

**Committee of Experts on the Transport of Dangerous Goods  
and on the Globally Harmonized System of Classification  
and Labelling of Chemicals**

**Sub-Committee of Experts on the Globally Harmonized  
System of Classification and Labelling of Chemicals**

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Item 4 (c) of the provisional agenda

**Implementation of the GHS:**

**cooperation with other bodies or international organizations**

**Review and update of references to OECD guidance  
documents and test guidelines in the GHS**

**Transmitted by the Organisation for Economic Cooperation and  
Development (OECD)**

1. As outlined in ST/SG/AC.10/C.4/2019/14 the OECD secretariat has conducted a review of references to OECD documents in the GHS.
2. This informal document shows the proposed amendments to the GHS listed in ST/SG/AC.10/C.4/2019/14, in track-changes. They concern chapters 3.2 and 3.5 as well as annexes 9 and 10 of the GHS.

## Annex

## Proposed amendments to the GHS

## Chapter 3.2

Updates based on the updated version of Test Guideline 431 published in 2019.

Table 3.2.6: Skin corrosion criteria for *in vitro/ex vivo* methods

Category	OECD Test Guideline 430 (Transcutaneous Electrical Resistance test method)	OECD Test Guideline 431 Reconstructed human Epidermis test methods: Methods 1, 2, 3, 4 and 5 as numbered in Annex 2 of OECD Test Guideline 431				OECD Test Guideline 435 Membrane barrier test method	
	Using rat skin discs corrosive chemicals are identified by their ability to produce a loss of normal <i>stratum corneum</i> integrity. Barrier function of the skin is assessed by recording the passage of ions through the skin. The electrical impedance of the skin is measured using transcutaneous electrical resistance (TER). A confirmatory test of positive results using a dye-binding step that assesses if an increase in ionic permeability is due to the physical destruction of the <i>stratum corneum</i> is performed in case of a reduced TER (less than or around 5 kΩ) in the absence of obvious damage. The criteria are based on the mean TER value in kΩ and sometimes on dye content.	Four similar methods where the test chemical is applied topically to a three-dimensional reconstructed human epidermis (RhE) which closely mimics the properties of the upper parts of human skin. The test method is based on the premise that corrosive chemicals are able to penetrate the <i>stratum corneum</i> by diffusion or erosion, and are cytotoxic to the cells in the underlying layers. Tissue viability is assessed by enzymatic conversion of the dye MTT into a blue formazan salt that is quantitatively measured after extraction from the tissues. Corrosive chemicals are identified by their ability to decrease tissue viability below defined threshold values. The criteria are based on the percent tissue viability following a defined exposure period.				An <i>in vitro</i> membrane barrier test method comprising a synthetic macromolecular bio-barrier and a chemical detection system (CDS). Barrier damage is measured after the application of the test chemical to the surface of the synthetic membrane barrier. The criteria are based on the mean penetration/breakthrough time of the chemical through the membrane barrier.	
		Type 1 chemicals (high acid/alkaline reserve)			Type 2 chemicals (low acid/alkaline reserve)		
<b>1</b>	(a) mean TER value $\leq 5$ kΩ and the skin discs are obviously damaged (e.g. perforated), or (b) mean TER value $\leq 5$ kΩ, and (i) the skin discs show no obvious damage (e.g. perforation), but (ii) the subsequent confirmatory testing of positive results using a dye binding step is positive.	Method 1 < 35% after 3, 60 or 240 min exposure	Methods 2, 3, 4, 5 < 50% after 3 min exposure; or $\geq 50\%$ after 3 min exposure and < 15% after 60 min exposure			$\leq 240$ min	$\leq 60$ min
<b>1A</b>	Not applicable	Method 1 < 35% after 3 min exposure	Method 2 < 25% after 3 min exposure	Method 3 < 18% after 3 min exposure	Method 4, 5 < 15% after 3 min exposure	0-3 min.	0-3 min
<b>1B</b>		$\geq 35\%$ after 3 min exposure and < 35% after 60 min exposure	$\geq 25\%$ after 3 min exposure and fulfilling criteria for category 1	$\geq 18\%$ after 3 min exposure and fulfilling criteria for category 1	$\geq 15\%$ after 3 min exposure and fulfilling criteria for category 1	> 3 to 60 min.	> 3 to 30 min
<b>1C</b>		or $\geq 35\%$ after 60 min exposure and < 35% after 240 min exposure				> 60 to 240 min.	> 30 to 60 min
<b>Not classified as skin corrosive</b>	(a) the mean TER value > 5 kΩ, or (b) the mean TER value $\leq 5$ kΩ, and (i) the skin discs show no obvious damage (e.g. perforation), and (ii) the subsequent confirmatory testing of positive results using a dye binding step is negative	$\geq 35\%$ after 240 min exposure	$\geq 50\%$ after 3 min exposure and $\geq 15\%$ after 60 min exposure			> 240 min.	> 60 min

