[D7.3] REPORT ON THE STANDARDIZATION LANDSCAPE AND APPLICABLE STANDARDS

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1. EXECUTIVE SUMMARY

This document is part of the deliverables scheduled within WP7, "Dissemination, Clustering and Exploitation", specifically the first deliverable of Task 7.4 about Standardization activities of INNOMEM project. This task will use the standardization system to facilitate the acceptance and utilisation by the market of the developed solutions and to ensure compatibility with what already exists in the market.

INNOMEM aims at developing a sustainable Open Innovation Test Bed to foster deployment and scale-up of innovative nano-enabled membranes and their derived products through a sustainable framework ensuring a competitive, quality, safe and environmentally friendly production in compliance with the applicable regulations and standards.

Therefore, this first deliverable on standardization aims at providing a report on the standardization landscape and applicable standards relevant to INNOMEM project, activities and products.

INNOMEM project will achieve its objectives with the upscaling and upgrading of 14 pilot lines to get a sustainable manufacturing complemented with technological and nontechnological services to support companies for further development of marketable nanoenabled membrane products. Among the technological services following aspects will be covered:

- Design, modelling and simulation
- Testing and characterization
- Sustainability

Additionally, different materials, geometries and applications are covered in INNOMEM project:

- polymeric, ceramic, metallic and nanocomposites
- membrane geometries (flat sheet, tubular and hollow fiber) adapted for serial and continuous production.
- main functions expected by the markets: higher selectivity, improved chemical resistance, higher permeation rates, process intensification.

Standardization analysis carried out has been conducted considering above mentioned aspects and how standardization can impact in these areas, during project development but also in the future.

This document starts with a short introduction to standardisation, helping to understand what it is and how it works. It identifies the key players at International and European level and provides information on the different kinds of standardisation deliverables, as well as practical information regarding its coding. Useful information on the abbreviations and acronyms commonly used in standardisation are also given.

Additionally, it has been prepared to guide the partners about the published standards and standards under development that can be applicable to INNOMEM project as well as the technical committees involved. This will be the starting point to identify standardization gaps considering the results of the project.

The main technical committees identified and for which more information is provided are the ones related to nanotechnologies, at European and international level, although others have been identified that have been considered of interest and applicable for the INNOMEM applications and the sustainable framework expected.

This deliverable will be followed by others under task 7.4 serving as a basis for them:

- Report on the contribution to the ongoing and future standardization developments
- Report on Test Beds coordination on standardization
- Guide for the use of standardization by Test Bed users.

2. PUBLISHABLE SUMMARY

Deliverable D7.3 *Report on the standardization* landscape and applicable standards is the first of a set of deliverables related to standardization activities, which aims at providing a first overview of the technical bodies and documents applicable to INNOMEM project.

Standardization activities have been considered a relevant element to facilitate and trigger the acceptance and utilisation of project results in the market. As a first step, a brief introduction to the standardization system is included in the deliverable, giving way afterwards to a description of selected technical bodies within European and International Standardization Organizations considered relevant for the project and its objectives.

Focus has been put on the documents produced and activities carried out by European and International groups on nanotechnologies (CEN/TC 352 and ISO/TC 229), but also on other documents and technical groups supporting specific aspects like health, safety or environmental aspects of nano-manufacturing.

Description of other technical bodies related to INNOMEM applications and products are included as well, and specifically, information on technical groups devoted to the standardization of sustainability manufacturing aspects.

After the analysis carried out, next steps are outlined.

3. METHODOLOGY & APPROACH

For the identification of technical committees, standards and standards under development relevant for INNOMEM project the following considerations have been taken into account:

- A list of key areas has been taken as starting point for the search, considering, on one hand, the products covered by the project, the pilot lines to be upscaled and upgraded, the democases that will show evidence of different possible applications… and on the other hand, the aim and goals of the project for the development of a sustainable production framework enabling sustainable manufacturing processes and ensuring products and ecosystems complying with relevant quality, environmental and safety requirements.

- Given the core products of the project, the nanoenabled membranes, the analysis has focussed on the standards and technical committees related to nanotechnologies, including different perspectives (from measurement and characterization to health, safety and environmental aspects and sustainability and societal dimensions).

- Nevertheless, information on other technical committees considered relevant for INNOMEM project in some respect is provided, although non exhaustive details on standards and works under development has been included.

- In line with the above, some other technical committees, although covering aspects related to nanotechnologies, nanoparticles or nanoproducts, were discarded as the scope were considered far from the fields of INNOMEM project.

- The search covered mainly the European standardization developed by the European Committee for Standardization (CEN), and International standardization developed by the International

Organization for Standardization (ISO). However, specific references to other organizations can also be found in the document (e.g. specific ASTM bodies).

- Finally, proper identification of committees and standards relevant for sustainability and sustainable manufacturing have been identified, considered useful for developing a sustainable manufacturing framework.

- Among the non-technological services for sustainable and cost-effective manufacturing, advice on the use of standardization is considered and therefore the content of this document aims at being the basis for future detection of standardization needs and gaps. Proper training and guidelines are to be defined to adequately guide INNOMEM partners.

4. SHORT INTRODUCTION ABOUT STANDARDIZATION

4.1 GENERAL

A standard is an agreed definition or specification of a unit, method, product, process or service, voluntary in its application, developed by consensus in a standardization body and made publicly available.

Standards provide people and organizations with a basis for mutual understanding and are used as tools to facilitate communication, measurement, commerce and manufacturing. The initiative to develop a standard is taken by interested stakeholders who consider that a particular standard could address specific needs.

Standards are everywhere and play an important role in the economy, by:

- facilitating business interaction, market development and eliminating barriers
- enabling companies to comply with relevant standards, laws and regulations
- speeding up the introduction of innovative products to market
- providing interoperability between new and existing products, services and processes.

Standards form the basis for the introduction of new technologies and innovations, and ensure that products, components and services supplied by different companies will be mutually compatible.

Standards also disseminate knowledge in industries where products and processes supplied by various providers must interact with one another. Standardization is a voluntary cooperation among industry, consumers, public authorities, researchers and other interested parties for the development of technical specifications based on consensus.

Standardization is identified in FP7 and Horizon 2020 as one of the innovation-support measures by bridging the gap between research and the market and helping the fast and easy transfer of research results to the European and international market.

Standards are voluntary technical documents. They are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others. These experts are organized in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) or Working Groups (WGs). These TCs are included in the structure of the Standardization Organizations (National, European and International, with the respective mirror committees) and work following their internal regulations.

The standardization bodies operate at National (UNE, AFNOR, BSI, DIN, etc.), Regional - in our case European - (CEN, CENELEC, ETSI) or International (ISO, IEC, ITU) level. Sometimes there are different standardization bodies at the same level but covering different fields. This is the case of ISO (general), IEC (electrical) and ITU (telecommunications) at International level, or CEN, CENELEC and ETSI at European level in the same way.

There are also different kinds of standardization documents. The most widespread is the standard, which has a different code depending on the organization under it was developed. e.g. EN for European Standards, ISO for International standards. Other types of documents are Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (CWA). Further Amendments to the standards are identified by adding A1, A2, etc. at the end of the standard code.

At European level, all the members of CEN shall adopt EN standards as national standards and must withdraw any existing national standard which could conflict with them. A summary of the characteristics of the different standardization documents can be found in table 1.

Table 1 – Characteristics of different standardization documents

Type	International code	European code	National code	Main characteristics
Standard	ISO IEC	EN	UNE, NF, BS, DIN, etc. When adopting: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc.	• Elaboration: 3 years • 2 steps of member approval • European: compulsory national adoption Revision: every 5 years
Technical Specification	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc.	• Elaboration: 21 months • 1 step of member approval or internal approval in TC • European: optional national adoption Revision: at 3 years (upgrading to EN or deletion)
Technical Report	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc.	• Elaboration: free timeframe • Internal approval in TC • European: optional national adoption No revision required
Workshop Agreement	IWA	CWA	Variable	• Elaboration: free timeframe (usually few months) • Internal approval in the Workshop • European: optional national adoption Revision: at 3 years (upgrading to EN or deletion)

European and International Standardization Organizations (e.g. CEN and ISO) have signed formal agreements in order to avoid duplication of efforts and promote global relevance of standards, which allows to adopt or develop in parallel each other's standards with the same content and code.

The technical collaboration between ISO and CEN was formalized through the Vienna Agreement (VA).

European standards developed through the Vienna Agreement have EN ISO codification while International Standards developed through the Vienna Agreement remain only with ISO code.

CENELEC has close cooperation with its international counterpart, the International Electrotechnical Commission (IEC) through the Frankfurt Agreement (FA).

National standards could also be proposed as a base for new European or International standards. The following figure 1 shows the tracks of the standards.

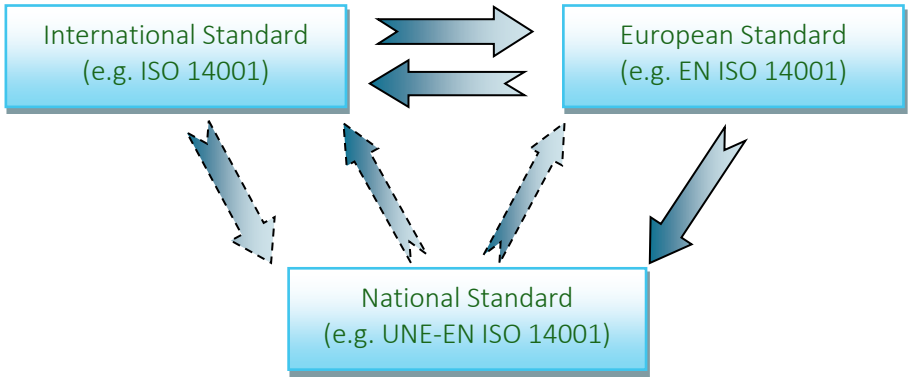

Figure 1 – Possible tracks of standards adoption

Therefore, the code of any standard is the combination of the above-mentioned issues, and could be explained as shown in figure 2:

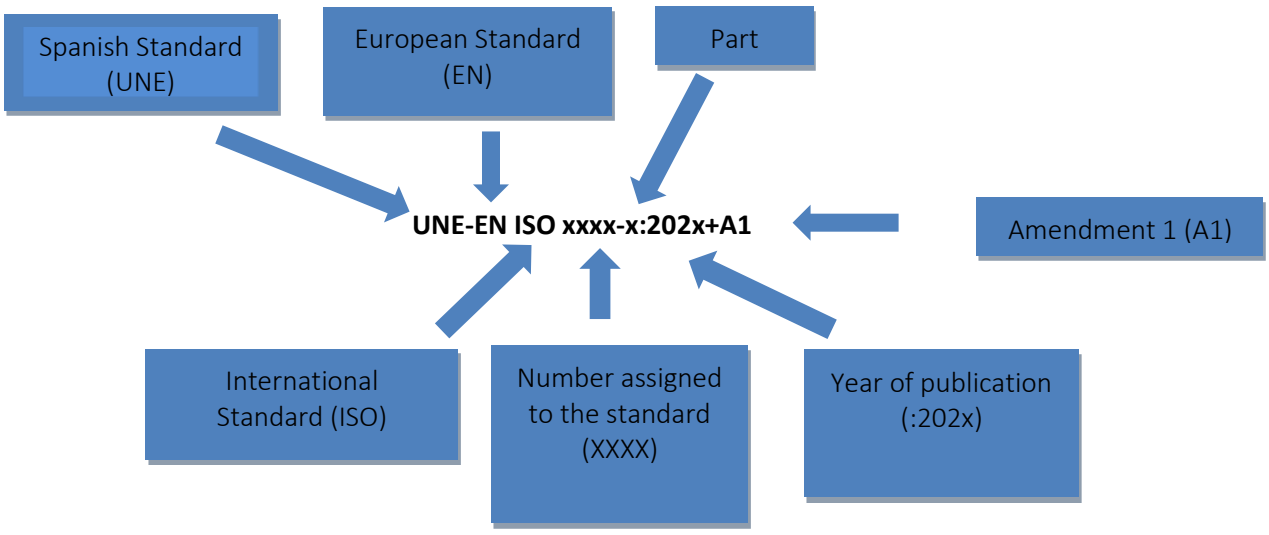

Figure 2 – Example of identification of elements in the code of a standard

4.2 ABBREVIATIONS AND ACRONYMS

Useful abbreviations related to standardization are listed below:

UNE	Spanish Association for Standardization
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Standardization in the Electrical field
CWA	CEN or CENELEC Workshop Agreement

EN	European Standard
ESO	European Standardisation Organisation
hEN	Harmonised European Standard
ISO	International Organization for Standardization; International Standard
IEC	International Electrotechnical Commission
NMC	National Mirror Committee
NSB	National Standardization Body
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
WG	Working Group
WI	Work Item
ISO/WD	ISO Working Draft of a document under development (ISO stage)
ISO/CD	ISO Committee Draft of a document under development (ISO stage)
ISO/DIS	ISO Draft International Standard of a document under development (ISO stage)

5. RELEVANT TECHNICAL COMMITTEES FOR INNOMEM PROJECT

5.1 GENERAL

When the European Commission set out the European Strategy for Nanotechnologies in 2004, it was based on a safe, integrated and responsible approach, being one of the building blocks of it the standardization. In 2010, the European Commission addressed a mandate[1](M 461) to the European Standardization Bodies (CEN-CENELEC-ETSI) requesting them to develop deliverables which could cover:

- Characterisation of and exposure from nanomaterials
  - Methodologies for nanomaterial characterisation in the manufactured from and before toxicity and eco-toxicity testing
  - Sampling and measurement of workplace, consumer and environment exposure to Nanomaterials
  - Methods to simulate exposures to nanomaterials
- Health, safety and environment
  - Occupational handling and exposure
  - Guidance on safe handling of manufactured nanoparticles and other manufactured nanoscale entities (including selection of Personal Protective Equipment)
  - Guidance on containment, trapping and destruction of nanoparticles and other manufactured nanoscale entities
  - Guidance on dosimetry and exposure determination in occupational settings relevant to manufactured nanomaterials
  - Methodology to determine effectiveness of filtration media against nanomaterials
  - Standard method to assess emissions from handling, or machining of nanomaterials containing products
  - Protocols for determining the explosivity and flammability of nano-powders (for transport, handling and storage)
  - Guidance on detection and identification of nanoparticles and other nanoscale entities (in all media types, including waste streams from manufacturing and manufacturing discharges)
  - Protocols for the characterisation of manufactured nanoparticles from aerosols and from environmental sources, including sampling, sample stabilisation, agglomeration, aggregation, etc.

