

# DIN ISO 18400-104:2020-11 (E)

## Soil quality - Sampling - Part 104: Strategies (ISO 18400-104:2018)

---

<b>Contents</b>		<b>Page</b>
<b>National foreword</b> .....		<b>5</b>
<b>National Annex NA (informative) Bibliography</b> .....		<b>7</b>
<b>Foreword</b> .....		<b>8</b>
<b>Introduction</b> .....		<b>9</b>
<b>1</b>	<b>Scope</b> .....	<b>12</b>
<b>2</b>	<b>Normative references</b> .....	<b>12</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>12</b>
<b>4</b>	<b>Overall investigation strategy</b> .....	<b>16</b>
4.1	General.....	16
4.2	Zoning.....	18
4.3	Types of investigation.....	18
4.3.1	General.....	18
4.3.2	Preliminary investigation.....	21
4.3.3	Exploratory investigation.....	22
4.3.4	Detailed investigation.....	22
4.3.5	Supplementary investigations.....	22
4.4	Conceptual site model.....	23
4.5	Preliminary risk assessment.....	23
<b>5</b>	<b>Sampling strategies — General aspects</b> .....	<b>24</b>
5.1	Sampling objectives.....	24
5.2	Scope of the sampling strategy.....	24
5.3	Designing the sampling strategy.....	25
5.4	Principal sampling situations.....	26
5.5	Representative and sufficiently representative samples.....	27
5.6	Characteristics of the spatial distribution.....	28
5.7	Statistical aspects.....	29
5.8	Uncertainty of measurements caused by sampling and analysis.....	29
5.9	Safety and environmental protection.....	30
5.10	Barriers to sampling.....	30
5.11	Timing of investigations.....	30
<b>6</b>	<b>Sampling strategies — Key aspects and concepts</b> .....	<b>31</b>
6.1	Statistics and geostatistics.....	31
6.1.1	General.....	31
6.1.2	Statistics.....	31
6.1.3	Geostatistics.....	31
6.2	Approaches to sampling.....	32
6.2.1	General.....	32
6.2.2	Judgemental sampling.....	33
6.2.3	Systematic sampling.....	33
6.2.4	Convenience sampling.....	34
6.3	Average properties.....	35

6.4	Types of samples.....	35
6.4.1	General.....	35
6.4.2	Disturbed and undisturbed samples.....	35
6.4.3	Spot (single) samples.....	36
6.4.4	Cluster samples.....	36
6.4.5	Spatial (composite) samples.....	36
6.4.6	Selective samples.....	38
6.5	Number of samples.....	38
6.5.1	General.....	38
6.5.2	Number of samples at discrete sampling points.....	39
6.5.3	Number of cluster samples.....	39
6.5.4	Number of composite samples.....	39
6.6	Sample sizes.....	40
6.6.1	General.....	40
6.6.2	Practical considerations.....	41
<b>7</b>	<b>Deciding how many samples to take.....</b>	<b>43</b>
7.1	General.....	43
7.2	Basic situations.....	44
7.3	Determining average concentrations.....	44
7.3.1	General.....	44
7.3.2	Using spatial composite samples.....	45
7.3.3	Using spot samples.....	46
7.3.4	Determining relation to threshold limit.....	46
7.4	Finding (hot spots and) areas of interest of a specified minimum size.....	46
7.5	Sampling for particular purposes.....	47
7.5.1	Determination of background values.....	47
7.5.2	Waste classification.....	47
7.5.3	Supplementary investigations for remediation.....	47
7.5.4	Validation of remediation and other works.....	48
<b>8</b>	<b>Sampling strategies for in-ground sampling.....</b>	<b>49</b>
8.1	Approach to sampling.....	49
8.2	Sampling patterns.....	49
8.2.1	General.....	49
8.2.2	Potentially contaminated sites.....	50
8.2.3	Hot spot detection, site investigation design and sampling.....	51
8.3	Types of samples.....	52
8.4	Sampling depths.....	53
8.4.1	General.....	53
8.4.2	Potentially contaminated sites.....	53
8.4.3	Sampling in relation to the groundwater profile and aquifer.....	54
8.5	Size of samples.....	55
8.6	Number of samples.....	56
8.6.1	General.....	56
8.6.2	Number of samples at individual sampling points.....	56
8.6.3	Number of composite samples.....	56
<b>9</b>	<b>Sampling of above-ground deposits.....</b>	<b>57</b>
9.1	General.....	57
9.2	Sampling patterns.....	57
9.3	Types of sample.....	57
9.3.1	General.....	57
9.3.2	Convenience sampling.....	58
9.4	Sampling depths.....	58
9.5	Size of samples.....	58
9.6	Number of samples.....	58

<b>Annex A</b> (informative) <b>Basic statistical concepts</b> .....	<b>59</b>
<b>Annex B</b> (informative) <b>Sampling patterns</b> .....	<b>65</b>
<b>Annex C</b> (informative) <b>Assessment and modification of sampling uncertainty</b> .....	<b>79</b>
<b>Annex D</b> (informative) <b>Examples of sampling for particular purposes</b> .....	<b>83</b>
<b>Annex E</b> (informative) <b>Scale of sampling</b> .....	<b>88</b>
<b>Annex F</b> (informative) <b>Determination of size and number of samples and increments</b> .....	<b>93</b>
<b>Annex G</b> (informative) <b>Statistical methods for estimating soil parameters</b> .....	<b>101</b>
<b>Annex H</b> (informative) <b>Geostatistical methods for sampling design and evaluation of soil quality</b> .....	<b>114</b>
<b>Annex I</b> (informative) <b>Sampling strategies for risk assessment</b> .....	<b>130</b>
<b>Bibliography</b> .....	<b>140</b>