National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

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RIVM report 601714023/2012

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the Water Framework Directive

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Colophon

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Abstract

Environmental risk limits for silver
A proposal for water quality standards in accordance with the Water Framework Directive

RIVM has derived environmental risk limits (ERLs) for silver in water. New ERLs are needed because the current standards have not been derived according to the current valid methodology. The ERLs in this report are advisory values that serve as a scientific background for the Dutch Steering Committee for Substances, which is responsible for setting those standards. The ERLs proposed in this report are not specifically intended for nanosilver, but for all forms of dissolved silver (in ionic form).

Better analytical techniques necessary for silver in water
For silver, the most used ERL is the Maximum Permissible Addition (MPA). At this concentration harmful effects are not expected for water, based on an annual average concentration. At the moment, it cannot be determined if the MPA is exceeded in the field, since the MPA is lower than the current detection level for silver in the environment. Improving analytical techniques is recommended.

Based on three routes
The MPA is based on three routes: direct ecotoxicity to water organisms, effects on birds and mammals through feeding on prey, and effects on humans through consumption of fish. Direct ecotoxicity is the most critical of these three routes and determines the overall MPA. For freshwater this results in an MPA of 10 nanogram per liter. For salt water the MPA depends on the salinity; with a higher salinity less silver is taken up by animals. For North Sea water with a salinity of 34 per mill, the MPA is 81 nanogram per liter.

Uses of silver
Silver has many uses, for example in dentistry, photography and jewelry. With the development of digital photography, use of silver has decreased. The use of silver in the form of nanosilver has increased, however. Nanosilver has an antibacterial effect and is, for instance, being used in clothing.

Keywords:
environmental quality standard, silver, maximum permissible concentration, negligible concentration

Rapport in het kort

Milieurisicogrenzen voor zilver
Een voorstel voor waterkwaliteitsnormen volgens de Kaderrichtlijn Water

Het RIVM heeft, in opdacht van het ministerie van Infrastructuur en Milieu (I&M), milieurisicogrenzen voor zilver in water bepaald. Dit was nodig omdat de huidige norm voor zilver voor waterkwaliteit niet is afgeleid volgens de meest recente methodiek. Op basis van de nu voorgestelde milieurisicogrenzen stelt de Stuurgroep Stoffen nieuwe normen vast. De voorgestelde risicogrenzen gelden niet specifiek voor nanozilver, maar voor alle vormen van zilver die in water zijn opgelost (als ionen).

Betere analysetechnieken voor zilver in water nodig
De risicogrens voor langdurige blootstelling is de Maximaal Toelaatbare Toevoeging (MTT). Dit is de concentratie in water waarbij, gebaseerd op jaargemiddelde concentraties, geen schadelijke effecten te verwachten zijn. Momenteel kan niet worden bepaald of de MTT voor zilver wordt overschreden. Dat komt doordat deze waarde lager blijkt te zijn dan de limiet waarop zilver in water kan worden gemeten. Aanbevolen wordt de analysetechniek voor zilver te verbeteren om dit wel mogelijk te maken.

Drie routes onderzocht
Voor de MTT zijn drie routes onderzocht: directe effecten op waterorganismen, effecten op vogels en zoogdieren via het eten van prooidieren, en effecten op mensen via het eten van vis. De eerste van de drie levert de laagste waarde en bepaalt daarmee de MTT. Voor zoetwater resulteert dit in een MTT van 10 nanogram per liter. Voor zoutwater hangt de MTT af van het zoutgehalte van het zeewater; hoe hoger het zoutgehalte, hoe minder zilver door dieren wordt opgenomen. Voor Noordzeewater met een zoutgehalte van 34 promille is de MTT 83 nanogram per liter.

Toepassingen van zilver
Zilver kent veel toepassingen, zoals in de tandheelkunde, fotografie en in sieraden. Met de komst van digitale fotografie is het gebruik van regulier zilver afgenomen. Daar staat tegenover dat het gebruik van zilver in de vorm van nanodeeltjes is toegenomen. Nanozilver heeft een antibacteriële werking en wordt als zodanig onder andere in kleding verwerkt.

Trefwoorden:
milieurisicogrenzen, zilver, maximaal toelaatbaar risiconiveau, verwaarloosbaar risiconiveau

Contents

Summary

Environmental risk limits (ERLs) for silver in water are derived using ecotoxicological, physico-chemical, and human toxicological data. They represent environmental concentrations of a substance offering different levels of protection to man and ecosystems. It should be noted that the ERLs are scientifically derived values. They serve as advisory values for the Dutch Steering Committee for Substances, which is appointed to set the Environmental Quality Standards (EQSs) from these ERLs. ERLs should thus be considered as preliminary values that do not have an official status.

This report contains ERLs for silver in water. The following ERLs are derived: Negligible Addition (NA), Maximum Permissible Addition (MPA), Maximum Acceptable Addition for ecosystems (MAA_{eco}), Serious Risk Addition for ecosystems (SRA_{eco}), and the standard for waters intended for the abstraction of drinking water ($MPA_{dw, hh}$).

For the derivation of the MPA and MAA_{eco} for water, the methodology used is in accordance with the Water Framework Directive. For the NA and the SRA_{eco}, the guidance developed for the project 'International and national environmental quality standards for substances in the Netherlands' was used (Van Vlaardingen and Verbruggen, 2007). An overview of the derived environmental risk limits is given in Table 1.

For salt water, the ERLs depend strongly on the salinity of the system for which the ERL is used. The calculated ERLs at salinities of 15‰ and lower are deemed to be not valid because of the speciation behaviour at these lower salinities. Below 15‰, the ERLs for fresh water should be used.

