

CEN Workshop Characterization and testing of membranes for gas separation applications

Workshop description form

- PART A – Workshop Summary**
- PART B – Project Plan**

PART A – Workshop SUMMARY

1	WS details	
1.1.	Organization	<input checked="" type="checkbox"/> CEN <input type="checkbox"/> CENELEC <input type="checkbox"/> Joint with <input type="checkbox"/> CEN lead <input type="checkbox"/> CENELEC lead
1.2.	Title	CEN WS Characterization and testing of membranes for gas separation applications
1.3.	Scope	<p>The planned Workshop will define a detailed set of common procedures to determine specific characteristics of gas separation membranes under different operating conditions. In particular, the following points will be addressed:</p> <ul style="list-style-type: none"> • General aspects <ul style="list-style-type: none"> - Definition of materials used for membrane manufacture and membrane - Classification of membrane: 1) Material of the selective layer (organic, ceramic, metallic, mixed matrix) 2) Material of the support 3) Type (thin film composite, integral asymmetric and others) 4) Geometry (tubular, flat sheet, hollow fibre, ...) - Experimental accuracies/errors - Temperature, pressure and flowrate measurement devices and procedures - Assessment of aging - Account for real gas behaviour (use of fugacity driving force and Joule-Thomson effect): Equations of state • Single gas permeation performance <ul style="list-style-type: none"> - Define what gases are to be tested for what type of membrane (e.g. N₂, O₂, CO₂, CH₄, H₂ for membranes using polyimides as selective layer, H₂ for Pd/Ag alloy, n-butane for silicon rubber type thin film composite membranes, ...) - How to assess the permeation of vapours <ul style="list-style-type: none"> - Temperature and pressure ranges - Used methods for permeation measurements - Compare membranes made of different materials (e.g. polymer vs. ceramic): definition of parameters for comparison, e.g. selectivity and permeance - How to assess permeating gas / membrane material interaction (swelling, pressure dependency, capillary condensation) - Necessity to include adsorption experiments into membrane permeation assessment • Gas mixtures <ul style="list-style-type: none"> - Define representative applications for membrane gas separations. This includes the definition of gas mixtures. - Define operating conditions: temperatures, pressures, compositions - Ensure, that only intrinsic membrane performance is assessed, avoid influence of: <ol style="list-style-type: none"> 1) Concentration gradient 2) Change of composition along the membrane surface) or ensure that this change is accounted for during experiment evaluation) 3) Pressure drops in support structures and apparatus - Composition analysis recommendations applicable instruments and methods • Reporting the results and modelling <ul style="list-style-type: none"> - Recommended models (Solution-Diffusion model, Arrhenius model, Dual-Sorption,

		<p>free-Volume, Sievert's law, etc.) and parameters to be reported</p> <ul style="list-style-type: none"> - Units of measurements - Definition and nomenclature of used parameters (e.g. selectivity vs. separation factor) <p>The resulting CWA will be applicable to manufactures of gas separation membranes in academia and industry. The results will form a valuable basis for design for chemical manufacturing companies as well as E&C companies. It will allow these companies to consider membrane gas separation in the early design phases and hence allow to develop more environmentally friendly, energy efficient and low carbon footprint processes.</p>	
1.4.	Does this WS stem from an EU Research project?	<input checked="" type="checkbox"/> YES Name of the project: INNOMEM Open Innovation Test Bed for nano-enabled Membranes Grant number: N° 862330 <input type="checkbox"/> End date 31-10-2024 <input type="checkbox"/> NO	
1.5.	Financial support	<input checked="" type="checkbox"/> EU Research project <input type="checkbox"/> EC/EFTA Grant reference: Type here <input type="checkbox"/> Other Specify, if needed: Type here	
1.6.	WS Proposer	Name: Organization: Postal address: Phone: Webpage: Contact person (name and email):	INNOMEM Open Innovation Test Bed for nano-enabled Membranes (Project under EU Horizon 2020 Research and Innovation Program and Grant Agreement N° 862330) Astondo Bidea, Building 700, Derio, Bizkaia 48160, Spain (+34) 667 11 60 32 https://www.innomem.eu/ Jon Zúñiga jon.zuniga@tecnalia.com
1.7.	WS Secretariat	Organization: Postal address: Email: Phone: Webpage: WS Secretary name: Email: Phone:	Spanish Association for Standardization, UNE Génova 6, 28004 Madrid Type here Type here https://www.une.org Raquel Martínez Egido ramartinez@une.org (+34) 680 27 14 75
1.8.	CEN and CENELEC Management Centre (CCMC) contact	Organization: Postal address: Webpage: CCMC Project Manager name: Email: Phone:	CEN and CENELEC Rue de la Science 23B - 1040 Brussels, Belgium https://www.cencenelec.eu/Pages/default.aspx Benjamin de VILLE de GOYET bdeville@cencenelec.eu +32 2 550 09 74 Type here
1.9.	Tentative date and place of the Kick-off Meeting	Date: 2024-07-04	Place: Virtual