## Chapter 3.5

### Paragraphs 3.5.2.7, 3.5.2.8 and 3.5.2.9

“3.5.2.7 Examples of mutagenicity/genotoxicity tests in germ cells are:

(a) Mutagenicity tests:

Mammalian spermatogonial chromosome aberration test (OECD 483)

Spermatid micronucleus assay

[Transgenic Rodent Somatic and Germ Cell Gene Mutation Assays \(OECD 488\)](#)

(b) Genotoxicity tests:

Sister chromatid exchange analysis in spermatogonia

Unscheduled DNA synthesis test (UDS) in testicular cells

3.5.2.8 Examples of genotoxicity tests in somatic cells are:

[In vivo Mammalian Alkaline Comet Assay \(OECD 489\)](#)

[Transgenic Rodent Somatic and Germ Cell Gene Mutation Assays \(OECD 488\)](#)

Liver Unscheduled DNA Synthesis (UDS) *in vivo* (OECD 486)

Mammalian bone marrow Sister Chromatid Exchanges (SCE)

3.5.2.9 Examples of in vitro mutagenicity tests are:

In vitro mammalian chromosome aberration test (OECD 473)

In vitro mammalian cell gene mutation test (OECD 476 [and 490](#))

Bacterial reverse mutation tests (OECD 471)”

## Annex 9

### Heading

#### “ANNEX 9

#### GUIDANCE ON HAZARDS TO THE AQUATIC ENVIRONMENT<sup>1,2</sup>”

#### Paragraph A9.3.2.2

“A9.3.2.2 The GHS criteria for determining health and environmental hazards should be test method neutral, allowing different approaches as long as they are scientifically sound and validated according to international procedures and criteria already referred to in existing systems for the endpoints of concern and produce mutually acceptable data. According to the proposed system (OECD 1998)<sup>3</sup>:

*“Acute toxicity would normally be determined using a fish 96 hour LC<sub>50</sub> (OECD Test Guideline 203 or equivalent), a crustacea species 48 hour EC<sub>50</sub> (OECD Test Guideline 202 or equivalent) and/or an algal species 72 or 96 hour EC<sub>50</sub> (OECD Test Guideline 201 or equivalent). These species are considered as*

<sup>1</sup> OECD Environment, Health and Safety Publications, Series on Testing and Assessment, No 27, Environment Directorate, Organization for economic Co-operation and Development, April 2001.

<sup>2</sup> [Since the publication of this document in 2001, new OECD Test Guidelines or Guidance Documents have been adopted which are an additional source of information. Footnotes are included in this Annex to this effect.](#)

<sup>3</sup> [Updated reference: OECD \(2001\). Harmonized integrated hazard classification system for human health and environmental effects of chemical substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.](#)

*surrogate for all aquatic organisms and data on other species such as the duckweed Lemna may also be considered if the test methodology is suitable.”*

Chronic testing generally involves an exposure that is lingering or continues for a longer time; the term can signify periods from days to a year, or more depending on the reproductive cycle of the aquatic organism. Chronic tests can be done to assess certain endpoints relating to growth, survival, reproduction and development.