Data on background concentrations in Dutch surface waters are not available. For compliance check, the effective background concentration is therefore assumed to be zero and the MPA is used as the MPC. For the other ERLs, the same arguments apply.

The newly derived ERLs are lower than the current standards. Monitoring data show that the detection limit is higher than the MPA (100–1,000 ng/L). This means that, if silver is not detected, the MPA may still be exceeded.

Table 1. Derived MPA, NA, MAA_{eco}, SRA_{eco}, $MPC_{dw, hh}$ values for silver.

	Salinity	**ERL (ng/L)**				
	(‰)	MPA	NA	MAA_{eco}	SRA_{eco}	$MPC_{dw, hh}$
fresh water		10	0.10	10	1,320	18,000
salt water	< 15	10	0.10	10	1,320	n.a.
	20	12.7	0.13	12.7	7,820	n.a.
	25	28.5	0.29	28.5	17,600	n.a.
	30	53.9	0.54	53.9	33,200	n.a.
	34	80.6	0.81	80.6	49,600	n.a.
	35	90.9	0.91	90.9	56,000	n.a.

1 Introduction

1.1 Background and aim

In this report, a proposal is made for water quality standards for silver. Silver is listed in the Dutch decree on monitoring within the context of the Water Framework Directive (WFD), also referred to as *Regeling monitoring KRW*. The current water quality standards for silver do not comply with the most recent methodology for EQS derivation. The list of so-called 'specific pollutants' included in the *Regeling monitoring KRW* is currently being evaluated in view of the second round of river basin management plans for 2015–2021 (Smit and Wuijts, 2012). For those substances remaining on the list, updated water quality standards according to the methodology of the WFD have to be available by the end of 2012.

Quality standards for soil, sediment, groundwater and suspended matter in surface water will not be derived in this report, because they are not relevant for compliance check under the *Regeling Monitoring KRW*.

1.2 Project framework

The derivation of ERLs is performed in the context of the project 'Chemical aspects of the Water Framework Directive', which is closely related to the project INS ('International and national environmental quality standards for substances in the Netherlands'). In addition to water quality standards required according to the WFD, some additional ERLs are considered in the context of INS, each representing a different protection aim. The following ERLs are derived in this report:

- Maximum Permissible Concentration (MPC) – defined in VROM (1999, 2004) as the standard based on scientific data which indicates the concentration in an environmental compartment for which:
  1 no effect to be rated as negative is to be expected for ecosystems;
  2a no effect to be rated as negative is to be expected for humans (for non-carcinogenic substances);
  2b for humans no more than a probability of 10^{-6} per year of death can be calculated (for carcinogenic substances). Within the scope of the Water Framework Directive (WFD), a probability of 10^{-6} on a life-time basis is used.

  The MPC for water should not result in risks due to secondary poisoning and/or risks to human health. These aspects are therefore also addressed in the MPC derivation. Separate MPC values are derived for the fresh-water and salt-water environments.

- Negligible Concentration (NC) – the concentration in fresh and salt water at which effects to ecosystems are expected to be negligible and functional properties of ecosystems are fully safeguarded. It defines a safety margin which should exclude combination toxicity. The NC is derived by dividing the MPC by a factor of 100.

- Maximum Acceptable Concentration (MAC_{eco}) for aquatic ecosystems – the concentration protecting aquatic ecosystems from effects due to short-term exposure or concentration peaks. The MAC_{eco} is derived for fresh-water and salt-water ecosystems.

- Serious Risk Concentration for ecosystems (SRC_{eco}) – the concentration in water at which possibly serious ecotoxicological effects are to be expected. The SRC_{eco} is valid for the fresh-water and salt-water compartments.

- Maximum Permissible Concentration for surface water used for drinking water abstraction ($MPC_{dw, hh}$). This is the concentration in surface water that meets the requirements for use of surface water for drinking water production. The $MPC_{dw, hh}$ specifically refers to locations that are used for drinking water abstraction.

The quality standards in the context of the WFD refer to the absence of any impact on community structure of aquatic ecosystems. Hence, not the potential to recover after transient exposure, but long-term undisturbed functioning is the protection objective under the WFD. Recovery in a test situation, after a limited exposure time, is therefore not included in the derivation of the MPC and MAC.

In the scope of this report, MPCs, MACs and SRCs are determined for the fresh-water and salt-water compartments.

1.3 Current standards

Since natural background concentrations for silver in the Netherlands are not officially established, the current standards for silver are only available as added concentrations, excluding background values. See section 2.2 for information on the use of the added risk approach for metals. The current Maximum Permissible Additions (MPAs) for silver in water are 0.082 µg/L for fresh water and groundwater, and 1.2 µg/L for marine water. The derivation of these values is reported by Van de Plassche et al. (1999).

In the REACH dossier, the PNEC for silver is reported as 0.04 µg/L in fresh water and 0.86 µg/L in marine water. These values refer to direct ecotoxicity to water organisms. There is no reference as to how these values are derived.

1.4 Use and sources of silver

Up to a decade ago, the main uses of silver were in photographic materials, electroplating, electrical conductors, dental alloys, solder and brazing alloys, paints, jewellery, coins, mirror production, cloud seeding, antibacterial agents and water purification (Faust, 1992). Over the last decade the use of silver for photographic materials, one of the largest applications, has declined because of the introduction of digital photography. This can be seen in the figures from the Dutch emission register (www.emissieregistratie.nl) regarding emission to surface water and sewage. However, over the last few years, the use of silver in consumer products has rapidly increased, mostly because of applications in the form of nanosilver (Fabrega et al., 2011). This increased use is expected to lead to increased emissions of silver to the environment, but cannot be seen in the figures from the Dutch emission register (www.emissieregistratie.nl; accessed on March 13, 2012).

