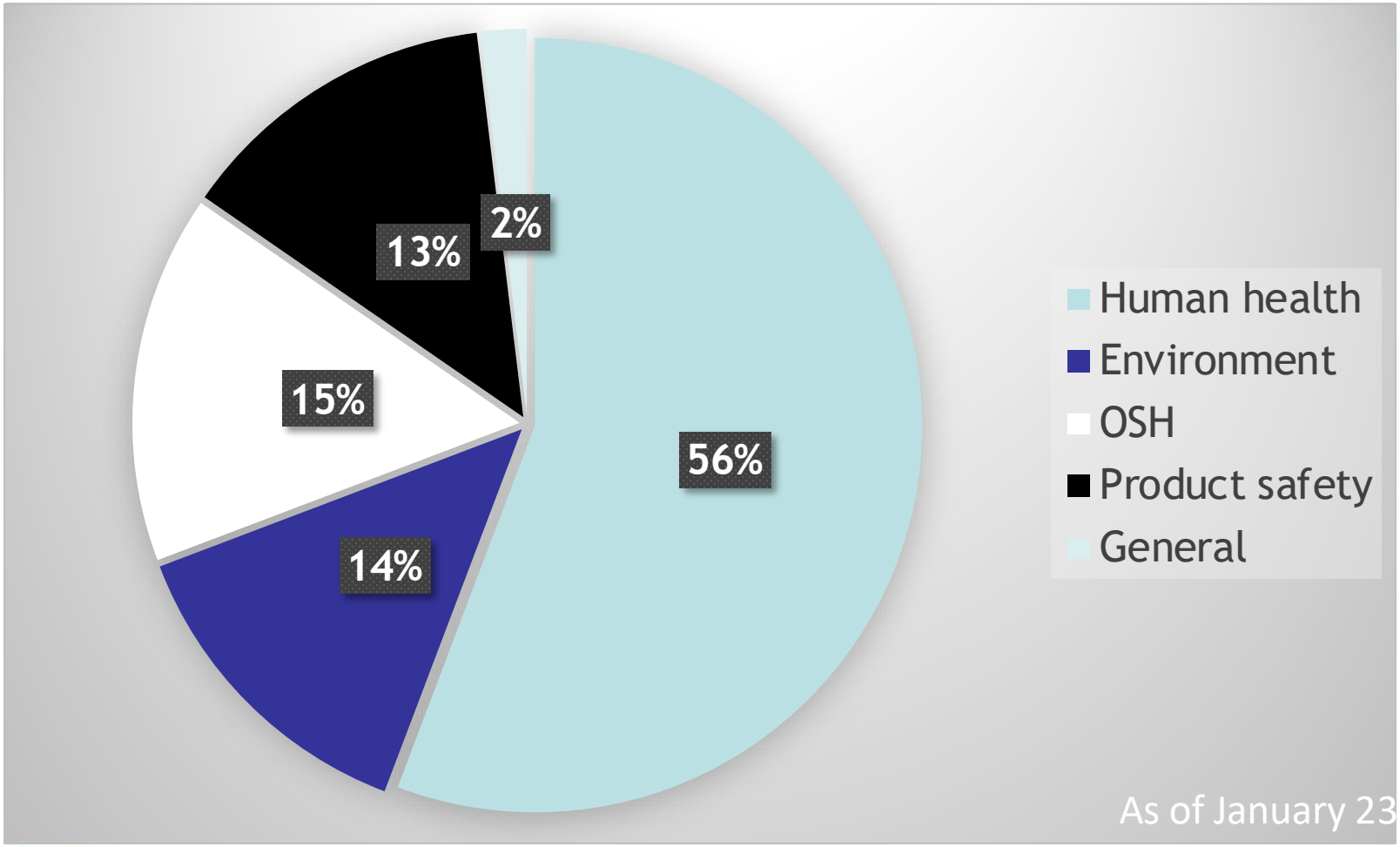
Measurement technique matrix



Technique									
	Acronym	Chemical composition	Concentration	Crystal properties	Electrokinetic potential	Shape	Size	Size distribution	Surface area
Acoustic spectroscopy			+				+	+	
Analytical centrifugation	AC							+	
Aerosol particle mass analyser	AMS		+				+		
Auger electron spectroscopy (scanning)	AES	+	+			+	+		
Brunauer-Emmett-Teller	BET								+
Condensation particle counter	CPC		+						
Differential mobility analysis system[a]	DMAS		+				+	+	