1.10.	Does the proposed Workshop fall within the scope of existing CEN and/or CENELEC Technical Bodies? ¹	<input type="checkbox"/> YES Specify: Type here <input checked="" type="checkbox"/> NO																									
1.11.	Are there other Technical Bodies or Joint Advisory and Coordination Groups potentially interested in the Workshop? ²	<input checked="" type="checkbox"/> YES Specify: CEN/TC 249 Plastics; CEN/TC 234 Gas infrastructure; CEN/TC 386 Photocatalysis; CEN/TC 243 Cleanroom technology; CEN/TC 195 Cleaning equipment for air and other gases <input type="checkbox"/> NO																									
1.12.	Are the following aspects affected?	<table border="0"> <tr> <td>Safety matters</td> <td>YES³</td> <td><input type="checkbox"/></td> <td>NO</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Management system aspects</td> <td>YES⁴</td> <td><input type="checkbox"/></td> <td>7</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Conformity assessment aspects</td> <td>YES⁵</td> <td><input type="checkbox"/></td> <td>NO</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Security matters</td> <td>YES⁶</td> <td><input type="checkbox"/></td> <td>NO</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td></td> <td>8</td> <td><input type="checkbox"/></td> </tr> </table>	Safety matters	YES ³	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>	Management system aspects	YES ⁴	<input type="checkbox"/>	7	<input checked="" type="checkbox"/>	Conformity assessment aspects	YES ⁵	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>	Security matters	YES ⁶	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>				8	<input type="checkbox"/>
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			8	<input type="checkbox"/>																							
		Add information/explanations if Management System aspects and Conformity Assessment aspects are affected: Type here																									
2 WS Deliverables																											
2.1. CWA #1																											
2.1.1	Title	<input checked="" type="checkbox"/> Same as WS title (1.2) <input type="checkbox"/> Other: Type here																									
2.1.2	Scope	See 1.3																									
2.1.3	Does the proposed CWA conflict with a published EN	<input type="checkbox"/> YES Specify: Type here <input checked="" type="checkbox"/> NO In case the answer is 'yes', the development of the CWA shall be stopped																									

¹ Part A and Part B of this form shall be sent by the WS secretary to the secretary of the Technical Bodies identified in this section to inform them about the creation of the WS and register any possible objection within 30 days (45 during the holiday period).

² Part A and Part B of this form should be sent by the WS secretary to the Bodies identified in this section to inform them about the creation of the WS.

³ Work on the proposed CEN and/or CENELEC Workshop shall not be initiated.

⁴ The CEN and/or CENELEC Workshop proposal shall be submitted to the CEN/CENELEC BT(s) for decision.

⁵ CEN-CENELEC Internal Regulations - Part 3, Clause 33 applies.

⁶ For projects dealing with security matters the security risk analysis provided in Annex I shall be carried out.

⁷ See Note 2 in CEN-CENELEC Guide 29, Clause 3.

⁸ See Note 2 in CEN-CENELEC Guide 29, Clause 3.

PART B – Project Plan

Abstract

In the field of membranes exist a wide variety of membrane materials and membrane applications that are usually characterized and tested using specific methods and protocols employed by manufactures and research institutions. These depend on their own and diverse facilities and apparatuses. The main objective of the WS Characterization and testing of membranes for gas separation applications is to provide a detailed set of common procedures, methodologies and protocols to be applied when determining characteristics of gas separation membranes that will allow for comparable and homogeneous results independent of the details of the instrumental infrastructure at the individual institutions. The WS aims at establishing a methodology that allows potential users of gas separation membrane technology to compare data from different sources to assess the viability of a membrane-based solution for a given gas separation task. Hence, the application of membrane technology in addressing separation needs arising from the transition of Europe's industry towards CO₂-neutrality and zero discharge operation can be fostered.

The CWA will be developed in the framework of INNOMEM European research project and some findings from the project will be used together with other sources (academic research, test protocols commonly used by participants etc).