1.5 Nanosilver

As indicated above, silver is also released into the environment in the form of nanoparticles. In a review by Fabrega et al. (2011) an overview of the behaviour and effects of silver nanoparticles in the environment is provided. These authors conclude that concentrations and forms of nanomaterials in the environment are difficult to quantify and that methodological progress is needed with regard to development of analytical tools to quantify nanoparticles in the environment. Toxicity studies on nanosilver are not consistent in methodology, which makes understanding the risk of nanosilver difficult. Fabrega et al. (2011) state that on the basis of current data it is not possible to conclude that either form of silver is consistently more toxic than the other. Furthermore, it can be expected that nanosilver, once released into the environment, will sooner or later be present in ionic form. This is confirmed by a study on the toxicity of nanosilver to *Caenorhabditis elegans* (Yang et al., 2012), where a linear correlation between nanosilver toxicity and dissolved silver was observed. In their experiments, the toxicity of tested nanosilver materials was never greater than would be predicted by complete dissolution of the same mass of silver as silver ions. In another review, it is stated that it is still unclear if dissolved silver causes the toxicity of nanosilver, but that it is also unclear if the nanoparticles themselves cause silver toxicity (Scown et al., 2010). Because of the lack of coherent information on fate and effects of nanosilver in the environment, the current report focuses only on dissolved silver ions.

2 Methods

2.1 General

The methodology for risk limit derivation is described in detail in the INS-guidance document (Van Vlaardingen and Verbruggen, 2007), also referred to as the INS Guidance. The methodology is based on the Technical Guidance Document (TGD), issued by the European Commission and developed in support of the risk assessment of new notified chemical substances, existing substances and biocides (EC, 2003) and on the Manual for the derivation of Environmental Quality Standards in accordance with the Water Framework Directive (Lepper, 2005). The latter document has been revised and the updated European guidance for derivation of water quality standards in the context of the WFD was published in December 2011 (EC, 2011). The new guidance is followed where it deviates from the INS Guidance and the terminology is harmonised as much as possible. This specifically applies to the derivation of the MAC (see section 5.4), for which the assessment factors in the new WFD Guidance differ from the INS Guidance. This also applies to the MPC for surface waters intended for the abstraction of drinking water ($MPC_{dw,\ hh}$, see section 5.3). In the INS Guidance, this is one of the MPCs from which the lowest value should be selected as the general MPC_{water} (see section 3.1.6 and 3.1.7 of the INS Guidance). According to the new guidance, the $MPC_{dw,\ hh}$ is not taken into account for the derivation of the general MPC_{water}, but specifically refers to locations that are used for drinking water abstraction.

With respect to the derivation of risk limits for metals, the new WFD Guidance is basically in line with the procedures in the INS Guidance, but the options for refinement, e.g. by incorporation of knowledge on speciation and bioavailability, are further elaborated.

2.2 Added risk approach and biotic ligand model

For derivation of ERLs for metals, the WFD Guidance (EC, 2011) proposes to follow the added risk approach and to include background concentrations in the final ERL for metals.

The added risk approach is used to take natural background concentrations into account when calculating ERLs for naturally occurring substances. The approach starts by calculating a maximum addition for chronic exposure and short-term concentration peaks equivalent to the MPC and MAC. These additions, denoted as MPA and MAA, are derived on the basis of available data from laboratory toxicity tests (with added amounts of toxicants). The MPA and MAA are considered to be the maximum concentrations to be added to the background concentration (C_b), without causing deleterious effects. Hence, the MPC is the sum of C_b and MPA, and the MAC is the sum of C_b and MAA:

$$MPC = C_b + MPA$$
$$MAC = C_b + MAA$$

The background concentration and the MPA/MAA are independently derived values, where the MPA and MAA are derived using a similar approach as the MPC and MAC for substances having no natural background concentration.

The aquatic ERLs derived in this report are for dissolved silver (i.e., after filtration of water samples over a filter with a maximum pore size of 0.45 µm). Therefore, only studies that report endpoints based on measured concentrations of samples that were filtered, or that were determined in laboratory water without particulate matter, are used for the derivation of the aquatic ERLs.

With regard to the bioavailable fraction of silver in laboratory tests, we assume that the dissolved fraction of silver in the test medium (< 0.45 µm) is fully bioavailable. In contrast, the background concentration is assumed to be completely unavailable, since at present there is insufficient information to determine the bioavailability of the background concentrations for metals. Moreover, for silver, no background concentrations have as yet been established, although work has been done on the methodology (Leonard Osté, personal communication). Also, in the database that might be used according to the WFD Guidance (EC, 2011): http://www.gsf.fi/publ/foregsatlas/maps_table.php; (accessed on March 13, 2012) no background concentrations for silver are reported. Thus, for compliance check the effective background concentration is assumed to be zero and the MPA is assumed to be equal to the MPC. For the MAC, the same arguments apply.

The WFD Guidance also notes that the recent developments in the area of biotic ligand modelling (BLM) may be used in the future for the assessment of bioavailability and the calculation of local quality standards after comprehensive data have become available for validation. In the case of silver, some work has been done on acute BLMs but with variable results (Bielmyer et al., 2007) and these BLMs are not yet validated. Moreover, data for chronic toxicity are needed for MPC derivation. This makes this approach not (yet) suitable for ERL derivation.

