DIN EN 17628:2022-06 (E)

Fugitive and diffuse emissions of common concern to industry sectors - Standard method to determine diffuse emissions of volatile organic compounds into the atmosphere

Contents

Page

European foreword 7

Introduction 8

1 Scope 9

2 Normative references 9

3 Terms and definitions 9

4 Symbols and abbreviations 12

5 Principle 12

6 Measurement objectives 13
6.1 General 13
6.2 Quantification of site emissions 14
6.3 Quantification of section emissions 14
6.4 Quantification of main equipment emissions 14
6.5 Localization emission sources/leaks 15

7 Data quality objectives 15
7.1 General 15
7.2 Quantification of site emissions 15
7.3 Quantification of section emissions 16
7.4 Quantification of main equipment emissions 16
7.5 Detection/localization of emission sources 16

8 Overview of methods 16
8.1 Applicability and limitations of monitoring techniques 16
8.1.1 Applicability 16
8.1.2 Limitations 17
8.2 Specific methods 19
8.2.1 General 19
8.2.2 Differential Absorption Lidar (DIAL) 19
8.2.3 Solar Occultation Flux (SOF) 21
8.2.4 Tracer Correlation (TC) 23
8.2.5 Optical Gas Imaging (OGI) 25
8.2.6 Reverse Dispersion Modelling (RDM) 27

9 Meteorology data and measurements 29

10 Measurement strategy and measurement campaign planning 30
10.1 General 30
10.2 Measurement objectives 31
10.3 Measurement planning 32
10.3.1 Specification of measurement plan 32
10.3.2 Surveyed areas and equipment 32
10.3.3 Technical supervisor and personnel 32

10.3.4 Planning of the measurement dates ... 32
10.3.5 Planning of combined measurements ... 33
10.4 Preparation of the measurement campaign ... 33
10.4.1 Preparations by the plant operator ... 33
10.4.2 Preparations by the measurement provider ... 33
10.4.3 Preparations after arrival at the plant ... 34
10.5 Conducting the measurements ... 34
10.6 Calculation of results and measurement uncertainty ... 34
10.6.1 Calculation of results ... 34
10.6.2 Assessment of measurement uncertainty ... 34
10.7 Meteorology ... 39

11 Reporting ... 40

12 Results of the validation and demonstration field studies ... 41
12.1 General ... 41
12.2 First campaign: validation study ... 41
12.3 Second campaign: demonstration of the applicability of the methods ... 42

Annex A (normative) DIAL procedure ... 43

A.1 Performance requirements ... 43
A.2 Application of the method ... 44
A.2.1 Before campaign ... 44
A.2.2 Set-up and initial tasks ... 45
A.2.3 Daily tasks ... 46
A.2.4 Measurement strategy ... 47
A.3 Quality control ... 49
A.3.1 General ... 49
A.3.2 Spectroscopic calibration procedures ... 49
A.3.2.1 General ... 49
A.3.2.2 Calibration gases ... 49
A.3.2.3 Calibration cell ... 50
A.3.2.4 Spectral scans ... 50
A.3.2.5 Continuous spectral monitoring ... 50
A.3.2.6 Check of system performance ... 50
A.3.3 Meteorological sensors calibration ... 50
A.4 Data analysis ... 50
A.4.1 General ... 50
A.4.2 Background subtraction ... 50
A.4.3 Normalization for variation in transmitted energy ... 51
A.4.4 Calculation of path-integrated concentration ... 51
A.4.5 Derivation of range-resolved concentrations ... 51
A.4.6 Calculation of emission rates ... 51
A.5 Reporting ... 52

Annex B (normative) SOF procedure ... 53

B.1 Performance requirements ... 53
B.2 Application of the method ... 53
B.2.1 Before campaign ... 53
B.2.2 Set-up and initial tasks ... 54
B.2.3 Daily tasks ... 55
B.2.4 Measurement strategy ... 55
B.3 Quality control ... 57
B.3.1 General ... 57
B.3.2 Spectroscopic calibration procedures ... 57
B.3.2.1 General ... 57
B.3.2.2 Calibration ... 57
B.3.3 Meteorological sensors calibration ... 57
B.3.4 Required QC checks in the field ... 57
B.4 Data analysis ... 58

B.4.1 General 58
B.4.2 Calculation of column values 59
B.4.3 Calculation of emission rates 59
B.4.4 Estimation and localization of emission sources 60
B.4.5 Data validation procedures 61
B.5 Reporting 62

Annex C (normative) OGI procedure 63

C.1 Application of the method 63
C.1.1 General 63
C.1.2 Set-up, initial tasks and detection planning 63
C.1.3 Performance of the survey 64
C.2 Quality control 66
C.2.1 Test procedures 66
C.2.1.1 General 66
C.2.1.2 Basic requirements 66
C.2.1.3 Frequency 66
C.2.1.4 Operating mode 66
C.3 Data analysis 67
C.3.1 General 67
C.3.2 Database Management 67
C.3.3 Emission rate calculation and quantification 67
C.4 Reporting 67
C.4.1 General 67
C.4.2 Customer requirements 67

Annex D (normative) TC procedure 68

D.1 Performance requirements 68
D.2 Application of the method 68
D.2.1 Before campaign 68
D.2.2 Set-up and initial tasks 69
D.2.3 Daily tasks 70
D.2.4 Measurement strategy 70
D.3 Quality control 72
D.3.1 General 72
D.3.2 Calibration of gas sensors 72
D.3.3 Meteorological sensor calibration 72
D.3.4 Tracer release equipment calibration 72
D.3.5 Required QC checks in the field 72
D.4 Data analysis 73
D.4.1 Calculation of emission rates 73
D.4.2 Estimation and localization of emission sources 73
D.4.3 Data validation procedures 73
D.5 Reporting 75

Annex E (normative) RDM procedure 76

E.1 General 76
E.2 Performance requirements 76
E.3 Application of the method 77
E.3.1 Before campaign 77
E.3.2 Set-up and initial tasks 78
E.3.3 Daily Tasks 78
E.3.4 Measurement strategy 79
E.4 Quality control 81
E.4.1 General 81
E.4.2 Analyser calibration procedures 81
E.4.2.1 General 81
E.4.2.2 Calibration gases 81
E.4.2.3 Calibration bag 81

E.4.2.4 Continuous monitoring 82
E.4.2.5 Check of system performance 82
E.4.3 Meteorological sensor calibration 82
E.5 Data analysis 82
E.5.1 General 82
E.5.2 Background subtraction 82
E.5.3 Concentration conversion according to speciation 82
E.5.4 Calculation of emission rates 83

Annex F (informative) Meteorology 84

F.1 General 84
F.2 Principles of placement specific to the application on complex sites 85
F.3 Height(s) 86
F.4 Instrumentation choices for wind speed and direction 87
F.5 Performance requirements for wind speed and direction 87
F.6 Lidar profiles 88
F.7 Emission rate calculations 88
F.8 Averaging time suited to different measurement strategies 89
F.9 Spatial variation (physical separation of wind measurement and concentration measurement) 91
F.10 Accounting for low wind speed and atmospheric stability 92
F.11 Instrumentation choices for other relevant data (insolation, temperature, visibility, rain, time-reference) 94
F.11.1 General 94
F.11.2 Time reference 94
F.11.3 Measurement of atmospheric pressure 94
F.11.4 Measurement of air temperature 94
F.11.5 Measurement of the moisture content of air 94
F.11.6 Quality assurance 95
F.12 Reporting 95

Annex G (informative) Example of measurement uncertainty calculation 96

Bibliography 99