*“Chronic toxicity data are less available than acute data and the range of testing procedures less standardised. Data generated according to the OECD Test Guidelines 210 (Fish Early Life Stage), 202 Part 2 or 211 (Daphnia Reproduction) and 201 (Algal Growth Inhibition) can be accepted. Other validated and internationally accepted tests could also be used. The NOECs or other equivalent L(E)Cx should be used.”*

An OECD document describes the main statistical methods for the analysis of data of standardized ecotoxicity tests (OECD 2006).<sup>4</sup>

### **Paragraph A9.3.2.7.2**

“A9.3.2.7.2 Tests in aquatic macrophytes

The most commonly used vascular plants for aquatic toxicity tests are duckweeds (*Lemna gibba* and *Lemna minor*). The Lemna test is a short-term test and, although it provides both acute and sub-chronic endpoints, only the acute EC<sub>50</sub> is used for classification in the harmonized system. The tests last for up to 14 days and are performed in nutrient enriched media similar to that used for algae, but may be increased in strength. The observational endpoint is based on change in the number of fronds produced. Tests consistent with OECD Test Guideline on Lemna (in preparation)<sup>4</sup> and US-EPA 850.4400 (aquatic plant toxicity, Lemna) should be used.”

### **Section A9.3.5**

#### **“A9.3.5 Difficult to test substances**

A9.3.5.1 Valid aquatic toxicity tests require the dissolution of the test substance in the water media under the test conditions recommended by the guideline. In addition, a bioavailable exposure concentration should be maintained for the duration of the test. Some substances are difficult to test in aquatic systems and guidance has been developed to assist in testing these materials (DoE 1996; ECETOC 1996; and US EPA 1996). OECD Guidance document on aquatic toxicity testing of difficult substances and mixtures (OECD, 2000)<sup>5</sup> is a good source of information on the types of substances that are difficult to test and the steps needed to ensure valid conclusions from tests with these materials.

A9.3.5.2 Nevertheless, much test data exist that may have used testing methodologies which, while not in conformity with what might be considered best practice today, can still yield information suitable for application of the classification criteria. Such data require special guidance on interpretation, although ultimately, expert judgement must be used in determining data validity. Such difficult to test substances may be poorly soluble, volatile, or subject to rapid degradation due to such processes as phototransformation, hydrolysis, oxidation, or biotic degradation. When testing algae, coloured materials may interfere with the test endpoint by attenuating the light needed for cell growth. In a similar manner, substances tested as cloudy dispersions above solubility may give rise to false toxicity measurements. Loading of the water column with test material can be an issue for particulates or solids such as metals. Petroleum distillate fractions can also pose loading problems, as well as difficult interpretational problems when deciding on the appropriate concentrations

<sup>4</sup> *Published. OECD Test Guideline No. 221: Lemna sp. Growth Inhibition Test.*

<sup>5</sup> *Updated document: OECD 2019. Second edition - Guidance Document on Aqueous-Phase Aquatic Toxicity Testing of Difficult Test Chemicals, Series on Testing and Assessment No. 23 (second edition). OECD, Paris.*

for determining L(E)C<sub>50</sub> values. The draft Guidance Document on Aquatic Toxicity Testing of Difficult Substances and Mixtures<sup>6</sup> describes the more common properties of many types of substances which are likely to pose testing difficulties.”

#### **Paragraph A9.4.2.4.8**

“A9.4.2.4.8 Inherent biodegradability tests

Substances that are degraded more than 70% in tests for inherent biodegradability (OECD Test Guidelines 302) have the potential for ultimate biodegradation. However, because of the optimum conditions in these tests, the rapid biodegradability of inherently biodegradable substances in the environment cannot be assumed. The optimum conditions in inherent biodegradability tests stimulate adaptation of the micro-organisms thus increasing the biodegradation potential, compared to natural environments. Therefore, positive results in general should not be interpreted as evidence for rapid degradation in the environment<sup>7</sup>.