2.3 Data collection and evaluation

An online literature search was performed on SCOPUS for the period 1998–2010. The search profile is given in Appendix 1. The search resulted in approximately 110 references, of which more than 60 references were considered relevant. In addition to this, all cited references in Van de Plassche et al. (1999), INERIS (2006), Ratte (1999) and Wood et al. (2002) were collected and (re)assessed for the purpose of the ERL derivation of silver. Also, all studies of which ecotoxicological endpoints were cited in the assessed papers were collected and assessed. Finally, all records on aquatic toxicity in the REACH dossier on silver were added.

Studies were evaluated according to the Klimisch criteria (Klimisch et al., 1997), where, in the case of silver, only studies where the endpoints were based on measured values were considered to be valid. The aquatic ERLs derived in this report are for dissolved silver (i.e., after filtration of water samples over a filter with a maximum pore size of 0.45 µm). Therefore, only studies that report endpoints based on measured concentrations of samples that were filtered, or that were determined in laboratory water without particulate matter, were used for the derivation of the aquatic ERLs.

Aggregated data tables for acute and chronic toxicity were constructed with only one effect value per species, using L(E)C50-values or NOEC/EC10-values, respectively. To construct this aggregated data table, studies were only used if they were (a) valid; (b) based on measured dissolved concentrations; and (c) performed in laboratory water or filtered natural water with DOC < 2 mg/L and a pH between 6 and 9. For experiments with algae, the presence of particulate organic matter (algae) can of course not be avoided. The influence of hardness on the toxicity data for silver is not clear; where hardness was varied within the same study, the results were variable. Therefore, no criteria were defined for the acceptable degree of hardness.

When several effect data are available for one species, the geometric mean of multiple values for the same endpoint was calculated where possible. Subsequently, when several endpoints (like growth, mortality and/or reproduction) were available for one species, the lowest of these endpoints (per species) is reported in the aggregated data table.

For salt water, two different aggregated data tables were constructed to account for speciation into AgCl complexes (see section 3.4):

- based on measured concentrations, irrespective of the salinity used in the experiments
- based on calculated free Ag-ion concentrations, using the CHEAQS model, version 2011.2 (Verweij, 2011). In this calculation, speciation to DOM was not taken into account, since the concentration of DOM is often not exactly known. Moreover, in sea water the complexation to DOM (up to 5 mg/L) comprised much less than 1 percent of the total dissolved silver (Cowan et al., 1985).

The ERLs that can be derived from these three methods are discussed in the main text.

3 Substance identification, physico-chemical properties, fate and human toxicology

3.1 Identity

Silver occurs in the environment in a large number of different ionic species. Since most species are not relevant from a toxicological point of view, only the identity and physico-chemical properties for elemental silver and silver nitrate are given.

Table 2. Identification of silver.

Parameter	silver	silver nitrate
Chemical name	silver	silver nitrate
CAS number	7440-22-4	7761-88-8
EC number	231-131-3	231-853-9
SMILES code	Ag	

3.2 Physico-chemical properties

Physico-chemical characteristics of elemental silver and silver nitrate are presented in Tables 3 and 4. Although the ERL derivation concerns dissolved silver ions, both elemental silver and silver salts ($AgNO_3$ and other salts) can be used in toxicity experiments.

Table 3. Physico-chemical properties of elemental silver.

Parameter	Unit	Value	Remark	Reference
Molecular weight	[g/mol]	107.87		Lide, 2005
Water solubility	[g/L]	insoluble		EU-ECB, 2000a
pK_a	[-]	n.a.		
$\log K_{OW}$	[-]	n.a.		
$\log K_d$	[-]	n.a.		
Vapour pressure	[Pa]	5.65×10^{-7}	at 25°C, estimated	SRC, 2011
		1.1×10^{-38}	at 25°C, estimated	Lide, 2005
Melting point	[°C]	961.9		EU-ECB, 2000a
		961.78		Lide, 2005
Boiling point	[°C]	2,212		EU-ECB, 2000a
		2,162		Lide, 2005
Henry's law constant	[Pa/m^3.mol]	n.a.		

n.a. = not applicable.

Table 4. Physico-chemical properties of silver nitrate.

Parameter	Unit	Value	Remark	Reference
Molecular weight	[g/mol]	169.89		EU-ECB, 2000b
Water solubility	[g/L]	1,438	20°C	EU-ECB, 2000b
		2,160	20°C	EU-ECB, 2000b
		2,340	25°C	Lide, 2005

Parameter	Unit	Value	Remark	Reference
pK_a	[-]	n.a.		
log K_{OW}	[-]	n.a.		
log K_d	[-]	1.2-6.1[a]		HSDB, 2011
		2.1	Average from two experimental K_d values of 45 L/kg and 364 L/kg	Kreule et al., 1995
Vapour pressure	[Pa]	n.a.	salt	
Melting point	[°C]	212		EU-ECB, 2000b
Boiling point	[°C]	none	thermal decomposition at 444°C	Lide, 2005
Henry's law constant	[Pa/m^3/mol]	n.a.		

n.a. = not applicable.

[a] These values were determined in field experiments; see also Section 3.3.

3.3 Behaviour in the environment

Reported partition coefficients between water and sediment (K_d) for silver range from 16 to 1,300,000 (HSDB, 2011). These values were determined in the San Francisco Bay as well as in relatively pristine estuaries and they involve the different species in which silver is present in the environment (see section 3.4). Specific details on the silver speciation at the sampling sites for the different reported values are, however, not available. Besides the speciation of silver, sorption would also be influenced by other environmental conditions like redox state and composition of the suspended matter or sediment (HSDB, 2011). Considering the potentially high K_d values of silver, ERLs for sediment should also be derived. However, since these are not relevant for the purpose of this report, they are not derived here.