1 A Standardisation Request (Mandate) is a demand from the European Commission to the European standardisation organisations (ESOs), such as CEN or CENELEC, to draw up and adopt European standards in support of European policies and legislation, such as Directives and Regulations. Draft mandates are drawn up by the Commission services through a process of consultation with a wide group of interested parties (social partners, consumers, SMEs, relevant industry associations, etc.). The European standards, even developed under a mandate and for European legislation, remain voluntary in their use, excepting the Annex ZA of the harmonised standards of construction products.

- Guide to the identification and definition of measurands required for characterising, evaluating functional properties and performance, etc of materials and devices at the nanoscales
- Product specifications for different manufactured nanomaterials
- Guide to basic morphology and purity of manufactured nanoparticles and other nanoscale entities
- Guide to purity evaluation of manufactured nanoparticles and other nanoscale entities
- Guide to modelling (measurement, simulation and visualisation) of the nanoscale
- Guide to the management of waste and the disposal of nanomaterials

Therefore, one of the major drivers for the European standardisation on nanotechnologies was the European Commission Mandate M/461 (preceded by a previous one M/409) for standardisation activities regarding nanotechnologies and nanomaterials. There are different technical committees which have developed standards in response to this mandate, the main one CEN/TC 352 Nanotechnologies, but also CEN/TC 137, Assessment of workplace exposure to chemical and biological agents, and CEN/TC 195, Air filters for general air cleaning. The standards published and the documents under development of these committees are included in the corresponding annexes.

At international level, in 2005 there was a similar proposal for the creation of a technical committee under ISO framework, and ISO/TC 229 Nanotechnologies was created. Anyhow, many of the works carried out by both CEN and ISO committees on nanotechnologies are developed jointly.

Although focus has been put in these technical committees, analysis of other related groups has been done on the following basis:

- Committees for which any work or published standard has been identified related to nanotechnologies, nanomaterials, nanofiltration… Sometimes there are technical bodies not focused on nanotechnologies but develop documents related to them
- Committees for which a relationship has been identified with the above-mentioned CEN/TC 352 or ISO/TC 229 committees.
- Committees for which, although not linked with nanotechnologies, could be of interest for the specific applications of INNOMEM project, or for the sustainable framework under consideration in the project.

Subject	Technical committee
Nanotechnologies	CEN/TC 352 Nanotechnologies
	ISO/TC 229 Nanotechnologies
	CLC/TC 113 Nanotechnology standardization for electrical and electronics products and systems
	IEC/TC 113 Nanotechnology for electrotechnical products and systems
Workplace atmospheres	CEN/TC 137 Assessment of workplace exposure to chemical and biological agents
	ISO/TC 146/SC2 Air quality. Workplace atmospheres
Air cleaning	CEN/TC 195 Air filters for general air cleaning
	ISO/TC 142 Cleaning equipment for air and other gases
	CEN/TC 290 Dimensional and geometrical product specification and verification

Subject	Technical committee
Dimensional and geometrical product specification and verification	ISO/213 Dimensional and geometrical product specifications and verification
Cleanrooms	CEN/TC 243 Cleanroom technology
	ISO/TC 209 Cleanrooms and associated controlled environments
Surface chemical analysis	ISO/TC 201 Surface chemical analysis
Particle characterization including sieving-Particle characterization	ISO/TC 24/SC4 Particle characterization including sieving-Particle characterization
Fine ceramics	CEN/184 Advanced technical ceramics
	ISO/TC 206 Fine ceramics
Plastic	CEN/TC 249 Plastics
	ISO/TC 61 Plastics
Water quality and supply	CEN/TC 164 Water supply
	ISO/TC 147 Water quality
Waste water	CEN/TC 165 Waste water engineering
	ISO/TC 282 Water reuse
Hydrometry	ISO/TC 113 Hydrometry
Air quality	CEN/TC 264 Air quality
	ISO/TC 146 Air quality
	CEN/TC 386 Photocatalysis
Others	CEN/TC 459/SC1 Test methods for steel (other than chemical analysis)
	ISO/TC 107 Metallic and other inorganic coatings
	ISO/TC 202 Microbeam analysis
	ISO/TC 135 Non-destructive testing
	ISO/TC 265 Carbon dioxide capture, transportation, and geological storage
	ISO/TC 197 Hydrogen technologies
Pulp, paper and board	CEN/TC 172 Pulp, paper and board
	ISO/TC 6 Paper, board and pulps
Nuclear energy	CEN/TC 430 Nuclear energy, nuclear technologies, and radiological protection
	ISO/TC 85 Nuclear energy, nuclear technologies, and radiological protection
Pigments and extenders	CEN/TC 298 Pigments and extenders
	ISO/TC 256 Pigments, dyestuffs and extenders
Paints and varnishes	CEN/TC 139 Paints and varnishes
	ISO/TC 35 Paints and varnishes
Textiles	CEN/TC 248 Textiles and textile products
	ISO/TC 38 Textiles

Subject	Technical committee
Medical devices	ISO/TC 194 Biological and clinical evaluation of medical devices
Aircraft	ISO/TC 20 Aircraft and space vehicles
CEN/WS MODA	Materials modelling, terminology, classification and metadata
ASTM E56	Nanotechnology

The above mentioned list is not exhaustive: some committees have been discarded from the first analysis and others, from the list above, have not been considered relevant for INNOMEM project, and therefore they are not included in the description that can be found in this document.

To conclude this introduction, CEN/TC 352 and ISO/TC 229 are the most significant committees on nanotechnologies, covering general aspects but also issues related to measurement, characterization and performance evaluation, sustainability, consumer and societal dimensions, and health, safety and environmental aspects.

Additionally, the scope and description of other technical bodies considered of interest have been included according the above-mentioned approach, completing the analysis with the committees and documents relevant for sustainability manufacturing purposes.

5.2 RELEVANT TECHNICAL COMMITTEES ON NANOTECHNOLOGIES

CEN/TC 352 Nanotechnologies

CEN/TC 352, *Nanotechnologies*, is the European Technical Committee aimed at developing standardization documents in the field of nanotechnologies, that includes either or both of the following:

- understanding and control of matter and processes at the nanoscale, typically, but not exclusively below 100 nanometres 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 or bulk matter, to create improved materials, devices and systems that exploit these new properties.

Specific tasks of this committee include developing standards for: classification, terminology and nomenclature; metrology and instrumentation, including specifications for reference materials; test methodologies; modelling and simulation; science-based health, safety and environmental practices; and nanotechnology products and processes. Standards in each of these areas could be specific to a product, process or industry.

The structure of CEN/TC 352 is the following:

- CEN/TC 352/WG 1 Measurement, characterization and performance evaluation
- CEN/TC 352/WG 2 Commercial and other stakeholder aspects
- CEN/TC 352/WG 3 Health, safety and environmental aspects
- CEN/TC 352/WG4 Manufactured nano-objects in food additives

The activities and documents produced within WG1, WG2 & WG3 could be relevant for INNOMEM project.

Standards and documents under development produced by this committee are included in annexes A & B.

ISO/TC 229 Nanotechnologies

ISO/TC 229, *Nanotechnologies*, is the International Technical Committee responsible of the standardization in the field of nanotechnologies. Its scope is equal to the one of CEN/TC 352 aforementioned.

The structure of ISO/TC 229 is the following:

- ISO/TC 229/JWG 1 Terminology and nomenclature
- ISO/TC 229/JWG 2 Measurement and characterization
- ISO/TC 229/TG 2 Sustainability, consumer and societal dimensions of nanotechnologies
- ISO/TC 229/WG 3 Health, Safety and Environmental Aspects of Nanotechnologies
- ISO/TC 229/WG 4 Material specifications
- ISO/TC 229/WG 5 Products and Applications

Standards and documents under development produced by this committee are included in annexes C & D.

CLC/SR 113 Nanotechnology standardization for electrical and electronics products and systems

CLC/SR 113, *Nanotechnology standardization for electrical and electronics products and systems*, developed in 2014 the European standard EN 62607-3-1:2014, *Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency*. This document describes the procedures to be followed and precautions to be observed when performing reproducible measurements of the quantum efficiency of luminescent nanomaterials.

CLC/SR 113 is currently developing prEN 62565-3-1, *Nanomanufacturing - Material specifications - Part 3-1: Graphene - Blank detail specification*.

IEC/TC 113 Nanotechnology for electrotechnical products and systems

The scope of IEC/TC 113*, Nanotechnology for electrotechnical products and systems*, is the standardization of the technologies relevant to electrotechnical products and systems in the field of nanotechnology in close cooperation with other committees of IEC and ISO. It has developed an extensive number of deliverables.

The structure of IEC/TC 113 is the following:

- WG 3 Performance assessment. It develops standards for the assessment of performance related to the nanotechnology-enabled aspects of components and systems in support of continuous improvement at all stages of the value adding chain. WG 3 considers market demand and technology pull with an emphasis on fabrication, processing and process control, disposal and recycling.
- WG 7 Reliability. It develops standards for the assessment of reliability in the field of nano electrotechnology. Focus is on failure mechanisms and failure modes related to the use of nanomaterials, nanostructures, material interfaces and nanoscale contacts with consideration to size dependent effects. Standards to be developed include test methods to identify failure mechanisms, determine lifetime, analyse failure effects and estimate durability of nano-enabled products.
- WG 8 Graphene related materials/Carbon nanotube materials. It discusses and develops actual and new standardization project for graphene related materials and carbon nanotube materials

- WG 9 Nano-Enabled Photovoltaics Thin Film Organic/Nano Electronics, Nanoscale. It develops standards in the area of nano-enabled photovoltaics and organic electronics to facilitate the assurance of quality and reliability of materials and intermediates, subject to the general concepts of blank detail specifications (BDS) and Key Control Characteristics (KCCs).
- WG 10 Luminescent nanomaterials. It develops standards within the field of luminescent nanomaterials, which include quantum dots, dye-incorporated matrix nanoparticles, up-conversion nanoparticles, rare earth luminescent nanomaterials and others, with a focus on key control characteristics and test methods for performance, reliability, stability and others related to fabrication, processing and process control, disposal, recycling, etc.
- WG 11 Nano-enabled energy storage. It discusses and develops actual and new standardization project for nano-enabled energy storage.

CEN/TC 137 Assessment of workplace exposure to chemical and biological agents

This technical committee, together with CEN/TC 195 described hereunder, is one of the two technical bodies apart from CEN/TC 352 developing standards under M/461. However, not all the catalogue of this committee is focused on nanotechnologies.

The scope of CEN/TC 137, Assessment of workplace exposure to chemical and biological agents, is the standardization in the field of assessment of exposure to agents at the workplace including the planning and performing of measurement but excluding the establishment of limit values.

The structure of CEN/TC 137 is the following:

- CEN/TC 137/WG 2 General requirements for measuring procedures
- CEN/TC 137/WG 3 Particulate matter
- CEN/TC 137/WG 5 Measurement of biological agents
- CEN/TC 137/WG 6 Dermal Exposure

The works of WG 3 and WG 6 are relevant to nanotechnologies and to the activities of INNOMEM.

The works of CEN/TC 137 have a close relationship with those of ISO/TC 146/SC 2, Air quality. Workplace atmospheres. The works of ISO/TC 146/SC2 could be relevant for INNOMEM purposes

Standards and documents under development produced by this committee are included in annex E.

ISO/TC 146/SC2 Air quality. Workplace atmospheres.

ISO/TC 146 standardises tools for air quality characterisation of emissions, workspace air, ambient air, indoor air… ISO/TC 146/SC2, devoted to standardising on workplace air, consists of several working groups:

- ISO/TC 146/SC 2/WG 1 Particle size-selective sampling and analysis
- ISO/TC 146/SC 2/WG 2 Inorganic particulate matter
- ISO/TC 146/SC 2/WG 3 Gases
- ISO/TC 146/SC 2/WG 4 Organic vapours
- ISO/TC 146/SC 2/WG 5 Inorganic fibres
- ISO/TC 146/SC 2/WG 7 Silica

- ISO/TC 146/SC 2/WG 8 Assessment of contamination of skin and surfaces from airborne chemicals
- ISO/TC 146/SC 2/WG 9 Sampling pump performance
- ISO/TC 146/SC 2/WG 10 Terminology and Quality Control in Workplace Air

Some examples of standards that could be relevant for the project are:

Reference	Title
ISO 28439:2011	Workplace atmospheres — Characterization of ultrafine aerosols/nanoaerosols — Determination of the size distribution and number concentration using differential electrical mobility analysing systems
ISO/TR 27628:2007	Workplace atmospheres — Ultrafine, nanoparticle and nano-structured aerosols — Inhalation exposure characterization and assessment
ISO/TS 21623:2017	Workplace exposure — Assessment of dermal exposure to nano-objects and their aggregates and agglomerates (NOAA)
ISO 16200-1:2001	Workplace air quality — Sampling and analysis of volatile organic compounds by solvent desorption/gas chromatography — Part 1: Pumped sampling method
ISO 16200-2:2000	Workplace air quality — Sampling and analysis of volatile organic compounds by solvent desorption/gas chromatography — Part 2: Diffusive sampling method
ISO 16017-1:2000	Indoor, ambient and workplace air — Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography — Part 1: Pumped sampling
ISO 16017-2:2003	Indoor, ambient and workplace air — Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography — Part 2: Diffusive sampling

CEN/TC 195 Air filters for general air cleaning

As stated for CEN/TC 137, this technical committee, is one of the two technical bodies apart from CEN/TC 352 developing standards under M/461. Likewise, not all the catalogue of this committee is focused on nanotechnologies.