A9.4.2.4.9 Sewage treatment plant simulation tests

Results from tests simulating the conditions in a sewage treatment plant (STP) (e.g. the OECD Test Guideline 303)<sup>8</sup> cannot be used for assessing the degradation in the aquatic environment. The main reasons for this are that the microbial biomass in a STP is significantly different from the biomass in the environment, that there is a considerably different composition of substrates, and that the presence of rapidly mineralized organic matter in waste water facilitates degradation of the test substance by co-metabolism.”

### **Section A9.5**

“A9.5 **Bioaccumulation**

**A9.5.1 Introduction**

A9.5.1.1 Bioaccumulation is one of the important intrinsic properties of substances that determine the potential environmental hazard. Bioaccumulation of a substance into an organism is not a hazard in itself, but bioconcentration and bioaccumulation will result in a body burden, which may or may not lead to toxic effects. In the harmonized integrated hazard classification system for human health and environmental effects of chemical substances (OECD, 1998)<sup>10</sup>, the wording “potential for bioaccumulation” is given. A distinction should, however, be drawn between bioconcentration and bioaccumulation. Here bioconcentration is

<sup>6</sup> [Updated guidance available in OECD 2019 above.](#)

<sup>7</sup> *In relation to interpretation of degradation data equivalent with the harmonised OECD criteria for Chronic 4, the standing EU working group for environmental hazard classification of substances is discussing whether certain types of data from inherent biodegradability tests may be used in a case by case evaluation as a basis for not classifying substances otherwise fulfilling this classification criterion.*

*The inherent biodegradability tests concerned are the Zahn Wellens test (OECD TG 302 B) and the MITI II test (OECD TG 302 C). The conditions for use in this regard are:*

- (a) *The methods must not employ pre-exposed (pre-adapted) micro-organisms;*
- (b) *The time for adaptation within each test should be limited, the test endpoint should refer to the mineralization only and the pass level and time for reaching these should be, respectively:*
  - (i) *MITI II pass level > 60 % within 14 days*
  - (ii) *Zahn Wellens Test > 70 % within 7 days.*

<sup>8</sup> [OECD Test Guidelines 311 “Anaerobic Biodegradability of Organic Compounds in Digested Sludge: by Measurement of Gas Production” and 314 “Simulation Tests to Assess the Biodegradability of Chemicals Discharged in Wastewater” are also available.](#)

<sup>10</sup> [Updated reference: OECD \(2001\). Harmonized integrated hazard classification system for human health and environmental effects of chemical substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.](#)

defined as the net result of uptake, transformation, and elimination of a substance in an organism due to waterborne exposure, whereas bioaccumulation includes all routes of exposure (i.e. via air, water, sediment/soil, and food). Finally, biomagnification is defined as accumulation and transfer of substances via the food chain, resulting in an increase of internal concentrations in organisms on higher levels of the trophic chain (European Commission, 1996). For most organic chemicals uptake from water (bioconcentration) is believed to be the predominant route of uptake. Only for very hydrophobic substances does uptake from food becomes important. Also, the harmonized classification criteria use the bioconcentration factor (or the octanol/water partition coefficient) as the measure of the potential for bioaccumulation. For these reasons, the present guidance document only considers bioconcentration and does not discuss uptake via food or other routes.

[...]

A9.5.2.2 Bioconcentration of an organic substance can be experimentally determined in bioconcentration experiments, during which BCF is measured as the concentration in the organism relative to the concentration in water under steady-state conditions and/or estimated from the uptake rate constant ( $k_1$ ) and the elimination rate constant ( $k_2$ ) (OECD 305, 1996)<sup>11</sup>. In general, the potential of an organic substance to bioconcentrate is primarily related to the lipophilicity of the substance. A measure of lipophilicity is the n-octanol-water partition coefficient ( $K_{ow}$ ) which, for lipophilic non-ionic organic substances, undergoing minimal metabolism or biotransformation within the organism, is correlated with the bioconcentration factor. Therefore,  $K_{ow}$  is often used for estimating the bioconcentration of organic substances, based on the empirical relationship between  $\log$  BCF and  $\log K_{ow}$ . For most organic substances, estimation methods are available for calculating the  $K_{ow}$ . Data on the bioconcentration properties of a substance may thus be (i) experimentally determined, (ii) estimated from experimentally determined  $K_{ow}$ , or (iii) estimated from  $K_{ow}$  values derived by use of Quantitative Structure Activity Relationships (QSARs). Guidance for interpretation of such data is given below together with guidance on assessment of chemical classes, which need special attention.

