DIN EN 16966:2019-01 (E)

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

Contents

Page

European foreword 5

Introduction 6

1 Scope 7

2 Normative references 7

3 Terms and definitions 7

4 Symbols and abbreviations 12

5 Relevance of ISO definition for assessing health impacts of airborne NOAA 13

6 Particle metrics and their selection 13
6.1 Workplace aerosols consisting of NOAA 13
6.2 NOAA metrics 14
6.3 NOAA number metric, NOAA surface area metric and NOAA mass metric 14
6.4 Occupational exposure limits for NOAA 15

7 Exposure assessment strategy based on EN 17058 15
7.1 General 15
7.2 Basic assessment according to EN 17058 16
7.3 Comprehensive assessment according to EN 17058 16
7.4 Personal samplers versus static samplers/monitors 17

8 Determination of exposure 17
8.1 General 17
8.2 Introductory remarks regarding the measurement of particle metrics 18
8.2.1 General 18
8.2.2 Continuous measurement and display (using a monitor) or post-sampling analytical determination of a NOAA metric 19
8.2.3 Calculation/estimation of a NOAA metric based on the size-resolved NOAA distribution 20
8.2.4 Calculation of NOAA mass ensemble metric based on the size-resolved NOAA mass metric 20
8.3 Information of the measurement of particle metrics 20

Annex A (informative) Source domains of workplace exposure scenarios for engineered/ manufactured NOAA 21

Annex B (informative) Evolution of available instrumental technology since the publication of ISO/TR 27628 and ISO/TR 12885 22

Annex C (informative) Direct-reading instruments for measuring the NOAA ensemble number metric 23

C.1 General 23
C.2 Condensation particle counter 23
C.2.1 Principle of operation 23

C.2.2 Assumptions, limits and potential problems ... 23
C.2.3 Accuracy and comparability according to EN 16897 ... 24

DIN EN 16966:2019-01 EN 16966:2018 (E) C.2.4 International standards on the use of CPC ... 24
C.3 Diffusion chargers ... 24
C.3.1 General ... 24
C.3.2 Assumptions, limits and potential problems ... 24
C.3.3 Accuracy and comparability ... 25

Annex D (informative) Monitors for measuring the NOAA ensemble surface area metric ... 26

D.1 General ... 26
D.2 Assumptions, limits and potential problems ... 26
D.3 Accuracy and comparability ... 28

Annex E (informative) Samplers for determining the NOAA mass (chemical element) metric by off-line analysis ... 29

E.1 General ... 29
E.2 Ensemble of all sampled particles analysed ... 29
E.2.1 General ... 29
E.2.2 Assumptions, potential problems and comparability ... 30
E.3 Individual particles analysed ... 30
E.3.1 General ... 30
E.3.2 Assumptions, potential problems and comparability ... 30

Annex F (informative) Monitors for measuring the size-resolved NOAA number metric (number-weighted electric mobility equivalent diameter distribution) ... 31

F.1 General ... 31
F.2 DMAS of various designs ... 31
F.2.1 General ... 31
F.2.2 Assumptions, potential problems and comparability ... 31
F.2.3 International Standards on the use of DMAS ... 32

Annex G (informative) Samplers for determining the size-resolved NOAA mass metric (mass-weighted diffusive equivalent diameter distribution) by off-line analysis ... 33

G.1 General ... 33
G.2 Diffusion spectrometers ... 33
G.2.1 General ... 33
G.2.2 Assumptions and potential problems ... 33

Annex H (informative) Samplers for determining the size-resolved NOAA mass (chemical element/ compound) metric (mass-weighted aerodynamic equivalent diameter distribution) by off-line analysis ... 34

H.1 General ... 34
H.2 Cascade impactors ... 34
H.2.1 General ... 34
H.2.2 Assumptions and potential problems ... 34

DIN EN 16966:2019-01 EN 16966:2018 (E) Annex I (informative) Monitors for determining the size-resolved NOAA number metric (number-weighted aerodynamic equivalent diameter distribution) ... 35

I.1 General ... 35
I.2 Assumptions and potential problems ... 35

Annex J (informative) Number-weighted minimum Feret diameter distribution of primary particles of aggregates and constituent parts of aggregates ... 36

J.1 Distinction between a NOAA and a non-NOAA particle 36
J.2 Aggregates and agglomerates 36
J.3 Sample analysis in an electron microscope 36
J.3.1 General 36
J.3.2 Assumptions and potential problems 37

Bibliography 38