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Nanotechnologies — Considerations for in vitro studies of airborne nano-objects and their aggregates and agglomerates (NOAA)

Nanotechnologies — Considérations pour les études in vitro des nano-objets en suspension dans l'air et de leurs agrégats et agglomérats (NOAA)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 229, *Nanotechnologies*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Inhalation is one of the prominent routes by which humans can come in contact with natural, unintended and engineered nano-objects and their aggregates and agglomerates (NOAA). Due to the physiological, biochemical and anatomical differences between humans and animals, as well as the considerable time, cost and animal numbers required to conduct in vivo toxicity tests, there is much interest in developing in vitro strategies for risk assessment that are based on human cells and mechanisms of toxicity. To enable comparability of the results of in vitro assay and in vivo effects observed after inhalation of NOAA, certain parameters should be considered, including:

a) the choice of cell types;

b) characterization of the NOAA throughout the assay, including life-cycle transformations;

c) the choice of nano-object concentration relevant to human exposures;

d) generation of NOAA form that mimics human exposures;

e) the use of relevant dispersants;

f) the use of appropriate mode of exposure (submerged or air liquid interface) and exposure duration[1].

This document includes descriptions of the aforementioned parameters with regard to using in vitro-based strategies for assessing specific aspects related to the inhalation toxicity of NOAA. For example, for inhalation studies, it is critical to choose the proper equipment for generation, exposure to, and characterization of the nano-objects. This document includes information about available in vitro aerosol exposure chambers and biological models that have been used to assess the inhalation toxicity of NOAA. This document does not include details regarding the techniques for aerosol generation or characterization of specific nanomaterials (NMs), their life cycle transformations or in vivo testing. An overview of the aerosol generation of NMs and in vivo testing is given in ISO/TR 19601[2].

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Nanotechnologies — Considerations for in vitro studies of airborne nano-objects and their aggregates and agglomerates (NOAA)

1 Scope

This document collates information regarding the systems available for exposure and assessment of nano-objects and their aggregates and agglomerates (NOAA) for in vitro air exposure studies. It provides an overview of the various exposure systems and in vitro cell systems used to perform in vitro studies that simulate an inhalation toxicology study design.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
aerosol
system of solid or liquid particles suspended in gas

[SOURCE: ISO 15900:2009, 2.1]

3.2
agglomerate
collection of weakly bound particles or *aggregates* (3.3) or mixtures of the two where the resulting external surface area is similar to the sum of the surface areas of the individual components

Note 1 to entry: The forces holding an agglomerate together are weak forces, for example van der Waals forces, or simple physical entanglement.

Note 2 to entry: Agglomerates are also termed secondary particles and the original source particles are termed primary particles.

[SOURCE: ISO/TS 80004-4:2011, 2.8]

3.3
aggregate
particle comprising strongly bonded or fused particles where the resulting external surface area may be significantly smaller than the sum of calculated surface areas of the individual components

Note 1 to entry: The forces holding an aggregate together are strong forces, for example covalent bonds, or those resulting from sintering or complex physical entanglement.

Note 2 to entry: Aggregates are also termed secondary particles and the original source particles are termed primary particles.

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