The scope of CEN/TC 195, *Air filters for general air cleaning*, is the standardization in the field of terminology, classification, characteristics, and test and performance methods for air and gas cleaning equipment for general ventilation and industrial applications and the definition of methods of testing and classification of air filters for general air cleaning.

The works of CEN/TC 195 have a close relationship with those of ISO/TC 142, *Cleaning equipment for air and other gases*.

The structure of CEN/TC 195 consist of 6 working groups, although only one is active at this very moment.

- CEN/TC 195/WG 2 HEPA and ULPA filters

Standards and documents under development produced by this committee are included in annex F.

ISO/TC 142 Cleaning equipment for air and other gases

The scope of ISO/TC 142 is the standardization in the fields of terminology, classification, characteristics, and test and performance methods for air and gas cleaning and disinfecting equipment for general ventilation and industrial applications. The structure being the following:

- ISO/TC 142/JWG 10 Joint ISO/TC 142 - ISO/TC 85/SC 2 WG: Aerosol filters for nuclear applications
- ISO/TC 142/JWG 11 Joint ISO/TC 142 - IEC/TC 59 WG: Portable room air cleaners for comfort applications
- ISO/TC 142/WG 1 Terminology
- ISO/TC 142/WG 2 UV-C technology
- ISO/TC 142/WG 3 General ventilation filters
- ISO/TC 142/WG 4 HEPA and ULPA filters
- ISO/TC 142/WG 5 Dust collectors, droplet separators and purifiers
- ISO/TC 142/WG 7 Cleanable filter media used in industrial applications
- ISO/TC 142/WG 8 Gas-phase air cleaning devices
- ISO/TC 142/WG 9 Particulate air filter intake systems for rotary machinery and stationary internal combustion engines
- ISO/TC 142/WG 12 Sustainability of air cleaning equipment and media
- ISO/TC 142/WG 13 Biological equipment for waste gas treatment

WG4 has developed some standards related to nanomaterials, which were adopted as European documents:

Reference	Title
ISO 21083-1:2018	Test method to measure the efficiency of air filtration media against spherical nanomaterials — Part 1: Size range from 20 nm to 500 nm
ISO/TS 21083-2:2019	Test method to measure the efficiency of air filtration media against spherical nanomaterials — Part 2: Size range from 3 nm to 30 nm
ISO 16170: 2016	In situ test methods for high efficiency filter systems in industrial facilities

5.3 OTHER RELEVANT TECHNICAL COMMITTEES FOR INNOMEM PROJECT

CEN/TC 290 Dimensional and geometrical product specification and verification

This technical committee standardises in the field of macro and micro-geometry specification including dimensional and geometrical tolerancing, surface properties and the related verification principles, measuring equipment and calibration requirements.

Methods and equipment for the determination and characterization of surface texture, surface geometry (cylindricity, roundness, straightness, flatness etc), geometrical tolerancing and filtration are the fields covered by the extensive catalogue of published standards and under development of this technical committee.

At this moment stablished working groups within this technical committee are disbanded or inactive.

ISO/213 Dimensional and geometrical product specifications and verification

With the same scope as the European technical committee, the structure of this group is the following:

- ISO/TC 213/WG 2 Datums and datum systems
- ISO/TC 213/WG 4 Uncertainty of measurement and decision rules
- ISO/TC 213/WG 6 General requirements for geometrical product specification (GPS) measuring equipment
- ISO/TC 213/WG 9 Dimensional and geometrical tolerancing for castings
- ISO/TC 213/WG 10 Coordinate measuring machines
- ISO/TC 213/WG 12 Size
- ISO/TC 213/WG 14 Vertical GPS principles
- ISO/TC 213/WG 15 GPS extraction and filtration techniques
- ISO/TC 213/WG 16 Areal and profile surface texture
- ISO/TC 213/WG 17 Facilitation of GPS implementation
- ISO/TC 213/WG 18 Geometrical tolerancing

CEN/TC 243 Cleanroom technology

The scope of this committee is the Standardization and classification of controlled environment spaces and fixing of criteria for controlling contamination in such spaces. Guidance on the design, taking into account sources of contamination; air, liquid, materials, equipment and personnel as well as their interactions. Guidance on biocontamination control is included, as are provisions for the control of molecular contamination. Methods of aseptic processing are excluded, as are methods of cleaning and disinfection except with particular reference to inert surfaces in cleanrooms. The field of competence of the committee embraces all aspects of cleanroom technology, including the classification of controlled environments, the achievement of contamination control in such environments and the design, construction and operation of cleanroom technology.

At this moment stablished working groups within this technical committee are disbanded or inactive, being the only active working group the one dedicated to biocontamination control, which is not considered of interest for INNOMEM purposes.

Worth mentioning the series of standards published under the code EN ISO 14644 on *Cleanrooms and associated controlled environments*.

ISO/TC 209 Cleanrooms and associated controlled environments

The scope is the standardization for cleanrooms and associated controlled environments for controlling cleanliness, as well as other attributes and characteristics, relating to facilities, sustainability, equipment, processes and operations. The structure is the following:

- ISO/TC 209/WG 4 Design and construction
- ISO/TC 209/WG 11 Assessment of suitability of equipment and materials for cleanrooms
- ISO/TC 209/WG 13 Energy saving for cleanrooms
- ISO/TC 209/WG 14 Particle deposition rate

ISO/TC 201 Surface chemical analysis

The scope of this committee is the standardization in the field of surface chemical analysis. Surface chemical analysis includes analytical techniques in which beams of electrons, ions, neutral atoms or molecules, or photons are incident on the specimen material and scattered or emitted electrons, ions, neutral atoms or molecules, or photons are detected. It also includes techniques in which probes are scanned over the surface and surface-related signals are detected.

The structure of this technical committee is the following:

- ISO/TC 201/SC 1 Terminology
- ISO/TC 201/SC 2 General procedures
- ISO/TC 201/SC 3 Data management and treatment
- ISO/TC 201/SC 4 Depth profiling
- ISO/TC 201/SC 6 Secondary ion mass spectrometry
- ISO/TC 201/SC 7 Electron spectroscopies
- ISO/TC 201/SC 8 Glow discharge spectroscopy
- ISO/TC 201/SC 9 Scanning probe microscopy
- ISO/TC 201/SC 10 X-ray Reflectometry (XRR) and X-ray Fluorescence (XRF) Analysis
- ISO/TC 201/SG 1 Nano-materials characterization
- ISO/TC 201/WG 4 Surface characterization of biological materials
- ISO/TC 201/WG 5 Optical interface analysis

Some of the listed groups develop standards of interest for nano-materials/products (SC2, SC4, SC6, SC7, SC8, SC9…), specifically SG1, and therefore of particular interest for INNOMEM project.

Some examples of the published standards and projects under development are:

Reference	Title
ISO 20579-4:2018	Surface chemical analysis — Guidelines to sample handling, preparation and mounting — Part 4: Reporting information related to the history, preparation, handling and mounting of nano-objects prior to surface analysis
ISO 18516:2019	Surface chemical analysis — Determination of lateral resolution and sharpness in beam based methods with a range from nanometres to micrometres
ISO/WD 23170 (under development)	Surface Chemical Analysis --- Depth Profiling — Non-destructive depth profiling of nanoscale heavy metal oxide thin films on Si substrates with medium energy ion scattering
ISO/TR 14187:2020	Surface chemical analysis — Characterization of nanostructured materials
ISO/CD TR 23173 (under development)	Nanoparticle coating analysis by electron spectroscopies
ISO/WD 24417 (under development)	Surface chemical analysis — Analysis of metallic nanolayers on iron based substrates by glow-discharge optical-emission spectrometry
ISO 13095:2014	Surface Chemical Analysis — Atomic force microscopy — Procedure for in situ characterization of AFM probe shank profile used for nanostructure measurement

ISO/TC 24/SC4 Particle characterization including sieving-Particle characterization

The technical committee ISO/TC 24 *Particle characterization including sieving* standardizing equipment and methods used in size classification of particulate material in solid or liquid state, has a subcommittee that could be relevant for nano characterization, which is SC4 *Particle characterization*.

Examples of works developed under this group are:

Reference	Title
ISO/DIS 15901-2 (under development)	Pore size distribution and porosity of solid materials by mercury porosimetry and gas adsorption — Part 2: Analysis of nanopores by gas adsorption
ISO 9277:2010	Determination of the specific surface area of solids by gas adsorption — BET method

ISO/CD 9277 (under development)	Determination of the specific surface area of solids by gas adsorption — BET method
ISO 13319:2007	Determination of particle size distributions — Electrical sensing zone method

CEN/184 Advanced technical ceramics

The scope of this committee is the standardization in the field of advanced technical ceramics with specific tasks being classification, terminology, sampling and test methods. The methods of test are to include physical, chemical, thermal and textural properties for ceramic powder, monolithic ceramics, ceramic composites (including fibres) and ceramic coatings, plus test methods for applications.

Currently, the structure of this committee consists of only one Subcommittee, CEN/TC 184/SC1 *Advanced technical ceramics - ceramic composites*.

Some examples of the standards published within this technical committee are the following, that could be of interest for INNOMEM partners (list not at all exhaustive).

.Reference	Title
Serie EN 1007 (7 parts)	Advanced technical ceramics - Ceramic composites - Methods of test for reinforcement
Serie EN 1159	Advanced technical ceramics - Ceramic composites - Thermophysical properties
EN 12289 EN 13234	Advanced technical ceramics - Mechanical properties of ceramic composites at ambient temperature
EN 13235 EN 15158 EN 1894	Advanced technical ceramics - Mechanical properties of ceramic composites at high temperature under inert atmosphere
EN 14186 Serie EN 658	Advanced technical ceramics - Mechanical properties of ceramic composites at room temperature
Serie EN 623	Advanced technical ceramics - Monolithic ceramics - General and textural properties
Serie EN 820	Advanced technical ceramics - Methods of testing monolithic ceramics
Serie 821	Advanced technical ceramics - Monolithic ceramics - Thermo-physical properties
Serie EN 843	Advanced technical ceramics - Mechanical properties of monolithic ceramics at room temperature
Serie EN ISO 13383-1	Fine ceramics (advanced ceramics, advanced technical ceramics) - Microstructural characterization
EN ISO 23146:2016	Fine ceramics (advanced ceramics, advanced technical ceramics) - Test methods for fracture toughness of monolithic ceramics - Single-edge V-notch beam (SEVNB) method (ISO 23146:2012)

EN ISO 18756:2005	Fine ceramics (advanced ceramics, advanced technical ceramics) - Determination of fracture toughness of monolithic ceramics at room temperature by the surface crack in flexure (SCF) method (ISO 18756:2003)
prEN ISO 14705 (under development)	Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for hardness of monolithic ceramics at room temperature (ISO 14705:2016)
prEN ISO 17138 (under development)	Fine ceramics (advanced ceramics, advanced technical ceramics) - Mechanical properties of ceramic composites at room temperature - Determination of flexural strength
prEN ISO 17562 (under development)	Fine ceramics (advanced ceramics, advanced technical ceramics) - Test method for linear thermal expansion of monolithic ceramics by push-rod technique (ISO 17562:2016)

Many of the standards are developed in close cooperation with ISO/TC 206 *Fine ceramics*.

ISO/TC 206 Fine ceramics

The scope of this committee is quite similar to the one of the European Committee: standardization in the field of fine ceramics materials and products in all forms: powders, monoliths, coatings and composites, intended for specific functional applications including mechanical, thermal, chemical, electrical, magnetic, optical and combinations thereof, being the structure:

- ISO/TC 206/WG 1 Terminology/Classification
- ISO/TC 206/WG 2 Powders
- ISO/TC 206/WG 3 Chemical analysis
- ISO/TC 206/WG 4 Composites
- ISO/TC 206/WG 5 Porous ceramics
- ISO/TC 206/WG 6 Monolithic ceramics/Mechanical properties
- ISO/TC 206/WG 7 Monolithic ceramics/Physical and thermal properties
- ISO/TC 206/WG 8 Joining
- ISO/TC 206/WG 9 Photocatalysis
- ISO/TC 206/WG 10 Coatings
- ISO/TC 206/WG 11 Electrical and optical applications
- ISO/TC 206/WG 12 Engineering applications

CEN/TC 249 Plastics

This technical committee standardises in aspects related to terminology, test methods, specifications, classifications and designation systems, environmental aspects, joining systems and techniques, of plastics, plastic-based materials, semi-finished products and products (thermoplastics, thermosets, degradable plastics, bio-based polymers, thermoplastic elastomers, composites, reinforcement products for plastics, recyclates). Rubber is excluded. Specific end-product related items are also excluded if they are covered by the scope of an existing product TC. The structure is as follows:

- CEN/TC 249/WG 11 Plastics recycling
- CEN/TC 249/WG 13 Wood Plastics Composites (WPC)
- CEN/TC 249/WG 16 Welding of thermoplastics
- CEN/TC 249/WG 19 Light exposure
- CEN/TC 249/WG 2 Plastics warning devices for underground cables and pipelines
- CEN/TC 249/WG 21 Profiles for windows and doors
- CEN/TC 249/WG 22 Wallcovering panels for building applications
- CEN/TC 249/WG 24 Environmental aspects
- CEN/TC 249/WG 25 Static thermoplastic tanks for above ground storage of fuel
- CEN/TC 249/WG 4 Decorative laminated sheets based on thermosetting resins
- CEN/TC 249/WG 5 Thermoplastic profiles for building applications
- CEN/TC 249/WG 7 Thermoplastic films for use in agriculture
- CEN/TC 249/WG 9 Bio-based and biodegradable plastics

The activities of this technical committee is much linked to the activities of the ISO technical Committee on plastics, ISO/TC 61, and many of its relevant standards for INNOMEM are adopted from the international committee, described hereafter.