[...]

A9.5.2.3.2 Different test guidelines for the experimental determination of bioconcentration in fish have been documented and adopted, the most generally applied being the OECD test guideline (OECD 305, 1996)<sup>11</sup>.

[...]

A9.5.2.3.5 BCF values of low or uncertain quality may give a false and too low BCF value; e.g. application of measured concentrations of the test substance in fish and water, but measured after a too short exposure period in which steady-state conditions have not been reached (cf. OECD 306, ~~1996~~1992, regarding estimation of time to equilibrium). Therefore, such data should be carefully evaluated before use and consideration should be given to using  $K_{ow}$  instead.

*[Correction: The reference to 1996 was a mistake]*

[...]

A9.5.2.3.8.2 Furthermore, when using existing data for classification, it is possible that the BCF values could be derived from several different fish or other aquatic species (e.g. clams) and for different organs in the fish. Thus, to compare these data to each other and to the criteria, some common basis or normalization will be required. It has been noted that there is a close relationship between the lipid content of a fish or an aquatic organism and the observed BCF value. Therefore, when comparing BCF values across different fish species or when converting BCF values for specific organs to whole body BCFs, the common approach

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<sup>11</sup> *OECD Test Guideline 305 was updated in 2012.*

<sup>11</sup> *OECD Test Guideline 305 was updated in 2012.*

is to express the BCF values on a common lipid content. If e.g. whole body BCF values or BCF values for specific organs are found in the literature, the first step is to calculate the BCF on a % lipid basis using the relative content of fat in the fish (cf. literature/test guideline for typical fat content of the test species) or the organ. In the second step the BCF for the whole body for a typical aquatic organism (i.e. small fish) is calculated assuming a common default lipid content. A default value of 5% is most commonly used (Pedersen *et al.*, 1995) as this represents the average lipid content of the small fish used in OECD 305 (1996)<sup>11</sup>.

#### A9.5.2.4 *Octanol-water-partitioning coefficient ( $K_{ow}$ )*

A9.5.2.4.1 For organic substances experimentally derived high-quality  $K_{ow}$  values, or values which are evaluated in reviews and assigned as the “recommended values”, are preferred over other determinations of  $K_{ow}$ . When no experimental data of high quality are available, validated Quantitative Structure Activity Relationships (QSARs) for log  $K_{ow}$  may be used in the classification process. Such validated QSARs may be used without modification to the agreed criteria if they are restricted to chemicals for which their applicability is well characterized. For substances like strong acids and bases, substances which react with the eluent, or surface-active substances, a QSAR estimated value of  $K_{ow}$  or an estimate based on individual *n*-octanol and water solubilities should be provided instead of an analytical determination of  $K_{ow}$  (EEC A.8., 1992; OECD 117, 1989)<sup>12</sup>. Measurements should be taken on ionizable substances in their non-ionized form (free acid or free base) only by using an appropriate buffer with pH below pK for free acid or above the pK for free base.

[...]

#### A9.5.3.2 *Difficult substances*

A9.5.3.2.1 Some substances are difficult to test in aquatic systems and guidance has been developed to assist in testing these materials (DoE, 1996; ECETOC 1996; US EPA 1996; OECD 2000). The OECD Guidance document on aquatic toxicity testing of difficult substances and mixtures (OECD, 2000)<sup>13</sup> is also a good source of information for bioconcentration studies, on the types of substances that are difficult to test and the steps needed to ensure valid conclusions from tests with these substances. Difficult to test substances may be poorly soluble, volatile, or subject to rapid degradation due to such processes as phototransformation, hydrolysis, oxidation, or biotic degradation.”