1 Status of the project plan

Draft project plan for public commenting (Version 1.0)

This draft project plan is intended to inform the public of a new Workshop. Any interested party can take part in this Workshop and/or comment on this draft project plan by sending an email to the WS secretary.

All those who have applied for participation or have commented on the project plan by the deadline will be invited to the kick-off meeting of the Workshop on **<2024-07-04>**.

2 Workshop proposer and potential Workshop participants

2.1 Workshop proposer

INNOMEM PROJECT (coordinated by TECNALIA Research Institute)

INNOMEM Research project aims at developing a sustainable OITB (Open Innovation Test Bed) to foster deployment and scale-up of innovative nano-enabled membranes and their derived products. Its consortium gathers some of the most recognised Membrane departments (>20) in Europe.

Within the scope of INNOMEM, different types of membrane materials (polymeric, ceramic, metallic and nanocomposite), surface modification, membrane morphology and geometry and applications are covered.

In the INNOMEM project, TECNALIA acts as Project Coordinator. Fundación TECNALIA Research and Innovation is the largest private non-profit applied research centre in Spain and the fifth in Europe. During the last years the Membrane Technology and Process Intensification Dept. has been involved in the development of materials and membranes and their use in different applications, being one of them the gas separation applications.

Hereon will chair the WS and lead the CWA that originated the proposed work. Helmholtz-Zentrum Hereon belongs to the Helmholtz Association, Germany's largest research organisation. Hereon conducts international

cutting-edge research for a changing world. Hereon's scientific spectrum encompasses high-performance materials, processes and environmentally friendly technologies for mobility and new energy systems. Within its Institute of Membrane Research innovative membranes and membrane processes are developed to address separation challenges. This involves a holistic, interdisciplinary approach: it includes developing new materials, processing these materials into membranes as well as constructing pilot plants in which these systems are made ready for implementation. The contact details of the chair are as follows:

Torsten Brinkmann
Helmholtz-Zentrum Hereon
Institute of Membrane Research
Max-Planck-Straße 121502 Geesthacht
Germany
+49 (0)4152 87 2400
+49 (0)4152 87 4 2400
Torsten.brinkmann@hereon.de
https://www.hereon.de/institutes/membrane_research/index.php.en

2.2 Potential participants

This CWA will be developed in a Workshop (temporary body) that is open to any interested party. The participation of other experts would be helpful and is desired. It is recommended that:

- Industrial users of membrane technology
- Membrane manufacturers
- Membrane equipment and plant manufacturers
- Academic and research institutions
- Testing organisations
- Professional societies and institutions
- ...

take part in the development of this CWA.

3 Workshop objectives and scope

3.1 Workshop background

Membrane technology has become a viable technology for various separation tasks in numerous industries, energy generation, environmental protection, wastewater treatment and clean water provision, to name but a few. Both liquid and gas phase mixtures are being treated. Furthermore, membranes can be classified according to the materials or material combinations they are made from as well as their geometrical form. Gas phase separation has gained in importance in the recent years, especially when considering the separation needs arising from the transition of Europe's industry towards CO₂-neutrality and zero discharge operation. Membrane technology can play a very important role here since it exhibits numerous advantages when compared to other separation technologies as e.g. ease of scalability and operation, steady state operation, small footprint area, energy efficiency and avoidance of potentially harmful chemicals during operation, to name but a few. However,

the methods and protocols employed by manufactures, industrial users and academia to assess and classify the separation properties of individual membranes differ widely. In order to realise the potential of gas separation membrane technology it is necessary to be able to select the right membrane for the given separation task. This entails a true comparability of reported performance and operating window data for membranes based on thorough testing. The main objective is to provide a detailed set of common procedures, methodologies and protocols to be applied when determining characteristics of gas separation membranes that will allow for comparable and homogeneous results independent of the details of the instrumental infrastructure at the individual institutions.

The resulting CWA will be applicable to manufactures of gas separation membranes in academia and industry. The results will form a valuable basis for design for chemical manufacturing companies as well as E&C companies. It will allow these companies to consider membrane gas separation in the early design phases and hence allow to develop more environmentally friendly, energy efficient and low carbon footprint processes.

The subject of the planned CWA is not at present the subject of any standard nor an existing Technical Committee. In the framework of standardization activities within the INNOMEM project several Technical Committees were contacted with two main goals: firstly to raise awareness on the project and secondly to inform about the specific needs on standardization detected over the course of the project on the characterization and testing of membranes for gas separation applications.