ISO/TC 61 Plastics

The aim of this committee is the standardization of nomenclature, methods of test, and specifications applicable to materials and products in the field of plastics including processing (of products) by assembly in particular, but not limited to, polymeric adhesives, sealing, joining, welding. The standardization of rubber, lacquers is excluded.
Jointing technology (including equipment and training) between plastic pipes (including all types of reinforced plastics), and/or fittings, valves and auxiliary equipment, and the assessment of the properties of the resulting joints are developed and maintained by ISO/TC 138.
The structure of this technical committee is the following:

- ISO/TC 61/SC 1 Wood Plastics Composites (WPC)
- ISO/TC 61/SC 2 Mechanical behavior
- ISO/TC 61/SC 4 Burning behaviour
- ISO/TC 61/SC5 Physical-chemical properties
- ISO/TC 61/SC6 Ageing, chemical and environmental resistance
- ISO/TC 61/SC9 Thermoplastic materials
- ISO/TC 61/SC10 Cellular plastics
- ISO/TC 61/SC11 Products
- ISO/TC 61/SC12 Thermosetting materials
- ISO/TC 61/SC13 Composites and reinforcement fibres
- ISO/TC 61/SC14 Environmental aspects
- ISO/TC 61/WG 4 Plastics joining

Some of the standards that could be relevant for INNOMEM project are:

Reference	Title
ISO 15105-1:2007	Plastics — Film and sheeting — Determination of gas-transmission rate — Part 1: Differential-pressure methods
ISO 15105-2:2003	Plastics — Film and sheeting — Determination of gas-transmission rate — Part 2: Equal-pressure method
ISO 15106-1:2003	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 1: Humidity detection sensor method
ISO 15106-2:2003	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 2: Infrared detection sensor method
ISO 15106-3:2003	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 3: Electrolytic detection sensor method
ISO 15106-4:2008	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 4: Gas-chromatographic detection sensor method
ISO 15106-5:2015	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 5: Pressure sensor method
ISO 15106-6:2015	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 6: Atmospheric pressure ionization mass spectrometer method
ISO 15106-7:2015	Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 7: Calcium corrosion method
ISO 2556:1974	Plastics — Determination of the gas transmission rate of films and thin sheets under atmospheric pressure — Manometric method
ISO 8295:1995	Plastics — Film and sheeting — Determination of the coefficients of friction
ISO 7765-1:1988	Plastics film and sheeting — Determination of impact resistance by the free-falling dart method — Part 1: Staircase methods
ISO 7765-2:1994	Plastics film and sheeting — Determination of impact resistance by the free-falling dart method — Part 2: Instrumented puncture test (Under revision)
ISO 6383-1:2015	Plastics — Film and sheeting — Determination of tear resistance — Part 1: Trouser tear method
ISO 6383-2: 1983	Plastics — Film and sheeting — Determination of tear resistance — Part 2: Elmendorf method

CEN/TC 164 Water supply

The aim of this technical committee is to establish standards for the installation and performance requirements of systems, constructions of components used for the water supply from the production facility, including the treatment of the water, to the taps attached or unattached to a sanitary appliance with the view of maintaining the quality of water as stated in Directive 80/778. The structure is the following:

- CEN/TC 164/WG 1 External systems and components
- CEN/TC 164/WG 10 Hot water and cold water storage within dwellings
- CEN/TC 164/WG 12 Flexible hoses assemblies
- CEN/TC 164/WG 13 Water conditioning equipment inside buildings
- CEN/TC 164/WG 14 Valves and fitting for buildings and devices to prevent pollution by backflow
- CEN/TC 164/WG 15 Security of drinking water supply
- CEN/TC 164/WG 16 In-situ generating and dosing of biocides for water treatment
- CEN/TC 164/WG 2 Internal systems and components
- CEN/TC 164/WG 3 Effects of materials in contact with drinking water
- CEN/TC 164/WG 8 Sanitary tapware
- CEN/TC 164/WG 9 Chemicals and filtering media for water treatment

WG´s 3, 9 or 13 have developed standards identified relevant for INNOMEM project:

Reference	Title
EN 12873-4:2006	Influence of materials on water intended for human consumption - Influence due to migration - Part 4: Test method for water treatment membranes (Under revision)
EN 14652:2005+A1:2007	Water conditioning equipment inside buildings - Membrane separation devices - Requirements for performance, safety and testing
EN 15798:2010	Products used for the treatment of swimming pool water - Filter media (Under revision)
EN 14898:2006 + A1:2007	Water conditioning equipment inside buildings - Active media filters - Requirements for performance, safety and testing
EN 13443-1:2002+A1:2007	Water conditioning equipment inside buildings - Mechanical filters - Part 1: Particle rating 80 µm to 150 µm - Requirements for performances, safety and testing
EN 12901:1999	Products used for treatment of water intended for human consumption - Inorganic supporting and filtering materials – Definitions (under revision)
EN 12902:2004	Products used for treatment of water intended for human consumption - Inorganic supporting and filtering materials - Methods of test

ISO/TC 147 Water quality

The scope is the standardization in the field of water quality, including definition of terms, sampling of waters, measurement and reporting of water characteristics. The structure is the following:

- ISO/TC 147/SC 6 Sampling (general methods)
- ISO/TC 147/SC 5 Biological methods
- ISO/TC 147/SC 4 Microbiological methods
- ISO/TC 147/SC 3 Radioactivity measurements
- ISO/TC 147/SC 2 Physical, chemical and biochemical methods
- ISO/TC 147/SC 1 Terminology

Reference	Title
ISO 14189:2013	Water quality — Enumeration of Clostridium perfringens — Method using membrane filtration
ISO 6461-2:1986	Water quality — Detection and enumeration of the spores of sulfite-reducing anaerobes (clostridia) — Part 2: Method by membrane filtration
ISO 7704:1985	Water quality — Evaluation of membrane filters used for microbiological analyses

CEN/TC 165 Waste water engineering

Although not directly connected with nanotechnologies or nanofiltration, the works and standards of this committee could be of interest for some of INNOMEM applications.

The standards developed are functional standards, standards for performance and installation in the field of wastewater engineering for systems and components. Where there is no existing material related TC, product standards for all components of discharge pipes, drain and sewer pipes, pipelines, separators etc. Standards for design, calculation, construction, commissioning, operation and maintenance in the field of wastewater engineering, from the point of origin up to the point of disposal, including treatment plants and use of treated wastewater for purposes other than agricultural irrigation.

Some of the working groups could be of interest for INNOMEM applications:

- CEN/TC 165/WG 40 Wastewater treatment plants > 50 PT
- CEN/TC 165/WG 41 Small type sewage treatment plants (< 50 inhabitants)
- CEN/TC 165/WG 50 Use of treated wastewater
- CEN/TC 165/WG 8 Separators

Reference	Title
EN 12255-16:2005	Wastewater treatment plants - Part 16: Physical (mechanical) filtration (Under revision)
CEN/TR 12566-5:2008	Small wastewater treatment systems up to 50 PT - Part 5: Pre-treated Effluent Filtration systems

ISO/TC 282/SC4 Water reuse-Industrial water reuse

ISO/TC 282 *Water reuse* standardises in the field of water reuse of any kind and for any purpose. It covers both centralized and decentralized or on-site water reclamation, and direct and indirect reuse applications,

taking into consideration the potential for unintentional exposure or ingestion. It includes technical, economic, environmental and societal aspects of water reuse.

- ISO/TC 282/SC 1 Treated wastewater reuse for irrigation
- ISO/TC 282/SC 2 Water reuse in urban areas
- ISO/TC 282/SC 3 Risk and performance evaluation of water reuse systems
- ISO/TC 282/SC 4 Industrial water reuse
- ISO/TC 282/WG 3 Water systems for biopharma industries

The Subcommittees SC3 and SC4 could be of interest for INNOMEM project. SC4 standardises in the field of industrial water reuse, including classification of industrial wastewater treatments, industrial wastewater pre-treatment (before treatment plant) and/or treatment in industrial wastewater plant; management and development of industrial wastewater – for reuse as a water source in industrial plants, which excludes the municipal treated wastewater use as a water source in industrial plants; aspects of technology, economy, management and energy consumption of industrial wastewater reuse.

Reference	Title
ISO 22519:2019	Purified water and water for injection pretreatment and production systems
ISO 23044:2020	Guidelines for softening and desalination of industrial wastewater for reuse
ISO/DIS 20468-5	Guidelines for performance evaluation of treatment technologies for water reuse systems — Part 5: Membrane filtration (Under development)

ISO/TC 113 Hydrometry

The aim of this committee is the standardization of methods, procedures, instruments, and equipments relating to techniques for hydrometric determination of water level, velocity, discharge and sediment transport in open channels, precipitation and evapotranspiration, availability and movement of ground water, including terminology and symbols; collection, evaluation, analysis, interpretation and presentation of data and evaluation of uncertainties.

The structure of this group is:

- ISO/TC 113/SC 1 Velocity area methods
- ISO/TC 113/SC 2 Flow measurement structures
- ISO/TC 113/SC 5 Instruments, equipment and data management
- ISO/TC 113/SC 6 Sediment transport
- ISO/TC 113/SC 8 Ground water
- ISO/TC 113/WG 3 Uncertainties
- ISO/TC 113/WG 4 Revision of ISO 772
- ISO/TC 113/WG 6 Stream gauging
- ISO/TC 113/WG 7 Dilution Gauging

CEN/TC 264 Air quality

The aim of this committee is the standardisation of methods for air quality characterisation of emissions, ambient air, indoor air, gases in and from the ground and deposition, in particular measurement methods for air pollutants (for example particles, gases, odours, microorganisms), meteorological parameters and methods for determination of the efficiency of gas cleaning systems. The structure is very large, as well as its catalogue of published standards.

- CEN/TC 264/WG 1 Emissions - Dioxins and PCB
- CEN/TC 264/WG 11 Ambient air - Diffusive samplers
- CEN/TC 264/WG 12 Ambient air - VOCs/SO2/NO2/O3/CO
- CEN/TC 264/WG 13 Ambient air - Ozone precursors and benzene
- CEN/TC 264/WG 15 Ambient air - PM10/PM2,5
- CEN/TC 264/WG 16 Emissions - NOx/SOx/O2/ CO/CO2/water vapour/equivalence of method
- CEN/TC 264/WG 2 Emissions - Dynamic olfactometry for the determination of odour concentration
- CEN/TC 264/WG 21 Ambient air – PAHs
- CEN/TC 264/WG 28 Ambient air and emissions – Bioaerosols
- CEN/TC 264/WG 3 Emissions - HCl and HF
- CEN/TC 264/WG 30 Ambient air - Biomonitoring with flowering plants
- CEN/TC 264/WG 32 Ambient air - Particle number concentration
- CEN/TC 264/WG 33 Emissions - GHG in energy-intensive industries
- CEN/TC 264/WG 35 Ambient air - EC/OC
- CEN/TC 264/WG 38 Emissions - Diffuse VOC
- CEN/TC 264/WG 39 Ambient air - Airborne pollen grains and fungal spores
- CEN/TC 264/WG 40 Emissions - Formaldehyde
- CEN/TC 264/WG 41 Emissions and ambient air - Instrumental odour monitoring
- CEN/TC 264/WG 42 Ambient air - Air quality sensors
- CEN/TC 264/WG 43 Ambient air - Modelling quality objectives
- CEN/TC 264/WG 44 Ambient air - Source apportionment
- CEN/TC 264/WG 45 Emissions - Proficiency testing schemes
- CEN/TC 264/WG 8 Emissions - Total mercury
- CEN/TC 264/WG 9 Emissions - Quality assurance of AMS

CEN/TC 386 Photocatalysis

This technical committee standardizes photocatalysis applications in the following sectors: air purification, water purification, self-cleaning application (surfaces: glass, metals, concretes, cements, plastics, ceramics, textils, paints and varnishes, etc.), medical application and light sources (UV A, UVB, UVC, visible,...). The objective is to produce performance standards for photocatalytic effects (including photo induced effects). The EN standards mainly concern test and analysis methods.

The structure is the following:

- CEN/TC 386/WG 1 Terminology
- CEN/TC 386/WG 2 Air purification
- CEN/TC 386/WG 3 Water purification
- CEN/TC 386/WG 4 Self-cleaning applications
- CEN/TC 386/WG 6 Light source

- CEN/TC 386/WG 7 New technologies and other important issues

CEN/WS MODA, Materials modelling terminology, classification and metadata

CEN/WS MODA, *Materials modelling terminology, classification and metadata* has its origin in the Review of Materials Modelling (RoMM) and the Materials Modelling Metadata (MODA) elaborated in the context of the European Materials Modelling Council (EMMC). This workshop aimed at establishing a common terminology in materials modelling which should lead to simplified and much more efficient communication, especially benefitting industrial end users in their understanding and lowering the barrier to utilising materials modelling. The end result was the adoption of the CEN Workshop Agreement (CWA) CWA 17284:2018, *Materials modelling - Terminology, classification and metadata*, a best practices document for further standardisation efforts and input for the development of a future certification scheme.