3.4 Silver speciation

Although the ERL derivation concerns dissolved silver ions, this is not the form at which silver is primarily present in the environment. Silver is present in the environment primarily as silver sulphide and silver chloride ($AgCl_n^{1-n}$) complexes (Hogstrand and Wood, 1998). Under reducing conditions in fresh water, silver sulphide dominates, while under oxidising conditions and in salt water silver chloride complexes are the most significant. This speciation behaviour influences the amount and activity of the free silver ion (Ag^+), which is supposed to be the most toxic species of silver (Hogstrand and Wood, 1998). In salt water, the amount of free silver ions is lower than in fresh water because of the strong chloride speciation. Water hardness and pH play very minor roles. In fresh water, test results suggest that DOC is probably an important variable for silver speciation in natural waters (Hogstrand and Wood, 1998).

Compared to other metals, the complexation of silver to chloride is relatively strong. For that reason, in this report, for saltwater speciation, calculations are performed to relate the observed toxicity to the free silver ion and then recalculate the final MPA and MAA back into dissolved silver concentrations at different salinities. For fresh water this refinement is less relevant; the influence of chloride complexes in fresh water is not as strong as in sea water.

3.5 Bioconcentration and biomagnification

According to HSDB (2011), inorganic silver ions will not bioconcentrate in aquatic organisms. Data on bioconcentration of silver are available only to a limited extent. Ratte et al. (1999) cite Bioconcentration Factors (BCF) ranging from 1.8 to 335 L/kg for fish and 1,400 L/kg for the mollusc *Ligumia* sp. Ikemoto et al. (2008) report silver concentrations in an aquatic food chain in the Mekong Delta (Vietnam). From these data, a geometric mean Bioaccumulation Factor (BAF) of 347 L/kg_{ww} for fish can be calculated, and no biomagnification is observed. Campbell et al. (2005) and Watanabe et al. (2008) even report inverse biomagnification (biodilution) in a food web from zooplankton to bird and seals in the Arctic, and a macro-invertebrate stream food web, respectively. Asante et al. (2008) reported biomagnification in zooplankton in a marine food web in the East China Sea, but biodilution in the whole food web. These results indicate that some bioconcentration of inorganic silver into zooplankton may be expected, but no further biomagnification in the food web. Therefore, the relevance of secondary poisoning to silver ERL derivation may be limited. Thus, in section 5.2 a reversed approach is applied in order to assess if secondary poisoning of silver is relevant for the ERLs to be derived. Since in this section it is concluded that secondary poisoning of silver is not relevant for the derivation of the ERLs, no further details on bioaccumulation are reported.

3.6 Human toxicological threshold limits and carcinogenicity

Elemental silver has no risk phrases. Silver nitrate, being the most relevant species for toxicity testing in the aquatic environment, has the following risk phrases: R8, R43 and R50/53 (EU-JRC, 2011). The hazard statements are H271, H290, H314, H400, and H410 (www.echa.europa.eu; accessed March 13, 2012). Thus, derivation of the $MPC_{water,\ hh\ food}$ for exposure of humans via fish consumption is not triggered. For drinking water, however, the derivation of the $MPC_{dw,hh}$ is relevant.

From a human toxicity study, the EPA derived an oral RfD for elemental silver of 0.005 mg/kg_{bw} per day (Faust, 1992). This value is taken as TDI for the calculation of the $MPC_{dw,\ hh}$. The US EPA derived a national secondary drinking water standard for silver of 0.1 mg/L because silver is used as an antibacterial agent in many home water treatment devices, and so presents a potential problem, which deserves attention (Erdreich et al., 1985).

4 Aquatic toxicity data

4.1 Fresh water

An overview of the aggregated fresh water toxicity data for silver is given in Table 5. Detailed toxicity data for silver are tabulated in separate Excel tables (See Appendix 2). As discussed in section 2.3, to construct this aggregated data table, studies were only used if they were were (a) valid; (b) based on measured dissolved concentrations; and (c) performed in laboratory water, well water or filtered natural water with DOC < 2 mg/L and a pH between 6 and 9.

Table 5. Aggregated toxicity data for fresh water organisms.

Chronic[a]		**Acute**[a]	
Taxonomic group	**NOEC/EC10 (μg Ag/L)**	**Taxonomic group**	**L(E)C50 (μg Ag/L)**
Algae		**Algae**	
Chlorella vulgaris	6.16[i]	*Chlamydomonas reinhardtii*	18.7[b]
Pseudokirchneriella subcapitata	1.57[j]	*Chlorella vulgaris*	18.4[c]
		Pseudokirchneriella subcapitata	7.8[d]
Crustacea			
Ceriodaphnia dubia	1.04[k]	**Crustacea**	
Daphnia magna	2.37[l]	*Ceriodaphnia dubia*	**0.66**[e]
		Daphnia magna	1.32[f]
Insecta		*Hyalella azteca*	4.9
Chironomus tentans	13		
Stenonema modestum	1.0[m]	**Pisces**	
		Oncorhynchus mykiss	2.75[g]
Pisces		*Pimephales promelas*	6.65[h]
Oncorhynchus mykiss	**0.1**[n]		
Pimephales promelas	2.0		
Salmo trutta	0.19		

[a] For detailed information see the Excel tables. Bold values are used for ERL derivation.