### Section A9.7

“A9.7.1.1 The harmonized system for classifying substances is a hazard-based system, and the basis of the identification of hazard is the aquatic toxicity of the substances, and information on the degradation and bioaccumulation behaviour (OECD 1998)<sup>14</sup>. Since this document deals only with the hazards associated with a given substance when the substance is dissolved in the water column, exposure from this source is limited by the solubility of the substance in water and bioavailability of the substance in species in the aquatic environment. Thus, the hazard classification schemes for metals and metal compounds are limited to the hazards posed by metals and metal compounds when they are available (i.e. exist as dissolved metal ions, for example, as  $M^+$  when present as  $M-NO_3$ ), and do not take into account exposures to metals and metal compounds that are not dissolved in the water column but may still be bioavailable, such as metals in foods. This section does not take into account the non-metallic ion (e.g.  $CN^-$ ) of metal compounds which may be toxic or

<sup>11</sup> [OECD Test Guideline 305 was updated in 2012.](#)

<sup>12</sup> [OECD Test Guideline 117 was updated in 2004.](#)

<sup>13</sup> [Updated Document: OECD 2019. Second Edition - Guidance Document on Aqueous-Phase Aquatic Toxicity Testing of Difficult Test Chemicals, Series on Testing and Assessment No. 23 \(second edition\). OECD, Paris](#)

<sup>14</sup> [Updated reference: OECD \(2001\). Harmonized integrated hazard classification system for human health and environmental effects of chemical substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.](#)

which may be organic and may pose bioaccumulation or persistence hazards. For such metal compounds the hazards of the non-metallic ions must also be considered.

[...]

## Annex 9, Appendix III

### Paragraph 1.2.1

“1.2.1 Different test guidelines for the experimental determination of bioconcentration in fish have been documented and adopted; the most generally applied being the OECD test guideline (OECD 305, 1996)<sup>1</sup> and the ASTM standard guide (ASTM E 1022-94). OECD 305 (1996) was revised and replaced the previous version OECD 305A-E, (1981). Although flow-through test regimes are preferred (OECD 305, 1996), semi-static regimes are allowed (ASTM E 1022-94), provided that the validity criteria on mortality and maintenance of test conditions are fulfilled. For lipophilic substances ( $\log K_{ow} > 3$ ), flow-through methods are preferred.”

### Paragraph 2.2

“2.2.1 For experimental determination of  $K_{ow}$  values, two different methods, Shake-flask and HPLC, have been described in standard guidelines e.g. OECD 107 (1995); OECD 117 (1983)<sup>2</sup>; EEC A.8. (1992); EPA-OTS (1982); EPA-FIFRA (1982); ASTM (1993). Not only data obtained by the employment of the shake-flask or the HPLC method according to standard guidelines are recommended. For highly lipophilic substances, which are slowly soluble in water, data obtained by employing a slow-stirring method are generally more reliable (De Bruijn *et al.*, 1989; Tolls and Sijm, 1993; OECD Guideline 123).”

## Annex 9, Appendix V

### Test guidelines

“1. Most of the guidelines mentioned are found in compilations from the organisation issuing them. The main references to these are:

[...]

- (c) OECD guidelines for the testing of chemicals. OECD, Paris, 1993 with regular updates  
<http://www.oecd.org/env/ehs/testing/oecdguidelinesforthetestingofchemicals.htm>;

*[Note by the secretariat: Updated reference: OECD guidelines for the testing of chemicals. OECD, Paris, <http://www.oecd.org/env/ehs/testing/oecdguidelinesforthetestingofchemicals.htm>]*

[...]

### 2. Test guidelines for aquatic toxicity<sup>1</sup>

[...]