ASTM International Technical Committee E56 Nanotechnology

ASTM International, formerly known as American Society for Testing and Materials, has evolved from a national standards organisation, based in the USA, to an international one. Although it is not any of the three International standards organisations (ISO, IEC and ITU), its documents are widely used by the nanotechnologies community.

The scope of the Technical Committee E56 on Nanotechnology of ASTM International is the development of standards and guidance for nanotechnology and nanomaterials, as well as the coordination between the existing ASTM standardization related to nanotechnology needs.

The structure of ASTM E56 is the following:

- E56.01 Informatics and Terminology
- E56.02 Physical and Chemical Characterization
- E56.03 Environment, Health, and Safety
- E56.04 Intellectual Property Issues
- E56.05 Liaison and International Cooperation
- E56.06 Nano-Enabled Consumer Products
- E56.07 Education and Workforce Development
- E56.08 Nano-Enabled Medical Products
- E56.90 Executive
- E56.91 S trategic Planning and Review

5.4 RELEVANT TECHNICAL COMMITTEES ON SUSTAINABILITY

5.4.1 Sustainability - General

Sustainability standards have increased in recent years, and many sectors and areas are developing standards considered under the sustainable umbrella. Standards published try to address not only environmental, but social and economic challenges. Additionally, the new challenges of the 2030 Global Agenda with its sustainable development goals constitute a new challenge for society but also for standardization.

Hereafter, some technical bodies and documents have been identified considered relevant for sustainability purposes, from its three different dimensions. Some of them have been mentioned previously, but they are referred to here from the sustainability perspective.

CEN/TC 352, Nanotechnologies

The works of CEN/TC 352/WG 2, Commercial and other stakeholder aspects, and CEN/TC 352/WG 3, Health, safety and environmental aspects, are relevant to sustainability. Although social and economic aspects are dealt with in subsequent subclauses, documents produced by these WGs are listed here.

Reference	Title
CEN/TS 16937:2016	Nanotechnologies - Guidance for the responsible development of nanotechnologies
	Safe-by-Design concept dedicated for nano scale materials (MNM) and products containing nanomaterials (under development)
CEN/TS 17276:2018	Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials
CEN/TS 17273:2018	Nanotechnologies - Guidance on detection and identification of nano-objects in complex matrices
CEN/TS 17274:2018	Nanotechnologies - Guidelines for determining protocols for the explosivity and flammability of powders containing nano-objects (for transport, handling and storage)
CEN/TS 17275:2018	Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects
	Nanotechnologies - Quick start guide for deploying a relevant nano health and safety risk management (under development)

	Nanotechnologies — Decision trees and flow charts towards sensible toxicity and ecotoxicity testing of engineered nanomaterials (under development)

Two documents should be highlighted: CEN/TS 16937:2016, *Nanotechnologies - Guidance for the responsible development of nanotechnologies*, drafted by CEN/TC 352/WG 2. It provides a guidance for the responsible development of nanotechnologies taking into account: board accountability; stakeholder involvement; worker health and safety; benefits to and risks for public health, safety and the environment; wider social and ethical implications and impacts; engagement with business partners; transparency and disclosure. The other one is CEN/TS 17276:2018, *Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials*. Drafted by CEN/TC 352/WG 3, this document provides guidelines for application of Life Cycle Assessments (LCA) of specific relevance to manufactured nanomaterials (MNMs), including their use in other products, according to EN ISO 14044:2006.

CEN/TC 350, Sustainability of construction works

CEN/TC 350 is the European Technical Body developing standardisation deliverables relevant to the sustainability of construction works. Its scope is the development of voluntary horizontal standardised methods for the assessment of the sustainability aspects of new and existing construction works and for standards for the environmental product declaration of construction products. The standards will be generally applicable (horizontal) and relevant for the assessment of integrated performance of buildings over its life cycle. The standards will describe a harmonized methodology for assessment of environmental performance of buildings and life cycle cost performance of buildings as well as the quantifiable performance aspects of health and comfort of buildings.

CEN/TC 350 has developed standards to assess the sustainability of the construction works. The following are some of the standards developed defining the framework for the environmental, social and economic performance, the calculation methods or the core rules for the Environmental Product Declarations (some of these standards are under revision). There are other interesting standards and projects on communication formats business-to business and business-to-consumer.

Reference	Title
EN 15643-1:2010	Sustainability of construction works - Sustainability assessment of buildings - Part 1: General framework
EN 15643-2:2011	Sustainability of construction works - Assessment of buildings - Part 2: Framework for the assessment of environmental performance
EN 15643-3:2012	Sustainability of construction works - Assessment of buildings - Part 3: Framework for the assessment of social performance
EN 15643-4:2012	Sustainability of construction works - Assessment of buildings - Part 4: Framework for the assessment of economic performance
EN 15643-5:2017	Sustainability of construction works - Sustainability assessment of buildings and civil engineering works - Part 5: Framework on specific principles and requirement for civil engineering works

EN 15978:2011	Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method
EN 16627:2015	Sustainability of construction works - Assessment of economic performance of buildings - Calculation methods
EN 16309:2014+A1:2014	Sustainability of construction works - Assessment of social performance of buildings - Calculation methodology
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

These documents are a good example of how to address the three sustainability aspects (social, environmental and economic).

ISO/TC 59/SC 17, Sustainability in buildings and civil engineering works

This committee also standardizes in the field of sustainability of the built environment including environmental, economic, and social aspects of sustainability. Hereafter some of the standards produced. ISO/TC 59/C 17 is also drafting documents on benchmarking of the sustainability.

Reference	Title
ISO 15392:2019	Sustainability in buildings and civil engineering works — General principles
Serie ISO 21929	Sustainability in building construction — Sustainability indicators
ISO 21930:2017	Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
Serie ISO 21931	Sustainability in building construction — Framework for methods of assessment of the environmental performance of construction works

CEN/WS 072, Framework for SustainValue - Sustainable Value Creation in manufacturing networks

This CEN Workshop, now disbanded, drafted CWA 16768:2014, *Framework for Sustainable Value Creation in Manufacturing Network*. This document covers good-practices for developing business models, governance models, sustainable solutions and performance management for existing and new sustainable production and service networks. It defines a Sustainable Business Modelling process and provides guidance to develop a Sustainability Performance Framework.

ASTM International Technical Committee E60.13 Sustainable Manufacturing of

The Technical Committee E60.13 on Sustainable Manufacturing of ASTM International develops standards that manufacturers can use to benchmark, assess, act on, and communicate sustainability metrics, including standards for evaluating, improving, and measuring processes to produce finished goods.

Reference	Title
E2986-18	Standard Guide for Evaluation of Environmental Aspects of Sustainability of Manufacturing Processes
E2987/E2987M-20	Standard Terminology for Sustainable Manufacturing
E3012-20	Standard Guide for Characterizing Environmental Aspects of Manufacturing Processes
E3096-18	Standard Guide for Definition, Selection, and Organization of Key Performance Indicators for Environmental Aspects of Manufacturing Processes

OECD Sustainable Manufacturing Toolkit

The Organisation for Economic Co-operation and Development (OECD) launched a Sustainable Manufacturing Toolkit that aims to provide a practical starting point for businesses around the world to improve the efficiency of their production processes and products enabling them to contribute to sustainable development and green growth. The Toolkit includes an internationally applicable common set of indicators helping businesses measure their environmental performance at the level of a plant or facility. This edition focuses on the environmental aspects of sustainable development.

The Toolkit comprises:

- A start-up guide, which provides easy-to-read guidance to help the reader understand the basic issues and start measurement step by step.
- A web portal that provides detailed explanation on indicators, technical advice on performance management and links to more guidance.

This toolkit is a good base towards building a sustainable manufacturing framework.

5.4.2 Sustainability-Social

CEN/TC 352, Nanotechnologies & ISO/TC 229, Nanotechnologies

There are some standards from these two technical committees dealing with social aspects of nano-manufacturing and sustainability. In previous subclause, the ones from CEN/TC 352 have been listed.

Herewith documents from ISO/TC 229 related to health and safety are compiled:

Reference	Title
ISO/TR 12885:2008	Nanotechnologies — Health and safety practices in occupational settings relevant to nanotechnologies
ISO/TR 12885:2018	Nanotechnologies — Health and safety practices in occupational settings

ISO/TS 12901-1:2012	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 1: Principles and approaches
ISO/CD TS 12901-1	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 1: Principles and approaches
ISO/TS 12901-2:2014	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 2: Use of the control banding approach
ISO/TR 13014:2012	Nanotechnologies — Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment
ISO/TR 13014:2012/Cor 1:2012	Nanotechnologies — Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment — Technical Corrigendum 1
ISO/TR 13121:2011	Nanotechnologies — Nanomaterial risk evaluation
ISO/TR 16197:2014	Nanotechnologies — Compilation and description of toxicological screening methods for manufactured nanomaterials
ISO/TR 17302:2015	Nanotechnologies — Framework for identifying vocabulary development for nanotechnology applications in human healthcare
ISO/TR 18637:2016	Nanotechnologies — Overview of available frameworks for the development of occupational exposure limits and bands for nano-objects and their aggregates and agglomerates (NOAAs)
ISO/TS 18827:2017	Nanotechnologies — Electron spin resonance (ESR) as a method for measuring reactive oxygen species (ROS) generated by metal oxide nanomaterials
ISO/TS 19006:2016	Nanotechnologies — 5-(and 6)-Chloromethyl-2',7' Dichloro-dihydrofluorescein diacetate (CM-H2DCF-DA) assay for evaluating nanoparticle-induced intracellular reactive oxygen species (ROS) production in RAW 264.7 macrophage cell line
ISO 19007:2018	Nanotechnologies — In vitro MTS assay for measuring the cytotoxic effect of nanoparticles
ISO/TS 19337:2016	Nanotechnologies — Characteristics of working suspensions of nano-objects for in vitro assays to evaluate inherent nano-object toxicity
ISO/CD TS 19337	Nanotechnologies — Characteristics of working suspensions of nano-objects for in vitro assays to evaluate inherent nano-object toxicity
ISO/TS 19590:2017	Nanotechnologies — Size distribution and concentration of inorganic nanoparticles in aqueous media via single particle inductively coupled plasma mass spectrometry
ISO/TR 19601:2017	Nanotechnologies — Aerosol generation for air exposure studies of nano-objects and their aggregates and agglomerates (NOAA)
ISO/TS 19808:2020	Nanotechnologies — Carbon nanotube suspensions — Specification of characteristics and measurement methods
ISO/TS 20477:2017	Nanotechnologies — Standard terms and their definition for cellulose nanomaterial

ISO/TS 20787:2017	Nanotechnologies - Aquatic toxicity assessment of manufactured nanomaterials in saltwater lakes using Artemia sp. Nauplii
ISO/TS 21361:2019	Nanotechnologies — Method to quantify air concentrations of carbon black and amorphous silica in the nanoparticle size range in a mixed dust manufacturing environment
ISO/TS 21362:2018	Nanotechnologies — Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation
ISO 21363:2020	Nanotechnologies — Measurements of particle size and shape distributions by transmission electron microscopy
ISO/TR 21386:2019	Nanotechnologies — Considerations for the measurement of nano-objects and their aggregates and agglomerates (NOAA) in environmental matrices
ISO/TR 21624:2020	Nanotechnologies — Considerations for in vitro studies of airborne nano-objects and their aggregates and agglomerates (NOAA)
ISO/TR 22019:2019	Nanotechnologies — Considerations for performing toxicokinetic studies with nanomaterials
ISO/TS 22082:2020	Nanotechnologies — Assessment of nanomaterial toxicity using dechorionated zebrafish embryo

Social responsibility

The International Standard on *Social Responsibility*, ISO 26000:2010, provides guidance rather than requirements, so it cannot be certified to unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location.

The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups and labour organizations around the world were involved in its development, which means it represents an international consensus.

ISO/TC 283, Occupational health and safety management

The scope of ISO/TC 283, *Occupational health and safety management*, is the standardization in the field of occupational health and safety management to enable an organization to control its OH&S risks and improve its OH&S performance.

Its main document is ISO 45001, Occupational health and safety management systems -- Requirements with guidance for use. This standard follows other generic management system approaches such as ISO 14001 and ISO 9001. It was based on earlier international standards in this area such as OHSAS 18001, the International Labour Organization's ILO-OSH Guidelines, various national standards and the ILO's international labour standards and conventions.

ISO/TC 262, Risk management

The main document developed by ISO/TC 262, *Risk management*, is ISO 31000:2018, R*isk management – Guidelines.* It provides principles, framework and a process for managing risk. It can be used by any organization regardless of its size, activity or sector. Using ISO 31000 can help organizations increase the likelihood of achieving objectives, improve the identification of opportunities and threats and effectively allocate and use resources for risk treatment. However, ISO 31000 cannot be used for certification purposes, but does provide guidance for internal or external audit programmes. Organizations using it can compare their risk management practices with an internationally recognised benchmark, providing sound principles for effective management and corporate governance.

5.4.3 Sustainability-Environmental

ISO/TC 207, Environmental management

The scope of ISO/TC 207, *Environmental management*, is the standardization in the field of environmental management systems and tools in support of sustainable development, excluding test methods of pollutants, setting limit values and levels of environmental performance, and standardization of products.