However, the above-mentioned Technical Committees (or any other detected which could have any related activity or standards/ technical specifications that could be of interest for the future development of the CWA) will be contacted and invited to participate in the development of the CWA or to provide any feedback on it.

No regulations have been identified in the scope of the future CWA.

4 Workshop programme

4.1 General

The kick-off meeting is planned to take place on **2024-07-04 through TEAMS**. A draft for public commenting will be published for 30 days.

A total of 5 Workshop meetings (kick-off meeting and Workshop meetings) via web conference will be held, during which the content of the CWA(s) will be presented, discussed and approved.

The CWA will be drawn up in English (language of meetings, minutes, etc.)

4.2 Workshop schedule

Table 1: Workshop schedule (preliminary)

CEN/CENELEC Workshop	M01 May 24	M02 Jun 24	M03 Jul 24	M04 Aug 24	M05 Sep 24	M06 Oct 24	M07 Nov 24	M08 Dec 24	M09	M10	M11	M12	...
Initiation	[Dark Blue]												
1. Workshop description form submission and TC response	[Light Blue]												
2. Open commenting period on draft project plan (mandatory)		[Light Blue]											
Operation			[Dark Teal]										
3. Kick-off meeting			[Light Teal]										
4. CWA(s) development			[Light Teal]	[Light Teal]	[Light Teal]	[Light Teal]							
5. Open commenting period on draft CWA(s) (optional)						[Light Teal]	[Light Teal]						
6. CWA(s) finalized and approved by Workshop participants							[Light Teal]						
Publication								[Dark Green]	[Dark Green]				
7. CWA(s) publication								[Light Green]	[Light Green]				
Dissemination (see 6)		[Orange]	[Orange]				[Orange]	[Orange]	[Orange]	[Orange]			
Milestones			K	V		V	V		V		P	D	

K Kick-off
M Workshop meeting
V Virtual Workshop meeting



- A** Adoption of CWA
- P** Publication of CWA
- D** Online distribution of CWA

5 Resource planning

Registration and participation at this CEN Workshop are free of charge, but each participant shall bear his/her own costs for travel, accommodation, and subsistence in the case of on-site meetings (at the moment of writing this document all meetings are planned to take place on-line).

The administrative costs of the CEN Workshop Secretariat will be financed within the framework of a research project: European Union's Horizon 2020 research and innovation program funded project INNOMEM (grant agreement No. 862330).

The copyright of the CWAs shall be with CEN. 8% secretariat costs will be provided by UNE to CCMC to cover the free download of the published CWA.

6 Workshop structure and rules of cooperation

6.1 Participation in the Workshop

The Workshop will be constituted during the kick-off meeting. By approving this project plan, the interested parties declare their willingness to participate in the Workshop and will be formally named as Workshop participants, with the associated rights and duties. Participants at the kick-off meeting who do not approve the project plan are not given the status of a Workshop participant and are thus excluded from further decisions made during the kick-off meeting and from any other decisions regarding the Workshop.

As a rule, the request to participate in the Workshop is closed once it is constituted. The current Workshop participants shall decide whether any additional members will be accepted or not.

Any new participant in the Workshop at a later date is decided on by the participants making up the Workshop at that time. It is particularly important to consider these aspects:

- a. expansion would be conducive to shortening the duration of the Workshop or to avoiding or averting an impending delay in the planned duration of the Workshop;
- b. the expansion would not result in the Workshop taking longer to complete;
- c. the new Workshop participant would not address any new or complementary issues beyond the scope defined and approved in the project plan;
- d. the new Workshop participant would bring complementary expertise into the Workshop in order to incorporate the latest scientific findings and state-of-the-art knowledge;
- e. the new Workshop participant would actively participate in the drafting of the manuscript by submitting concrete, not abstract, proposals and contributions;
- f. the new Workshop participant would ensure wider application of the CWA.

All Workshop participants who approved the publication of the CWA or its draft will be named as authors in the European Foreword, including the organizations which they represent. All Workshop participants who did not approve the publication of the CWA will not be named in the European Foreword.

6.2 Workshop responsibilities

The Workshop Chair is responsible for content management and consensus building. The Workshop Chair is supported by the Workshop Vice-Chair (if any) and the responsible Workshop secretariat, whereby the Workshop secretariat will always remain neutral regarding the content of the CWA(s). Furthermore, the Workshop

secretariat shall ensure that CEN-CENELEC's rules of procedure, rules of presentation, and the principles governing the publication of CWA(s) have been observed. Should a Workshop Chair no longer be able to carry out her/his duties, the Workshop secretariat shall initiate the election of a new Workshop Chair. The list below covers the main tasks of the Workshop Chair. It is not intended to be exhaustive.