OECD Test Guideline 201 (1984)<sup>2</sup> Alga, Growth Inhibition Test

<sup>1</sup> *OECD Test Guideline 305 was updated in 2012.*

<sup>2</sup> *OECD Test Guideline 117 was updated in 2004.*

<sup>1</sup> *The list below will need to be regularly updated as new guidelines are adopted or draft guidelines are elaborated.*

<sup>2</sup> *Updated in 2011.*

OECD Test Guideline 202 (1984)<sup>3</sup> Daphnia sp. Acute Immobilisation Test and Reproduction Test

OECD Test Guideline 203 (1992)<sup>4</sup> Fish, Acute Toxicity Test

OECD Test Guideline 210 (1992)<sup>5</sup> Fish, Early-Life Stage Toxicity Test

OECD Test Guideline 211 (1998)<sup>6</sup> Daphnia magna Reproduction Test

OECD Test Guideline 212 (1998) Fish, Short-term Toxicity Test on Embryo and Sac-Fry Stages

OECD Test Guideline 215 (2000) Fish, Juvenile Growth Test

OECD Test Guideline 221 Lemna sp. Growth inhibition test<sup>7</sup>

[...]

### 3. Test guidelines for biotic and abiotic degradation <sup>8</sup>

[...]

OECD Test Guideline 209 (1984)<sup>9</sup>. Activated sludge, respiration inhibition test. OECD guidelines for testing of chemicals

[...]

OECD Test Guideline 307 (2002). Aerobic and anaerobic transformation in soil. OECD guidelines for testing of chemicals

OECD Test Guideline 308 (2002). Aerobic and anaerobic transformation in aquatic sediment systems. OECD guidelines for testing of chemicals

OECD Test Guideline 309 (2004). Aerobic mineralisation in surface water – Simulation biodegradation test. OECD guidelines for testing of chemicals<sup>10</sup>

[...]

### 4. Test guidelines for bioaccumulation<sup>11</sup>

[...]

OECD Test Guideline 117, 1989<sup>12</sup>. OECD Guideline for testing of chemicals. Partition Coefficient (n-octanol/water), High Performance Liquid Chromatography (HPLC) Method

<sup>3</sup> Updated in 2004.

<sup>4</sup> Updated in 2019

<sup>5</sup> Updated in 2013

<sup>6</sup> Updated in 2012

<sup>7</sup> Additional OECD tests include:

OECD Test Guideline 219 (2004) Sediment-Water Chironomid Toxicity Using Spiked Water

OECD Test Guideline 233 (2010) Sediment-Water Chironomid Life-Cycle Toxicity Test Using Spiked Water or Spiked Sediment

OECD Test Guideline 238 (2014) Sediment-Free Myriophyllum Spicatum Toxicity Test

OECD Test Guideline 240 (2015), Medaka Extended One-generation Test

OECD Test Guideline 242 (2016) Potamopyrgus antipodarum Reproduction Test

OECD Test Guideline 243 (2016) Lymnaea stagnalis Reproduction Test

<sup>8</sup> The list below will need to be regularly updated as new guidelines are adopted or draft guidelines are elaborated.

<sup>9</sup> Updated in 2010.

<sup>10</sup> Additional OECD Test Guidelines include:

OECD Test Guideline 310 (2014) Ready Biodegradability - CO<sub>2</sub> in sealed vessels (Headspace Test)

OECD Test Guideline 311 (2006) Anaerobic Biodegradability of Organic Compounds in Digested Sludge: by Measurement of Gas Production

OECD Test Guideline 316 (2008) Phototransformation of Chemicals in Water – Direct Photolysis

<sup>11</sup> The list below will need to be regularly updated as new guidelines are adopted or draft guidelines are elaborated.

<sup>12</sup> Updated in 2004.

OECD Test Guideline 305, 1996<sup>13</sup>. Bioconcentration: Flow-through Fish Test. OECD Guidelines for testing of Chemicals  
 OECD Test Guidelines 305 A-E, 1981. Bioaccumulation. OECD Guidelines for testing of chemicals  
 OECD Test Guideline 123. Partition Coefficient (1-Octanol/Water). Slow-stirring method. OECD Guidelines for testing of chemicals.<sup>14</sup>

## Annex 9, Appendix VI

### References

#### “1. Aquatic toxicity

[...]