The structure of ISO/TC 207 is the following:

- ISO/TC 207/CAG 0 Chairman's advisory group
- ISO/TC 207/DCCG Developing Countries Coordination Group
- ISO/TC 207/STTF Spanish translation task force
- ISO/TC 207/TCG Terminology Coordination Group
- ISO/TC 207/TG 1 Sustainable Finance Coordination
- ISO/TC 207/TG 2 Circular economy coordination
- ISO/TC 207/WG 8 Material flow cost accounting – General principles and framework
- ISO/TC 207/WG 9 Land degradation and desertification
- ISO/TC 207/WG 10 Environmentally conscious design
- ISO/TC 207/WG 11 Green finance
- ISO/TC 207/SC 1 Environmental management systems
- ISO/TC 207/SC 2 Environmental auditing and related environmental investigations
- ISO/TC 207/SC 3 Environmental labelling
- ISO/TC 207/SC 4 Environmental performance evaluation
- ISO/TC 207/SC 5 Life cycle assessment
- ISO/TC 207/SC 7 Greenhouse gas management and related activities

Its main document relevant to the environmental aspect of sustainable manufacturing is EN ISO 14001, *Environmental management systems -- Requirements with guidance for use*.

Other relevant document is EN ISO 14031:2013, *Environmental management -- Environmental performance evaluation – Guidelines*, provides guidance on how an organization can evaluate its environmental performance. The standard also addresses the selection of suitable performance indicators, so that performance can be assessed against criteria set by management.

Finally, the serie ISO 14040 standards give guidelines on the principles and conduct of LCA studies that provide an organization with information on how to reduce the overall environmental impact of its products and services.

5.4.4 Sustainability-Economic

ISO/TC 176/SC 2, Quality systems

The works of ISO/TC 176/SC 2, Quality systems, namely ISO 9001, Quality management systems – Requirements, have a direct relationship with the fulfilment of the economic aspects of sustainability of a process such as nano-manufacturing.

Implementing a quality management system helps organisations to:

- Assess its overall context to define who is affected by its work and what they expect from it.
- Put customers first, making sure the organisation meets their needs and exceeds their expectations.
- Work in a more efficient way, increasing productivity and efficiency.
- Meet the necessary statutory and regulatory requirements.
- Expand into new markets, as some sectors and clients require ISO 9001
- Identify and address the risks associated with its activity.

Sustainable procurement

ISO 20400:2017, Sustainable procurement – Guidance provides guidelines for integrating sustainability into an organization's procurement processes. Aimed at top managers and directors of the purchasing function, it covers the political and strategic aspects of the purchasing process, namely how to align procurement with an organization's goals and objectives and create a culture of sustainability. The standard defines the principles of sustainable procurement, including accountability, transparency, respect for human rights and ethical behaviour, and highlights key considerations such as risk management and priority setting. It also covers various stages of the procurement process, outlining the steps required to integrate social responsibility into the purchasing function.

5.4.5 Others

ISO/TC 184, Automation systems and integration

The scope of ISO/TC 184 is the standardization in the field of automation systems and their integration for design, sourcing, manufacturing, production and delivery, support, maintenance and disposal of products

and their associated services. Areas of standardization include information systems, automation and control systems and integration technologies.

The structure of ISO/TC 184 is the following:

- ISO/TC 184/SC 1, Physical device control
- ISO/TC 184/SC 4, Industrial data
- ISO/TC 184/SC 5, Interoperability, integration, and architectures for enterprise systems and automation applications
- ISO/TC 184/AG, Advisory group
- ISO/TC 184/AHG 1, Support for smart manufacturing reference model
- ISO/TC 184/AHG 2, Digital Twin
- ISO/TC 184/JWG 21, Joint ISO/TC 184 - IEC/TC 65/JWG 21 - Smart Manufacturing Reference Model(s) linked to ISO/TC 184
- ISO/TC 184/TF 1, Business plan
- ISO/TC 184/TF 2, Supermeeting organization
- ISO/TC 184/WG 6, Asset intensive industry interoperability

The activity of ISO/TC 184/SC 5 is especially interesting for manufacturing operations management.

6. WAY FORWARD

With respect the specific actions to be carried out for the subsequent development of standardization activities, first of all it should be analysed if participating in a technical committee could be interesting for INNOMEM partners, and the grade of implication. Different options exist:

a) The follow up of the standardisation activity through updates reported by UNE. This could be the case for technical committees of horizontal nature or the ones with no direct impact from project results.

b) The follow up through the joining and participation of INNOMEM partners to a standardisation committee. Standardization is an open activity and all interested parties may participate in CEN/CENELEC/ISO/IEC technical committees through National Mirror Committees and National Standardization Bodies.

c) The establishment of a Project Liaison with a Technical Committee. Under this figure, the consortium can participate as an entity in the TC works, without voting rights. This implies an economic cost and is only advisable when the TC is developing a related standard during the life of the project.

Other specific actions are related to informing the relevant technical committees about the project. The aim is to familiarise the technical committees with INNOMEM project, trying to involve them. For this purpose, the possible actions are:

a) the dissemination of the INNOMEM project progress by delivering reports to the relevant TCs Secretaries. UNE can easily perform this task due to its knowledge of standardisation contact information.

b) attending relevant technical committees' meetings to show the project and to establish personal contacts with relevant industry representatives.

Finally, once the development of the project allows for proper knowledge of the gaps, needs and results expected, consideration should be paid for the contribution to the development of new standardization documents.

7. REFERENCES

Following links could be useful for particular searches in the standardization system:

https://www.cen.eu/

https://www.iso.org/home.html

https://www.cenelec.eu/

https://www.iec.ch/

https://www.astm.org/

8. ANNEXES

ANNEX A- PUBLISHED STANDARDS BY CEN/TC 352 NANOTECHNOLOGIES

Reference	Title
EN ISO 29701:2010	Nanotechnologies - Endotoxin test on nanomaterial samples for in vitro systems - Limulus amebocyte lysate (LAL) test (ISO 29701:2010)
EN ISO 10801:2010	Nanotechnologies - Generation of metal nanoparticles for inhalation toxicity testing using the evaporation/condensation method (ISO 10801:2010)
EN ISO 10808:2010	Nanotechnologies - Characterization of nanoparticles in inhalation exposure chambers for inhalation toxicity testing (ISO 10808:2010)
CEN ISO/TR 11811:2012	Nanotechnologies - Guidance on methods for nano- and microtribology measurements (ISO/TR 11811:2012)
CEN ISO/TS 13830:2013	Nanotechnologies - Guidance on voluntary labelling for consumer products containing manufactured nano-objects (ISO/TS 13830:2013)
CEN/TS 16937:2016	Nanotechnologies - Guidance for the responsible development of nanotechnologies
CEN/TS 17010:2016	Nanotechnologies - Guidance on measurands for characterising nano-objects and materials that contain them
CEN/TS 17276:2018	Nanotechnologies - Guidelines for Life Cycle Assessment - Application of EN ISO 14044:2006 to Manufactured Nanomaterials
CEN/TS 17273:2018	Nanotechnologies - Guidance on detection and identification of nano-objects in complex matrices
CEN/TS 17274:2018	Nanotechnologies - Guidelines for determining protocols for the explosivity and flammability of powders containing nano-objects (for transport, handling and storage)
CEN/TS 17275:2018	Nanotechnologies - Guidelines for the management and disposal of waste from the manufacturing and processing of manufactured nano-objects
CEN ISO/TS 80004-3:2014	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects (ISO/TS 80004-3:2010)
CEN ISO/TS 80004-4:2014	Nanotechnologies - Vocabulary - Part 4: Nanostructured materials (ISO/TS 80004-4:2011)
CEN ISO/TS 12025:2015	Nanomaterials - Quantification of nano-object release from powders by generation of aerosols (ISO/TS 12025:2012)
CEN ISO/TS 80004-8:2015	Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes (ISO/TS 80004-8:2013)
CEN ISO/TS 80004-6:2015	Nanotechnologies - Vocabulary - Part 6: Nano-object characterization (ISO/TS 80004-6:2013)

CEN ISO/TS 80004-1:2015	Nanotechnologies - Vocabulary - Part 1: Core terms (ISO/TS 80004-1:2015)
CEN ISO/TS 80004-2:2017	Nanotechnologies - Vocabulary - Part 2: Nano-objects (ISO/TS 80004-2:2015)
CEN ISO/TS 80004-12:2017	Nanotechnologies - Vocabulary - Part 12: Quantum phenomena in nanotechnology (ISO/TS 80004-12:2016)
EN ISO 17200:2020	Nanotechnology - Nanoparticles in powder form - Characteristics and measurements (ISO 17200:2020)
CEN ISO/TS 19590:2019	Nanotechnologies - Size distribution and concentration of inorganic nanoparticles in aqueous media via single particle inductively coupled plasma mass spectrometry (ISO/TS 19590:2017)
CEN ISO/TS 80004-11:2020	Nanotechnologies - Vocabulary - Part 11: Nanolayer, nanocoating, nanofilm, and related terms (ISO/TS 80004-11:2017)
CEN ISO/TS 80004-13:2020	Nanotechnologies - Vocabulary - Part 13: Graphene and related two-dimensional (2D) materials (ISO/TS 80004-13:2017)
CEN ISO/TR 18401:2020	Nanotechnologies - Plain language explanation of selected terms from the ISO/IEC 80004 series (ISO/TR 18401:2017)

ANNEX B- STANDARDS UNDER DEVELOPMENT BY CEN/TC 352 NANOTECHNOLOGIES

Reference	Title
FprCEN/TS 17629	Nanotechnologies - Nano- and micro- scale scratch testing
FprCEN ISO/TS 12025	Nanomaterials - Quantification of nano-object release from powders by generation of aerosols (ISO/DTS 12025:2020)
CEN ISO/TS 19590:2019	Nanotechnologies - Size distribution and concentration of inorganic nanoparticles in aqueous media via single particle inductively coupled plasma mass spectrometry (ISO/TS 19590:2017)
FprCEN ISO/TS 80004-3	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects (ISO/DTS 80004-3:2020)
FprCEN ISO/TS 80004-8	Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes (ISO/DTS 80004-8:2020)
FprCEN ISO/TS 80004-6	Nanotechnologies - Vocabulary - Part 6: Nano-object characterization (ISO/DTS 80004-6:2020)
FprCEN ISO/TS 21362	Nanotechnologies - Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation (ISO/TS 21362:2018)
	Nanotechnologies - Sampling for direct analysis (shape, size distribution, elemental composition)
	Nanotechnologies - Quick start guide for deploying a relevant nano health and safety risk management
	Nanotechnologies — Decision trees and flow charts towards sensible toxicity and ecotoxicity testing of engineered nanomaterials
	Nanotechnologies - Guidance on the determination of aggregation and agglomeration state of nano-objects
	Nanotechnologies - Guidelines for the characterization of nanoobjects-containing additives in food products
	Nanotechnologies - Challenges and capabilities to enhance the NOAA traceability in the B2B value chain for transparency and innovation purposes
	Risk Assessment and Life Cycle Assessment of Nanomaterials: Synergistic use of data for efficient and effective evaluations
	Safe-by-Design concept dedicated for nano scale materials (MNM) and products containing nanomaterials
	Nanotechnologies - Suitability of particle size and surface area measurement methods for the assessment of the amount of nano-objects in a sample

ANNEX C- PUBLISHED STANDARDS BY ISO/TC 229 NANOTECHNOLOGIES

Reference	Title
ISO/TS 10797:2012	Nanotechnologies — Characterization of single-wall carbon nanotubes using transmission electron microscopy
ISO/TS 10798:2011	Nanotechnologies — Charaterization of single-wall carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectrometry analysis
ISO 10801:2010	Nanotechnologies — Generation of metal nanoparticles for inhalation toxicity testing using the evaporation/condensation method
ISO 10808:2010	Nanotechnologies — Characterization of nanoparticles in inhalation exposure chambers for inhalation toxicity testing
ISO/TS 10867:2010	Nanotechnologies — Characterization of single-wall carbon nanotubes using near infrared photoluminescence spectroscopy
ISO/TS 10867:2019	Nanotechnologies — Characterization of single-wall carbon nanotubes using near infrared photoluminescence spectroscopy
ISO/TS 10868:2011	Nanotechnologies — Characterization of single-wall carbon nanotubes using ultraviolet-visible-near infrared (UV-Vis-NIR) absorption spectroscopy
ISO/TS 10868:2017	Nanotechnologies — Characterization of single-wall carbon nanotubes using ultraviolet-visible-near infrared (UV-Vis-NIR) absorption spectroscopy
ISO/TR 10929:2012	Nanotechnologies — Characterization of multiwall carbon nanotube (MWCNT) samples
ISO/TS 11251:2010	Nanotechnologies — Characterization of volatile components in single-wall carbon nanotube samples using evolved gas analysis/gas chromatograph-mass spectrometry
ISO/TS 11251:2019	Nanotechnologies — Characterization of volatile components in single-wall carbon nanotube samples using evolved gas analysis/gas chromatograph-mass spectrometry
ISO/TS 11308:2011	Nanotechnologies — Characterization of single-wall carbon nanotubes using thermogravimetric analysis
ISO/TS 11308:2020	Nanotechnologies — Characterization of carbon nanotube samples using thermogravimetric analysis
ISO/TR 11360:2010	Nanotechnologies — Methodology for the classification and categorization of nanomaterials
ISO/TR 11811:2012	Nanotechnologies — Guidance on methods for nano- and microtribology measurements
ISO/TS 11888:2011	Nanotechnologies — Characterization of multiwall carbon nanotubes — Mesoscopic shape factors
ISO/TS 11888:2017	Nanotechnologies — Characterization of multiwall carbon nanotubes — Mesoscopic shape factors