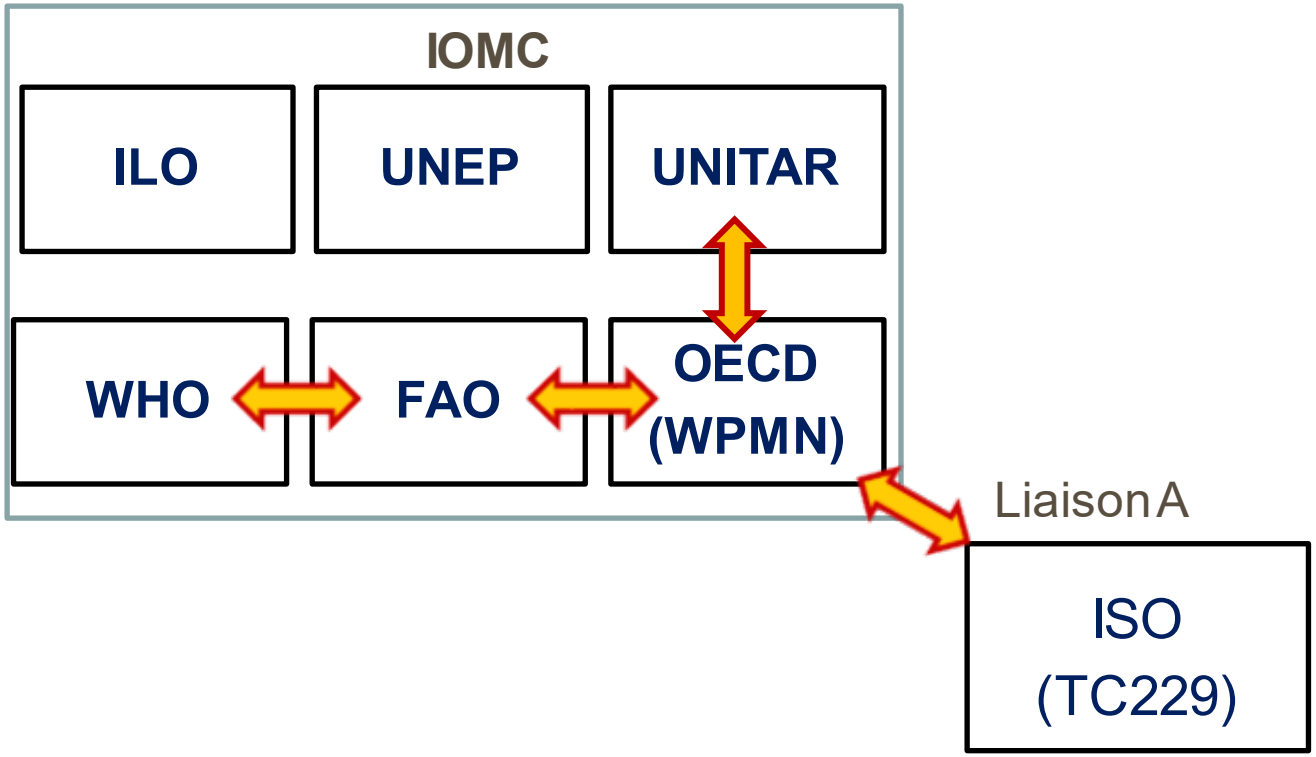
WG 3 projects by application area (Total 43, published 34)





Collaborations with international organizations





ISO TC 229 WG 3 Health, Safety and Environment



Project 1: **Safety assessment of nanomaterials for use as fertilizers in agriculture**

- **Leadership:** United States
- **Opportunity:** Nanomaterials, including metals and carbon nanotubes, are being used as fertilizers
- **Issue:** Currently, there are no standardized protocols to either determine the efficiency of nanomaterials as fertilizers or to confirm the safety of nano-fertilizers for both consumers and the environment
- **Concerns:** How much? How often? What conditions? What formulations? How do we determine human and ecological safety?