[b] Geometric mean of 19.6 and 17.8 μg/L.

[c] Geometric mean of 22.15, 21.7, and 13 μg/L.

[d] Geometric mean of 6.47 and 9.47 μg/L.

[e] Geometric mean of 0.31, 0.53, 6.1, 0.86, 0.7, 0.55, 3.8, 1.2, 0.34, 0.1, 0.41, and 0.3 μg/L.

[f] Geometric mean of 0.22, 0.28, 3.09, 3.21, 3.54, 0.23, 1.35, 1.41, 1.72, 1.56, 2.33, 2.84, 2.08, and 1.41 μg/L.

[g] Geometric mean of 2.6, 12.6, 3.3, 1.02, 3.18, 2.57, 2.19, and 1.64 μg/L.

[h] Geometric mean of 6.02, 3.6, 5.6, 5.2, 3.5, 13, 7.7, 5.27, 8.26, 13.4, 3.1, 5.7, 8.8, 4.5, 7.8, 8.1, 5.0, 4.7, 9.7, 5.9, 10.4, and 16.0 μg/L for 96 h exposure.

[i] Geometric mean of 7.97, 6.3, and 4.66 μg/L.

[j] Geometric mean of 0.94 and 2.61 μg/L.

[k] Most sensitive endpoint: mortality; geometric mean of 0.37 and 2.9 μg/L.

[l] Most sensitive endpoint: 21d NOEC for growth.

[m] Most sensitive endpoint: moulting.

[n] Most sensitive endpoint: growth.

Please note that, for *Ceriodaphnia dubia* and *Daphnia magna*, it seems odd that the acute LC50s are lower than the values for the chronic NOEC. However, this is caused primarily by the fact that the acute and chronic experiments are not performed within the same study, and results can vary among research laboratories. Two valid chronic endpoints were available for these species. Since there was no obvious reason to exclude one or the other value, it was decided to use the geometric mean. For the acute values, there are more study results available than for the chronic values, and the one or two relatively high acute values do not have a strong influence on the resulting geometric mean.

4.2 Salt water

An overview of the selected toxicity data for marine species is given in Table 6. Marine species are considered those species that are representative for marine and brackish water environments, and that were tested in water with salinity >5 ‰. As discussed in section 2.3, to construct this aggregated data table, only studies were used which were (a) valid; (b) were based on measured dissolved concentrations (c) performed in laboratory water or filtered natural water with DOC < 2 mg/L and a pH between 6 and 9.

Table 6. Aggregated toxicity data for marine species, not taking into account any variations in salinity

Chronic [a] **Taxonomic group**	**NOEC/EC10 (µg Ag/L)**	**Acute** [a] **Taxonomic group**	**L(E)C50 (µg Ag/L)**
Algae		**Algae**	
Thalassiosira weissflogii	**4.9**	*Thalassiosira weissflogii*	**20.5** [e]
Crustacea		**Crustacea**	
Americamysis bahia	25.1 [b]	*Acartia tonsa*	23.7 [f]
		Americamysis bahia	267 [g]
Echinodermata			
Arbacia punctulata	8.6 [c]		
Pisces			
Medina beryllina	58.3 [d]		

[a] For detailed information see the Appendix 2. Bold values are used for ERL derivation.

[b] Most sensitive endpoint: reproduction, geometric mean of 78.9, 3, 60, and 27.8 µg/L.

[c] Most sensitive endpoint: loss of spines, spine tugor and inability to adhere to surfaces.

[d] Most sensitive endpoint: mortality, geometric mean of 26, 25, 27.5, 49, 71, 144, 19, 100, and 460 µg/L.

[e] Most sensitive endpoint: growth.

[f] Geometric mean of 7.1 and 79.2 µg/L.

[g] Geometric mean of 260, 280, and 260 µg/L.

In Table 6, no attention is paid to the considerable differences in toxicity values among studies with different salinities. To better compare the endpoints from the selected studies, toxicity values were recalculated into toxicity values for free silver ions in 34‰ sea water (as measured in the North Sea), containing 18,800 mg/L Cl-, 10,770 mg/L Na, 412 mg/L Ca, 1,290 mg/L Mg, 2,711 mg/L SO_4, 380 mg/L K and 67 mg/L Br (Grasshof, 1976; Joop Bakker, Waterdienst, personal communication). Speciation to DOM was not taken into account, since the concentration of DOM is often not exactly known. Moreover, in sea water the complexation to DOM (up to 5 mg/L) comprised much less than 1 percent of the total dissolved silver (Cowan et al., 1985). Our calculations were performed using CHEAQS (version 2011.2) (Verweij, 2011). The resulting aggregated data based on free silver ion concentrations are tabulated in Table 7.

Table 7. Aggregated toxicity data for marine species, recalculated to free Ag$^+$ concentrations.

Chronic [a] **Taxonomic group**	**NOEC/EC10 (ng free Ag$^+$/L)**	**Acute** [a] **Taxonomic group**	**L(E)C50 (ng free Ag$^+$/L)**
Algae		**Algae**	
Thalassiosira weissflogii	**2.76 x 10^{-3}**	*Thalassiosira weissflogii*	**0.012** [e]
Crustacea		**Crustacea**	
Americamysis bahia	0.13 [b]	*Acartia tonsa*	0.84 [f]
		Americamysis bahia	1.17 [g]
Echinodermata			
Arbacia punctulata	0.010 [c]		
Pisces			
Medina beryllina	0.38 [d]		

[a] For detailed information see the Excel tables. Bold values are used for ERL derivation.