ISO/TS 11931:2012	Nanotechnologies — Nanoscale calcium carbonate in powder form — Characteristics and measurement
ISO/TS 11937:2012	Nanotechnologies — Nanoscale titanium dioxide in powder form — Characteristics and measurement
ISO/TS 12025:2012	Nanomaterials — Quantification of nano-object release from powders by generation of aerosols
ISO/TR 12802:2010	Nanotechnologies — Model taxonomic framework for use in developing vocabularies — Core concepts
ISO/TS 12805:2011	Nanotechnologies — Materials specifications — Guidance on specifying nano-objects
ISO/TR 12885:2008	Nanotechnologies — Health and safety practices in occupational settings relevant to nanotechnologies
ISO/TR 12885:2018	Nanotechnologies — Health and safety practices in occupational settings
ISO/TS 12901-1:2012	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 1: Principles and approaches
ISO/CD TS 12901-1	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 1: Principles and approaches
ISO/TS 12901-2:2014	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 2: Use of the control banding approach
ISO/TR 13014:2012	Nanotechnologies — Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment
ISO/TR 13014:2012/Cor 1:2012	Nanotechnologies — Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment — Technical Corrigendum 1
ISO/TR 13121:2011	Nanotechnologies — Nanomaterial risk evaluation
ISO/TS 13278:2011	Nanotechnologies — Determination of elemental impurities in samples of carbon nanotubes using inductively coupled plasma mass spectrometry
ISO/TS 13278:2017	Nanotechnologies — Determination of elemental impurities in samples of carbon nanotubes using inductively coupled plasma mass spectrometry
ISO/TR 13329:2012	Nanomaterials — Preparation of material safety data sheet (MSDS)
ISO/TS 13830:2013	Nanotechnologies — Guidance on voluntary labelling for consumer products containing manufactured nano-objects
ISO/TS 14101:2012	Surface characterization of gold nanoparticles for nanomaterial specific toxicity screening: FT-IR method
ISO/TR 14786:2014	Nanotechnologies — Considerations for the development of chemical nomenclature for selected nano-objects
ISO/TS 16195:2013	Nanotechnologies — Guidance for developing representative test materials consisting of nano-objects in dry powder form
ISO/TS 16195:2018	Nanotechnologies — Specification for developing representative test materials consisting of nano-objects in dry powder form

ISO/TR 16196:2016	Nanotechnologies — Compilation and description of sample preparation and dosing methods for engineered and manufactured nanomaterials
ISO/TR 16197:2014	Nanotechnologies — Compilation and description of toxicological screening methods for manufactured nanomaterials
ISO/TS 16550:2014	Nanotechnologies — Determination of silver nanoparticles potency by release of muramic acid from Staphylococcus aureus
ISO 17200:2020	Nanotechnology — Nanoparticles in powder form — Characteristics and measurements
ISO/TS 17200:2013	Nanotechnology — Nanoparticles in powder form — Characteristics and measurements
ISO/TR 17302:2015	Nanotechnologies — Framework for identifying vocabulary development for nanotechnology applications in human healthcare
ISO/TS 17466:2015	Use of UV-Vis absorption spectroscopy in the characterization of cadmium chalcogenide colloidal quantum dots
ISO/TS 18110:2015	Nanotechnologies — Vocabularies for science, technology and innovation indicators
ISO/TR 18196:2016	Nanotechnologies — Measurement technique matrix for the characterization of nano-objects
ISO/TR 18401:2017	Nanotechnologies — Plain language explanation of selected terms from the ISO/IEC 80004 series
ISO/TR 18637:2016	Nanotechnologies — Overview of available frameworks for the development of occupational exposure limits and bands for nano-objects and their aggregates and agglomerates (NOAAs)
ISO/TS 18827:2017	Nanotechnologies — Electron spin resonance (ESR) as a method for measuring reactive oxygen species (ROS) generated by metal oxide nanomaterials
ISO/TS 19006:2016	Nanotechnologies — 5-(and 6)-Chloromethyl-2',7' Dichloro-dihydrofluorescein diacetate (CM-H2DCF-DA) assay for evaluating nanoparticle-induced intracellular reactive oxygen species (ROS) production in RAW 264.7 macrophage cell line
ISO 19007:2018	Nanotechnologies — In vitro MTS assay for measuring the cytotoxic effect of nanoparticles
ISO/TR 19057:2017	Nanotechnologies — Use and application of acellular in vitro tests and methodologies to assess nanomaterial biodurability
ISO/TS 19337:2016	Nanotechnologies — Characteristics of working suspensions of nano-objects for in vitro assays to evaluate inherent nano-object toxicity
ISO/CD TS 19337	Nanotechnologies — Characteristics of working suspensions of nano-objects for in vitro assays to evaluate inherent nano-object toxicity
ISO/TS 19590:2017	Nanotechnologies — Size distribution and concentration of inorganic nanoparticles in aqueous media via single particle inductively coupled plasma mass spectrometry

ISO/TR 19601:2017	Nanotechnologies — Aerosol generation for air exposure studies of nano-objects and their aggregates and agglomerates (NOAA)
ISO/TR 19716:2016	Nanotechnologies — Characterization of cellulose nanocrystals
ISO/TR 19733:2019	Nanotechnologies — Matrix of properties and measurement techniques for graphene and related two-dimensional (2D) materials
ISO/TS 19807-1:2019	Nanotechnologies — Magnetic nanomaterials — Part 1: Specification of characteristics and measurements for magnetic nanosuspensions
ISO/TS 19808:2020	Nanotechnologies — Carbon nanotube suspensions — Specification of characteristics and measurement methods
ISO/TS 20477:2017	Nanotechnologies — Standard terms and their definition for cellulose nanomaterial
ISO/TR 20489:2018	Nanotechnologies — Sample preparation for the characterization of metal and metal-oxide nano-objects in water samples
ISO/TS 20660:2019	Nanotechnologies — Antibacterial silver nanoparticles — Specification of characteristics and measurement methods
ISO/TS 20787:2017	Nanotechnologies - Aquatic toxicity assessment of manufactured nanomaterials in saltwater lakes using Artemia sp. Nauplii
ISO 20814:2019	Nanotechnologies — Testing the photocatalytic activity of nanoparticles for NADH oxidation
ISO/TS 21236-1:2019	Nanotechnologies — Clay nanomaterials — Part 1: Specification of characteristics and measurement methods for layered clay nanomaterials
ISO/TS 21237:2020	Nanotechnologies — Air filter media containing polymeric nanofibres — Specification of characteristics and measurement methods
ISO/TS 21361:2019	Nanotechnologies — Method to quantify air concentrations of carbon black and amorphous silica in the nanoparticle size range in a mixed dust manufacturing environment
ISO/TS 21362:2018	Nanotechnologies — Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation
ISO 21363:2020	Nanotechnologies — Measurements of particle size and shape distributions by transmission electron microscopy
ISO/TR 21386:2019	Nanotechnologies — Considerations for the measurement of nano-objects and their aggregates and agglomerates (NOAA) in environmental matrices
ISO/TS 21412:2020	Nanotechnologies — Nano-object-assembled layers for electrochemical bio-sensing applications — Specification of characteristics and measurement methods
ISO/TR 21624:2020	Nanotechnologies — Considerations for in vitro studies of airborne nano-objects and their aggregates and agglomerates (NOAA)
ISO/TS 21975:2020	Nanotechnologies — Polymeric nanocomposite films for food packaging with barrier properties — Specification of characteristics and measurement methods

ISO/TR 22019:2019	Nanotechnologies — Considerations for performing toxicokinetic studies with nanomaterials
ISO/TS 22082:2020	Nanotechnologies — Assessment of nanomaterial toxicity using dechorionated zebrafish embryo
ISO/TS 27687:2008	Nanotechnologies — Terminology and definitions for nano-objects — Nanoparticle, nanofibre and nanoplate
ISO 29701:2010	Nanotechnologies — Endotoxin test on nanomaterial samples for in vitro systems — Limulus amebocyte lysate (LAL) test
IEC/TS 62607-2-1:2012	Nanomanufacturing - key control characteristics for CNT film applications - Resistivity — Part 2-1:
IEC/TS 62622:2012	Artificial gratings used in nanotechnology — Description and measurement of dimensional quality parameters
ISO/TS 80004-1:2010	Nanotechnologies — Vocabulary — Part 1: Core terms
ISO/TS 80004-1:2015	Nanotechnologies — Vocabulary — Part 1: Core terms
ISO/TS 80004-2:2015	Nanotechnologies — Vocabulary — Part 2: Nano-objects
ISO/TS 80004-3:2010	Nanotechnologies — Vocabulary — Part 3: Carbon nano-objects
ISO/TS 80004-4:2011	Nanotechnologies — Vocabulary — Part 4: Nanostructured materials
ISO/TS 80004-5:2011	Nanotechnologies — Vocabulary — Part 5: Nano/bio interface
ISO/TS 80004-6:2013	Nanotechnologies — Vocabulary — Part 6: Nano-object characterization
ISO/TS 80004-7:2011	Nanotechnologies — Vocabulary — Part 7: Diagnostics and therapeutics for healthcare
ISO/TS 80004-8:2013	Nanotechnologies — Vocabulary — Part 8: Nanomanufacturing processes
IEC/TS 80004-9:2017	Nanotechnologies — Vocabulary — Part 9: Nano-enabled electrotechnical products and systems
IEC/TS 80004-11 :2017	Nanotechnologies — Vocabulary — Part 11: Nanolayer, nanocoating, nanofilm, and related terms
ISO/TS 80004-12:2016	Nanotechnologies — Vocabulary — Part 12: Quantum phenomena in nanotechnology
ISO/TS 80004-13:2017	Nanotechnologies — Vocabulary — Part 13: Graphene and related two-dimensional (2D) materials

ANNEX D- STANDARDS UNDER DEVELOPMENT BY ISO/TC 229 NANOTECHNOLOGIES

Reference	Title
ISO/CD TS 10798	Nanotechnologies — Characterization of carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectrometry
ISO/PRF TS 12025	Nanomaterials — Quantification of nano-object release from powders by generation of aerosols
ISO/CD TS 12901-1	Nanotechnologies — Occupational risk management applied to engineered nanomaterials — Part 1: Principles and approaches
ISO/DIS 19749	Nanotechnologies — Measurements of particle size and shape distributions by scanning electron microscopy
ISO/CD TS 19807-2	Nanotechnologies — Magnetic nanomaterials — Part 2: Specification of characteristics and measurements for nanostructured superparamagnetic beads for nucleic acid extraction
ISO/CD TS 21236-2	Nanotechnologies — Clay nanomaterials — Part 2: Specification of characteristics and measurements for clay nanoplates used for gas barrier film applications
ISO/PRF TS 21346	Nanotechnologies - Characterization of individualized cellulose nanofibril samples
ISO/CD TS 21356-1	Nanotechnologies — Structural characterization of graphene — Part 1: Graphene from powders and dispersions
ISO/CD TS 21357	Nanotechnologies — Evaluation of the mean size of nano-objects in liquid dispersions by static multiple light scattering (SMLS)
ISO/AWI 21362	Nanotechnologies — Analysis of nano-objects using asymmetrical-flow and centrifugal field-flow fractionation
ISO/DTS 21633	Label-free impedance technology to assess the toxicity of nanomaterials in Vitro
ISO/CD TS 22292	Nanotechnologies — 3D image reconstruction of rod-supported nano-objects using transmission electron microscopy
ISO/CD TR 22293	Evaluation of methods for assessing the release of nanomaterials from commercial, nanomaterial-containing polymer composites
ISO/DTR 22455	High throughput screening method for nanoparticles toxicity using 3D cells
ISO/CD TS 23034	Method to estimate cellular uptake of carbon nanomaterials using optical absorption
ISO/CD TS 23151	Nanotechnologies — Particle size distribution for cellulose nanocrystals
ISO/CD TS 23302	Nanotechnologies — Guidance on measurands for characterising nano-objects and materials that contain them

ISO/PRF TS 23362	Nanotechnologies — Nanostructured porous alumina as catalyst support for vehicle exhaust emission control — Specification of characteristics and measurement methods
ISO/AWI TS 23366	Nanotechnologies — Performance evaluation requirements for quantifying biomolecules using fluorescent nanoparticles in immunohistochemistry
ISO/AWI TS 23367	Nanotechnologies — Performance characteristics of nanosensors for chemical and biomolecule detection
ISO/CD TS 23459	Nanotechnologies — Assessment of protein secondary structure during an interaction with nanomaterials using ultraviolet circular dichroism
ISO/WD TR 23463	Nanotechnologies — Characterization of carbon nanotube and carbon nanofiber aerosols in relation to inhalation toxicity tests
ISO/CD TS 23650	Nanotechnologies — Evaluation of the antimicrobial performance of textiles containing manufactured nanomaterials
ISO/AWI TR 23652	Nanotechnologies — Considerations for radiolabelling methods of nanomaterials for performance evaluation
ISO/AWI TS 23690	Nanotechnologies — Multiwall carbon nanotubes — Determination of amorphous carbon content by thermogravimetric analysis
ISO/AWI TR 24672	Nanotechnologies — Guidance on the measurement of nanoparticle number concentration
IEC/CD 62565-3-1	Nanomanufacturing — Material specifications — Part 3-1: Graphene — Blank detail specification
IEC/AWI 62607-6-3	Nanomanufacturing — Key control characteristics — Graphene - Characterization of graphene domains and defects — Part 6-3:
IEC/CD TR 63258	Nanotechnologies — A guideline for ellipsometry application to evaluate the thickness of nanoscale films
ISO/PRF TS 80004-3	Nanotechnologies — Vocabulary — Part 3: Carbon nano-objects
ISO/PRF TS 80004-6	Nanotechnologies — Vocabulary — Part 6: Nano-object characterization
ISO/PRF TS 80004-8	Nanotechnologies — Vocabulary — Part 8: Nanomanufacturing processes