OECD 1998. Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances. OECD, Paris. (Document [ENV/JM/MONO\(2001\)6](#))<sup>1</sup>

OECD 1999. Guidelines for Testing of Chemicals. Organisation for Economic Co-operation and Development, Paris

OECD 2000. Guidance Document on Aquatic Toxicity Testing of Difficult Substances and Mixtures, Series on Testing and Assessment No. 23, OECD, Paris<sup>2</sup>

[...]

#### 2. Biotic and abiotic degradation

[...]

OECD (1998). Harmonized integrated hazard classification system for human health and environmental effects of chemical substances. Paris. (Document [ENV/JM/MONO\(2001\)6](#))<sup>1</sup>

[...]

#### 3. Bioaccumulation

[...]

OECD, 1998. Harmonized integrated hazard classification system for human health and environmental effects of chemical substances. As endorsed by the 28<sup>th</sup> joint meeting of the chemicals committee and the working party on chemicals in November 1998<sup>1</sup>

<sup>13</sup>–Updated in 2012.

<sup>14</sup> *Additional OECD Test Guideline: OECD Test Guideline 315 (2008) Bioaccumulation in Sediment-dwelling Benthic Oligochaetes*

<sup>1</sup> *Updated reference: OECD 2001. Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.*

<sup>2</sup> *Updated guidance: OECD 2019. Second Edition - Guidance Document on Aqueous-Phase Aquatic Toxicity Testing of Difficult Test Chemicals, Series on Testing and Assessment No. 23 (second edition). OECD, Paris*

<sup>1</sup> *Updated reference: OECD 2001. Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.*

<sup>1</sup> *Updated reference: OECD 2001. Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.*

OECD, 2000. Guidance Document on Aquatic Toxicity Testing of Difficult Substances and Mixtures, OECD, Paris<sup>2</sup>

[...]

#### 4. Reference for QSAR

[...]

#### 5. Metals and metal compounds

Brown, D.S. and Allison, J.D. (1987). MINTEQA1 Equilibrium Metal Speciation Model: A user's manual. Athens, Georgia, USEPA Environmental Research Laboratory, Office of Research and Development

OECD (1998). Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances (Document ENV/JM/MONO(2001)6)<sup>1</sup>

OECD (2000). Guidance Document on Aquatic Toxicity Testing of Difficult Substances and Mixtures<sup>2</sup>

OECD (2001). Guidance Document on Transformation/Dissolution of Metals and Metals Compounds in Aqueous Media

[...]

## Annex 10, Appendix

### References

[...]

### Bibliography

“[...]

3. OECD Guideline for testing of chemicals, Paris (1992). Guideline 203: Fish, Acute Toxicity Test<sup>3</sup>

4. OECD Guideline for testing of chemicals, Paris (1992). Guideline 204: Fish, Prolonged Toxicity Test: 14- Day study<sup>4</sup>

5. OECD Guideline for testing of chemicals, Paris (1992). Guideline 210: Fish, Early-Life Stage Toxicity Test<sup>5</sup>

6. International standard ISO 6341 (1989 (E)). Determination of the inhibition of the mobility of *Daphnia magna* Straus (Cladocera, Crustacea)”

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<sup>2</sup> Updated guidance: OECD 2019. Second Edition - Guidance Document on Aqueous-Phase Aquatic Toxicity Testing of Difficult Test Chemicals, Series on Testing and Assessment No. 23 (second edition). OECD, Paris.

<sup>1</sup> Updated reference: OECD 2001. Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances and Mixtures. Series on Testing and Assessment No. 33, OECD, Paris.

<sup>2</sup> Updated guidance: OECD 2019. Second Edition - Guidance Document on Aqueous-Phase Aquatic Toxicity Testing of Difficult Test Chemicals, Series on Testing and Assessment No. 23 (second edition). OECD, Paris.

<sup>3</sup> Updated in 2019.

<sup>4</sup> This Test Guideline has been cancelled but may continue to be used until 2 April 2014.

<sup>5</sup> Updated in 2013.