- Content related contact point for the Workshop
- Presides at Workshop meetings
- Ensures that the development of the CWA respects the principles and content of the adopted project plan
- Manages the consensus building process, assesses when the Workshop participants have reached agreement on the final CWA, on the basis of the comments received
- Ensures due information exchange with the Workshop secretariat
- Represents the Workshop and its results to exterior

The Workshop secretariat, provided by a CEN and/or CENELEC Member, is responsible for organizing and leading the kick-off meeting, in consultation with the Workshop proposer. Further Workshop meetings and/or web conferences shall be organized by the Workshop secretariat in consultation with the Workshop Chair. The list below covers the main tasks of the Workshop secretariat. It is not intended to be exhaustive.

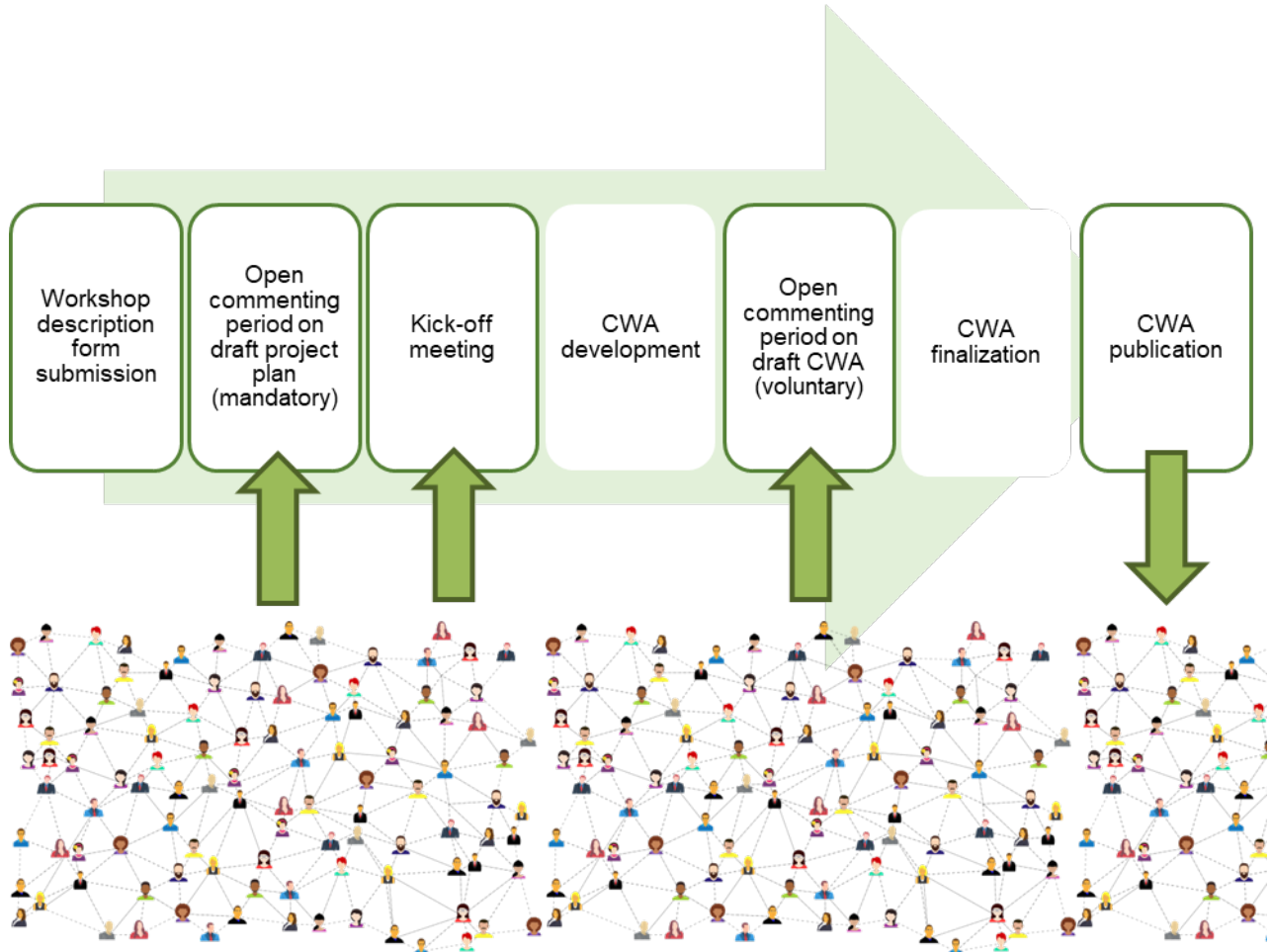
- Administrative and organizational contact point for the Workshop
- Ensures that the development of the CWA respects the principles and content of the adopted project plan and of the requirements of the CEN-CENELEC Guide 29
- Formally registers Workshop participants and maintains record of participating organizations and individuals
- Offers infrastructure and manages documents and their distribution through an electronic platform
- Prepares agenda and distributes information on meetings and meeting minutes as well as follow-up actions of the Workshop
- Initiates and manages CWA approval process upon decision by the Workshop Chair
- Interfaces with CEN-CENELEC Management Centre (CCMC) and Workshop Chair regarding strategic directions, problems arising, and external relationships
- Advises on CEN-CENELEC rules and brings any major problems encountered (if any) in the development of the CWA to the attention of CEN-CENELEC Management Centre (CCMC)
- Administrates the connection with relevant CEN or CENELEC/TCs