[b] Most sensitive endpoint: growth, geometric mean of 0.29, 0.25, 0.077, 0.76, 0.081, 0.075, 0.31, 0.017, and 0.067 ng free Ag$^+$/L.

[c] Most sensitive endpoint: loss of spines, spine tugor and inability to adhere to surfaces.

[d] Most sensitive endpoint: growth, geometric mean of 1.51, 0.063, 0.14, 1.11, 0.44, and 0.48 ng free Ag$^+$/L.

[e] Most sensitive endpoint: growth

[f] Geometric mean of 2.13 and 0.33 ng free Ag$^+$/L.

[g] Geometric mean of 1.14, 1.23, and 1.14 ng free Ag$^+$/L.

4.3 Treatment of fresh- and salt-water toxicity data

Since the speciation of silver is different in the marine environment, fresh- and salt-water toxicity data cannot be combined.

4.4 Mesocosm studies

Mesocosm studies with silver are not available.

5 Derivation of Environmental Risk Limits

5.1 Derivation of $MPC_{fw, eco}$ and $MPC_{sw, eco}$

For fresh water, there is a complete base set with acute and chronic data, and additional chronic data for insects. The lowest chronic endpoint is the value of 0.1 µg Ag/L for *Onchorhynchus mykiss*. It would have been preferred if toxicity data for micro-organisms was also available, since silver is used as an antimicrobial agent. However, from the reliable data on total silver (see Appendix 2) it can be seen that the toxicity to bacteria is in the same order of magnitude as the toxicity to fish. Therefore, an assessment factor of 10 is applied. This results in an $MPA_{fw, eco}$ of 10 ng Ag/L for dissolved silver.

For marine species, the acute base set is not complete, since data for fish are missing. However, if the valid data for fish that could not be used in the aggregated data table (for instance because no measured dissolved concentrations were reported) are taken into account, it is clear that marine fish are not the most sensitive species. Therefore, for the derivation of the $MPA_{sw, eco}$, it can be assumed that the acute base set is complete. For chronic toxicity, data for algae, crustaceans and fish are available with additionally an echinoderm. This means that an assessment factor of 50 should be used on the lowest NOEC/EC10.

When all toxicity data are used, regardless of the salinity at which the experiment was performed (Table 6), the lowest NOEC is 4.9 µg Ag/L, for *Thalassiosira weissflogii*. With an assessment factor of 50, this results in an $MPA_{sw, eco}$ of 98 ng Ag/L. However, because the salinity influences the toxicity of silver in marine waters, this approach is not preferable.

When toxicity data are used which have been recalculated into concentrations of the free Ag^+ ion, the lowest NOEC is 2.76×10^{-3} ng free Ag^+/L. With an assessment factor of 50, this results in an $MPA_{sw, eco}$ of 5.52×10^{-5} ng free Ag^+/L. This value can be recalculated using CHEAQS (version 2011.2) into values for dissolved silver in waters with different salinities (assuming that all ions mentioned in section 4.2 vary in the same ratios with salinity), and results can be found in Table 8.

Table 8. $MPA_{sw, eco}$ at different salinities, in ng dissolved Ag/L .

Salinity (‰)	**$MPA_{sw, eco}$ (ng/L, dissolved)**
≤ 15	10
20	12.7
25	28.5
30	53.9
34	80.6
35	90.9

At low salinities, the $MPA_{sw, eco}$ is lower than the $MPA_{fw, eco}$. This may be an artefact of the calculation (with a strong focus on silver complexation, which is mainly the case at higher salinities). Thus, the calculated $MPA_{sw, eco}$ at salinities of 15‰ and lower are deemed to be not valid because of the speciation behaviour at these lower salinities and at these salinities the $MPA_{fw, eco}$ should be used. Which MPA to choose thus depends on the salinity of the aquatic system for which the MPA is derived.

In water with a salinity of 34‰, which is representative for Dutch North Sea water (Joop Bakker, Waterdienst, personal communication; see details at section 4.2), the resulting $MPA_{sw,\ eco}$ is 81 ng dissolved Ag/L.