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ISO TC 229 WG 3 Health, Safety and Environment



Project 2: Sampling method to assess dermal transfer of metal and metal oxide nano-objects released from wood and wood surfaces

- **Leadership:** United States
- **Method:**
  - to determine potential risks of nanomaterials used in consumer products
  - based on exposure to the migration from wood onto hands and materials and potential chemical exposure to humans (e.g., pressure-treated wood used in children's playsets)
- **Impact:** Consumers utilizing pressure-treated wood products, manufacturers, potential impact workers (similar exposure scenarios)
- **Status:** The document to be submitted for NWIP in September 2024.

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ISO TC 229 WG 4 Materials Specifications



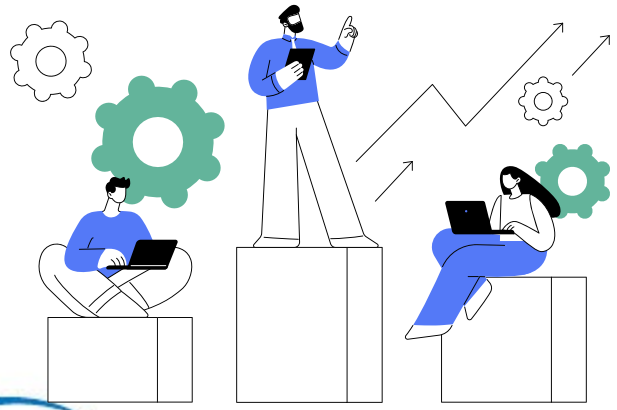
- WG 4 scope: specify relevant compositions and properties and characteristics of manufactured nanomaterials

*Excluded are areas of duplication in other ISO and IEC technical committees.

- Project: *Nanotechnologies –Classification framework for graphene-related 2D materials*
- Country leader: United States

Classification framework for graphene-related 2D materials

- provides stakeholders with standardized methodology
  - used to characterize GR2M
- establishes, describes transparent method of classifying, comparing all GR2M
- supplies the basis for material specification data sheets
  - containing a minimum set of data
- gives a framework
  - can be used equally by producers, users, and regulators



End Result

Syntax for consistent naming, descriptions, and Standardized Technical Data Sheets

ISO TC 229 WG 5
Products and applications

WG 5 Scope: *Development of performance-based standards for nano-enabled or nano-enhanced products and applications*

WG 5-developed standards identify, describe, and/or specify performance characteristics of nano-enabled or nano-enhanced products and applications.

Nanotechnology-related industries have been moving from research phase to commercialization. It is beneficial to develop standards to ensure optimal performance of nano-enabled or enhanced products and applications.

WG 5 project: *Nanotechnologies — Performance characteristics of nanosensors for chemical and biomolecule detection — Part 2: Analytical performance*



- Country of leadership: United States
  - Nanotechnology-enabled sensors can provide performance enhancements compared to conventional systems, in addition to creating entirely new sensing modes
  - This document describes techniques for isolating the analytical performance of nanotechnology enabled or nanotechnology enhanced components in sensor systems, focusing on electronic biosensors with an appendix that provides generalized guidance.

TC 229 Future Work Areas

- Nanoplastics
- 2-d materials
- Liposomes
- Exposure assessments

Why participation in nanotechnology standardization is important!

- **Place where government officials, industry leaders and representatives, academics, scientists and NGOs come together to collaborate to responsibly bring nanotechnology into use in commerce**
  - Opportunity to work with a wide range of stakeholders at the domestic and international levels
- **Influence international standards that:**
  - Are frequently conditions of international commerce that can have a direct impact on your business
  - May be adopted by regulators or affect regional and national regulatory policies
- **Opportunity to develop U.S. positions and advocate for them at the international level**
  - You get to be in the game, not watch from the sidelines

Benefits in participating in the U.S. TAG to ISO/TC 229



- Benefits to participating:
  - Ability to initiate new standards that are relevant to your industry/organization
  - Directly influence ISO standards under development which may effect your industry, organization or area of interest
  - Access to professional counterparts and potential clients/ business and/or research partners at home and around the world
  - Increase communication and cooperation amongst a wide range of stakeholders