6.3 Decision making process

The CEN and/or CENELEC Workshop Chair is responsible for ensuring that the development of the CWA follows the principles and content of the project plan described in this document and the requirements of CEN-CENELEC Guide 29. The CEN and/or CENELEC Workshop Chair may take decisions on the conduct of the CEN and/or CENELEC Workshop on the basis of the comments expressed by the participants and of CEN-CENELEC Guide 29.

Decisions shall be taken based on consensus of the WS participants.

7 Dissemination and participation strategy



Potential participants identified in section 2.2 and potential interested stakeholders identified in Part A should be informed of the open commenting phase, and of the publication of the CWA.

In addition to the CEN and CENELEC website, the WS description form and the date of the kick-off meeting will be advertised on INNOMEM website and social media channels as well as partners networks to raise awareness. Interested parties are requested to contribute either through commenting of the project plan (short term) or through Workshop participation (long term). They will also be invited comment on the draft CWA.

Examples of interested parties identified are:

- Technical Committees (as mentioned above)
- INNOMEM partners
- Professional governing organisations and institutions on a European and national level. Examples are DECHEMA and DGMT in Germany, IChemE in the UK, EMS in Europe...

In addition to the CEN & CENELEC website (www.cencenelec.eu), the final CWA might be advertised on:

- sector specific newsletter
- social media, such as
 - Facebook
 - Instagram
 - LinkedIn
 - X
- Research Gate
- EC Newsroom
- Others

Annex I – Security risk analysis

This annex shall be completed if section 1.12 of Part A indicates that security aspects are addressed by the Workshop.

I.I General

Security risk analysis is a process of identifying and analyzing the main negative factors that may affect a standardization project's objectives. The following is targeted at secretariats of CEN and/or CENELEC Workshop Agreements (CWA) dealing with security issues. Its purpose is to help them identify and mitigate the risks associated with their project. It is structured around two main security threats that can affect the success of the work: major diverging interests among stakeholders and sensitive information.

I.II Risk analysis on major diverging interest among stakeholders

Diverging interests among stakeholders can impede the process in reaching agreement on the CWA and even lead to failure to deliver the planned CWA. In order to identify and possibly mitigate the risks, the following questions should be reviewed:

- Is the planned CWA expected to have a major impact on the security policy/strategy of the core stakeholders?
- Does the scope of the CWA cover products or services with a clear dual-use purpose (i.e. which can be used for military purposes)?

I.III Risk analysis on sensitive information

- In light of the scope of the CWA, is it likely that it may deal with sensitive information? If so, what is the information sensitivity level?
- Is there a need for a (non-)disclosure agreement?
- Is there any conflict of interest for stakeholders involved in the CEN and/or CENELEC Workshop, regarding especially the use they may make of any information they receive during the development of the CWA?
- What steps should be taken to manage information dissemination and storage (e.g. memory stick, emailing, storage) during the development process of the CWA?

No security risks are expected during the development of the CWA

The CWA has no impact on the security or strategy of stakeholders

The scope of the CWA does not cover products or services with a dual-use purpose

The CWA will not deal with sensitive information

There is no need for a non-disclosure agreement

There is no conflict of interest for the stakeholders involved in the CEN Workshop

The information dissemination during the development of the CWA can be made by email