ANNEX E- STANDARDS PUBLISHED AND UNDER DEVELOPMENT BY CEN/TC 137 ASSESSMENT OF WORKPLACE EXPOSURE TO CHEMICAL AND BIOLOGICAL AGENTS

Reference	Title	Status	Drafting WG (and response to mandate)
EN 481:1993	Workplace atmospheres - Size fraction definitions for measurement of airborne particles	Published	
EN 14530:2004	Workplace atmospheres - Determination of diesel particulate matter - General requirements	Published	WG2
EN 14031:2003	Workplace atmospheres - Determination of airborne endotoxins	Published	WG5
CEN/TR 15230:2005	Workplace atmospheres - Guidance for sampling of inhalable, thoracic and respirable aerosol fractions	Published	WG3
CEN/TR 15278:2006	Workplace exposure - Strategy for the evaluation of dermal exposure	Published	WG6
CEN/TS 15279:2006	Workplace exposure - Measurement of dermal exposure - Principles and methods	Published	WG6
EN 838:2010	Workplace exposure - Procedures for measuring gases and vapours using diffusive samplers - Requirements and test methods	Published	WG2
CEN/TR 15547:2007	Workplace atmospheres - Calculation of the health-related aerosol fraction concentration from the concentration measured by a sampler with known performance characteristics	Published	WG3
EN ISO 28439:2011	Workplace atmospheres - Characterization of ultrafine aerosols/nanoaerosols - Determination of the size distribution and number concentration using differential electrical mobility analysing systems (ISO 28439:2011)	Published	WG3

EN 1540:2011	Workplace exposure - Terminology	Published	WG4
EN 15051-1:2013	Workplace exposure - Measurement of the dustiness of bulk materials - Part 1: Requirements and choice of test methods	Published	WG3
CEN/TR 16013-1:2010	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 1: Choice of monitor for specific applications	Published	WG3
CEN/TR 16013-2:2010	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 2: Evaluation of airborne particle concentrations using Optical Particle Counters	Published	WG3
EN 13936:2014	Workplace exposure - Procedures for measuring a chemical agent present as a mixture of airborne particles and vapour - Requirements and test methods	Published	WG2
EN 15051-3:2013	Workplace exposure - Measurement of the dustiness of bulk materials - Part 3: Continuous drop method	Published	WG3
CEN/TR 16013-3:2012	Workplace exposure - Guide for the use of direct-reading instruments for aerosol monitoring - Part 3: Evaluation of airborne particle concentrations using photometers	Published	WG3
EN ISO 13138:2012	Air quality - Sampling conventions for airborne particle deposition in the human respiratory system (ISO 13138:2012)	Published	
EN ISO 13137:2013	Workplace atmospheres - Pumps for personal sampling of chemical and biological agents - Requirements and test methods (ISO 13137:2013)	Published	

EN 13205-1:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 1: General requirements	Published	WG3
EN 13205-2:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 2: Laboratory performance test based on determination of sampling efficiency	Published	WG3
CEN/TR 13205-3:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 3: Analysis of sampling efficiency data	Published	WG3
EN 13205-4:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 4: Laboratory performance test based on comparison of concentrations	Published	WG3
EN 13205-5:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 5: Aerosol sampler performance test and sampler comparison carried out at workplaces	Published	WG3
EN 13205-6:2014	Workplace exposure - Assessment of sampler performance for measurement of airborne particle concentrations - Part 6: Transport and handling tests	Published	WG3
EN 16897:2017	Workplace exposure - Characterization of ultrafine aerosols/nanoaerosols - Determination of number concentration using condensation particle counters	Published	WG3 (M 461)
EN 17058:2018	Workplace exposure - Assessment of exposure by inhalation of nano-objects and their aggregates and agglomerates	Published	WG3 (M 461)
CEN ISO/TS 21623:2018	Workplace exposure - Assessment of dermal exposure to nano-objects and their aggregates and agglomerates (NOAA) (ISO/TS 21623:2017)	Published	WG6 (M461)

EN 16966:2018	Workplace exposure - Measurement of exposure by inhalation of nano-objects and their aggregates and agglomerates - Metrics to be used such as number concentration, surface area concentration and mass concentration	Published	WG3 (M 461)
EN 17199-1:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA and other respirable particles - Part 1: Requirements and choice of test methods	Published	WG3 (M 461)
EN 17199-2:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 2: Rotating drum method	Published	WG3 (M 461)
EN 17199-3:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 3: Continuous drop method	Published	WG3 (M 461)
EN 17199-5:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 5: Vortex shaker method	Published	WG3 (M 461)
EN 17199-4:2019	Workplace exposure - Measurement of dustiness of bulk materials that contain or release respirable NOAA or other respirable particles - Part 4: Small rotating drum method	Published	WG3 (M 461)
CEN/TR 17055:2017	Workplace exposure - Measurement of chemical agents complying with the requirements given in EN 482 and either one of EN 838, EN 1076, EN 13205, EN 13890 and EN 13936 - Choice of procedures	Published	WG2

EN ISO 17621:2015	Workplace atmospheres - Short term detector tube measurement systems - Requirements and test methods (ISO 17621:2015)	Published	
EN 482:2012+A1:2015	Workplace exposure - General requirements for the performance of procedures for the measurement of chemical agents	Published	WG2
EN 15051-2:2013+A1:2016	Workplace exposure - Measurement of the dustiness of bulk materials - Part 2: Rotating drum method	Published	WG6
EN 13098:2019	Workplace exposure - Measurement of airborne microorganisms and microbial compounds - General requirements	Published	
prEN 14583	Workplace exposure - Volumetric bioaerosol sampling devices - General requirements for use and evaluation of performance	Not Published	WG5
prEN 14031	Workplace exposure - Quantitative measurement of airborne endotoxins	Not Published	WG5
EN ISO 22065:2019	Workplace air - Gases and vapours - Requirements for evaluation of measuring procedures using pumped samplers (ISO 22065:2019)	Published	
FprEN 482	Workplace exposure - Procedures for the determination of the concentration of chemical agents - Basic performance requirements	Not Published	WG2
prEN 1540	Workplace exposure - Terminology	Not Published	WG4
EN 17289-1:2020	Characterization of bulk materials - Determination of a size-weighted fine fraction and crystalline silica content - Part 1: General information and choice of test methods	Not Published	WG3

EN 17289-2:2020	Characterization of bulk materials - Determination of a size-weighted fine fraction and crystalline silica content - Part 2: Calculation method	Not Published	WG3
EN 17289-3:2020	Characterization of bulk materials - Determination of a size-weighted fine fraction and crystalline silica content - Part 3: Sedimentation method	Not Published	WG3
EN 689:2018+AC:2019	Workplace exposure - Measurement of exposure by inhalation to chemical agents - Strategy for testing compliance with occupational exposure limit values	Published	
EN ISO 21832:2020	Workplace air - Metals and metalloids in airborne particles - Requirements for evaluation of measuring procedures (ISO 21832:2018)	Published	WG2
prEN ISO 13137 rev	Workplace atmospheres - Pumps for personal sampling of chemical and biological agents - Requirements and test methods	Not Published	
prEN ISO 22065	Workplace air - Gases and vapours - Requirements for evaluation of measuring procedures using pumped samplers (ISO/FDIS 22065:2020)	Not Published	
prEN ISO 23320	Workplace air — Gases and vapours — Requirements for evaluation of measuring procedures using diffusive samplers	Not Published	
	Workplace exposure - Sampling of nano-objects and their agglomerates and aggregates in the workplace for electron microscopy	Not Published	
	Workplace exposure - Counting rules for the characterization of airborne nano-objects and their agglomerates and aggregates for scanning electron microscopy (SEM) and transmission electron microscopy (TEM)	Not Published	

	Workplace exposure - Application of direct-reading low-cost sensors for measuring NOAA in the workplace	Not Published
prEN ISO 23861	Workplace air – Chemical agent present as a mixture of airborne particles and vapour – Requirements for evaluation of measuring procedures using pumped samplers	Not Published

ANNEX F- STANDARDS PUBLISHED AND UNDER DEVELOPMENT BY CEN/TC 195 AIR FILTERS FOR GENERAL AIR CLEANING

Reference	Title	Status	Drafting WG (and response to mandate)
EN ISO 12249-2	Particulate air filters for general ventilation - Part 2: Method of calculation for the energy performance of air cleaning devices and for the classification of the energy performance	Published	CEN/TC 195/WG 1
EN 15805:2009	Particulate air filters for general ventilation - Standardised dimensions	Published	CEN/TC 195/WG 1
EN 1822-1:2019	High efficiency air filters (EPA, HEPA and ULPA) - Part 1: Classification, performance testing, marking	Published	CEN/TC 195/WG 2
EN ISO 10121-1:2014	Test method for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 1: Gas-phase air cleaning media (ISO 10121-1:2014)	Published	CEN/TC 195/WG 5
EN ISO 10121-2:2013	Test methods for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 2: Gas-phase air cleaning devices (GPACD) (ISO 10121-2:2013)	Published	CEN/TC 195/WG 5
EN ISO 15858:2016	UV-C Devices - Safety information - Permissible human exposure (ISO 15858:2016)	Published	CEN/TC 195/WG 1
EN ISO 15957:2015	Test dusts for evaluating air cleaning equipment (ISO 15957:2015)	Published	CEN/TC 195/WG 1

EN ISO 16170:2016	In situ test methods for high efficiency filter systems in industrial facilities (ISO 16170:2016, Corrected version 2017-04)	Published	CEN/TC 195/WG 2
EN ISO 16890-1:2016	Air filters for general ventilation - Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM) (ISO 16890-1:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-2:2016	Air filters for general ventilation - Part 2: Measurement of fractional efficiency and air flow resistance (ISO 16890-2:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-3:2016	Air filters for general ventilation - Part 3: Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured (ISO 16890-3:2016)	Published	CEN/TC 195/WG 1
EN ISO 16890-4:2016	Air filters for general ventilation - Part 4: Conditioning method to determine the minimum fractional test efficiency (ISO 16890-4:2016)	Published	CEN/TC 195/WG 1
EN ISO 16891:2016	Test methods for evaluating degradation of characteristics of cleanable filter media (ISO 16891:2016)	Published	CEN/TC 195/WG 1
CEN ISO/TS 21083-2:2019	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 2: Size range from 3 nm to 30 nm (ISO/TS 21083-2:2019)	Published	CEN/TC 195/WG 6
EN ISO 21083-1:2018	Test method to measure the efficiency of air filtration media against spherical nanomaterials - Part 1: Size range from 20 nm to 500 nm (ISO 21083-1:2018)	Published	CEN/TC 195/WG 6
EN ISO 29461-1:2013	Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements (ISO 29461-1:2013)	Published	CEN/TC 195/WG 1

EN ISO 29462:2013	Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow (ISO 29462:2013)	Published	CEN/TC 195/WG 1
EN ISO 29463-2:2018	High-efficiency filters and filter media for removing particles in air - Part 2: Aerosol production, measuring equipment and particle-counting statistics (ISO 29463-2:2011)	Published	CEN/TC 195/WG 2
EN ISO 29463-3:2018	High-efficiency filters and filter media for removing particles in air - Part 3: Testing flat sheet filter media (ISO 29463-3:2011)	Published	CEN/TC 195/WG 2
EN ISO 29463-4:2018	High-efficiency filters and filter media for removing particles in air - Part 4: Test method for determining leakage of filter elements-Scan method (ISO 29463-4:2011)	Published	CEN/TC 195/WG 2
EN ISO 29463-5:2018	High-efficiency filters and filter media for removing particles in air - Part 5: Test method for filter elements (ISO 29463-5:2011)	Published	CEN/TC 195/WG 2
EN ISO 29464:2019	Cleaning of air and other gases - Terminology (ISO 29464:2017)	Published	CEN/TC 195
prEN 15805 rev	Particulate air filters for general ventilation - Standardised dimensions	Under development	CEN/TC 195
prEN ISO 29461-1 rev	Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements	Under development	CEN/TC 195/WG 1
prEN ISO 29461-2	Air filter intake systems for rotary machinery -- Test methods -- Part 2: Cleanable (Pulse jet) air filters	Under development	CEN/TC 195/WG 1

prEN ISO 29463-5 rev	ISO 29463-5 High-efficiency filters and filter media for removing particles in air - Part 5: Test method for filter elements	Under development	CEN/TC 195/WG 2
prEN ISO 10121-3	EN ISO 10121- 3 Test method for assessing the performance of gas-phase air cleaning media and devices for general ventilation - Part 3: Classification system for treatment of make up air	Under development	CEN/TC 195
prEN ISO 29462	Field testing of general ventilation filtration devices and systems for in situ removal efficiency by particle size and resistance to airflow (ISO/DIS 29462:2020)	Under development	CEN/TC 195
prEN ISO 15957 rev	Test dusts for evaluating air cleaning equipment	Under development	CEN/TC 195
prEN ISO 16890-2	Air filters for general ventilation - Part 2: Measurement of fractional efficiency and air flow resistance (ISO/DIS 16890-2:2020)	Under development	CEN/TC 195
prEN ISO 16890-4	Air filters for general ventilation - Part 4: Conditioning method to determine the minimum fractional test efficiency (ISO/DIS 16890-4:2020)	Under development	CEN/TC 195