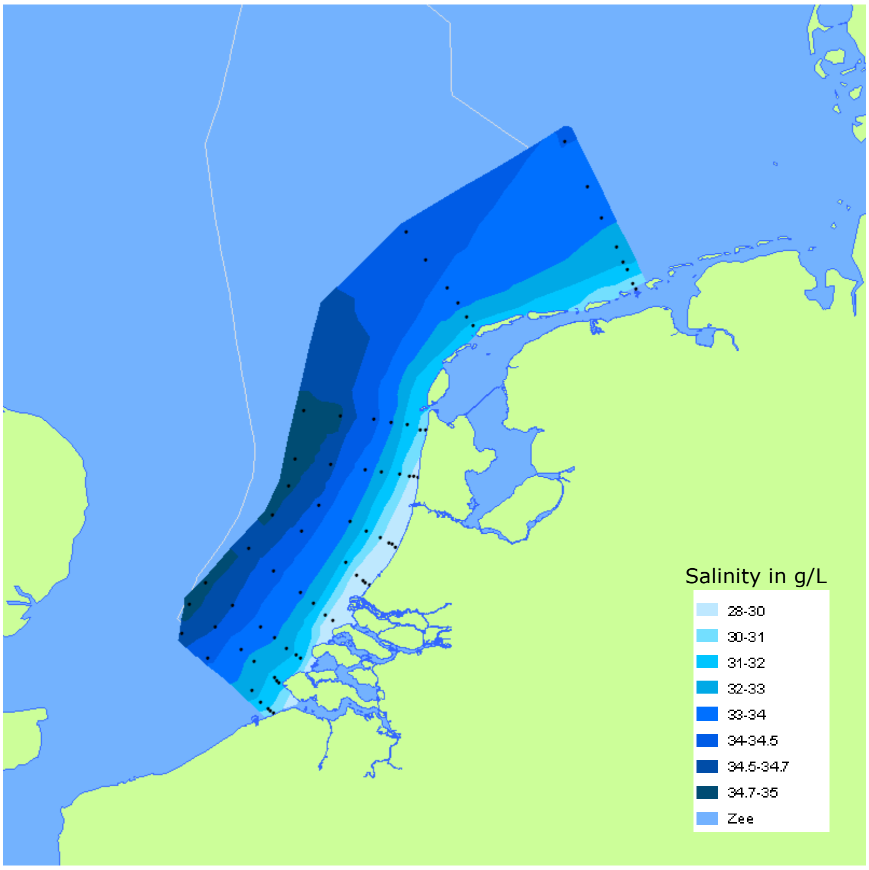

Figure 1. Salt concentrations in Dutch coastal waters (http://www.noordzeeatlas.nl/nl/nzaNl.html; accessed February 28, 2012).

As indicated in section 2.2, a background concentration for silver in Dutch surface waters has not yet been established. This means that, for compliance check, the effective background concentration is assumed to be zero and the MPA is used as the MPC. The MPC_{fw} thus equals the MPA_{fw} and is determined by the $MPA_{fw,\ eco}$ of 10 ng Ag/L. The MPC_{sw} equals the MPA_{sw} and depends on the salinity of the system for which the MPA_{sw} is derived, according to the values reported in Table 8. For North Sea water with a salinity of 34‰, the resulting MPA_{sw} is 81 ng dissolved Ag/L. These values are based on dissolved concentrations. If total concentrations or concentrations in suspended solids are needed, the above MPCs can be recalculated using the approach described in section 3.8.1 of the WFD Guidance (EC, 2011).

5.2 Secondary poisoning and human consumption of fishery products

Derivation of $MPC_{water,\ hh\ food}$ for silver is not triggered (section 3.6). With respect to secondary poisoning, data on the bioconcentration and biomagnification of silver are available to a limited extent and indicate that there is some bioconcentration of inorganic silver into zooplankton, but no further biomagnification in the food web. Thus the relevance of secondary poisoning to silver ERL derivation may be limited (section 3.5). For secondary poisoning, background concentrations are not relevant, and as a result not MPAs but MPCs are derived for this route.

In order to conclude whether secondary poisoning may be relevant to the derivation of ERLs for silver, a reversed approach is used. On the basis of the toxicity data for mammals and birds given in Table 9, it is calculated what the value of the BAF should be in order to let the $MPC_{fw,\ secpois}$ and $MPC_{sw,\ secpois}$ be more critical than the respective MPCs for direct ecotoxicity. As indicated above, the MPA is used as the MPC in the absence of background concentrations. Therefore, the $MPC_{fw,secpois}$ and $MPC_{sw,\ secpois}$ are compared with the $MPA_{fw,\ eco}$ and $MPA_{sw,\ eco}$, respectively.

The $MPC_{biota,secpois}$ per species is calculated applying the appropriate assessment factor (see Table 9). The lowest value is used for comparison of the derived MPAs according to Eq. 13 of the INS Guidance (Van Vlaardingen and Verbruggen, 2007) and section 4.4 in the WFD Guidance (EC, 2011).

Table 9 Toxicity data for mammals. Data for birds are not available.

	Duration	NOAEC diet [mg/kg$_{fd}$]	AF	$MPC_{biota,secpois}$ [mg/kg$_{fd}$]	Reference
Dog	90 d	455	90	5.1	Ctgb 2004
Rat	2 gen	130	30	4.3	Ctgb 2004

Because for mammals and birds more than one study is available, the most appropriate $MPC_{biota,\ secpois}$ for these organisms should be selected first. According to the WFD Guidance (EC, 2011), it is recommended in this case 'to use the most sensitive endpoint divided by the appropriate assessment factor (*i.e.* the factor implied by the study with the longest test duration)'. Taking the lowest from the $MPC_{biota,\ secpois}$ values for rat and dog, the $MPC_{biota,\ secpois,\ fw}$ is set to a 4.3 mg/kg diet.
The $MPC_{fw,\ secpois}$ is calculated by:

$MPC_{fw,\ secpois} = MPC_{biota,\ secpois,\ fw} / (BCF \times BMF_1) = 4.3 / (BCF \times BMF_1)$

In these formulas, the factor BCF x BMF_1 may be replaced by a field-derived BAF. To be more critical than the $MPC_{fw,\ eco}$ (10×10^{-6} mg/L), the BAF should be higher than 4.3 / 0.000010 = 430,000 L/kg. This value is a factor of 307 higher than the highest BCF of 1,400 L/kg for molluscs and a factor of almost 1,300 higher than the reported BAFs and BCFs for fish (see section 3.5). In other words, using the highest available BCF for molluscs, a BMF of over 300 kg/kg is needed to arrive at an $MPC_{fw,\ secpois}$ that is lower than the $MPC_{fw,\ eco}$. Since biomagnification is not observed for silver, this is highly unlikely.

For the marine environment, the $MPC_{sw,\ secpois}$ is calculated according to:

$MPC_{biota,\ secpois,\ sw} = MPC_{biota,\ secpois,\ fw} / BMF_2$

$MPC_{sw,\ secpois} = MPC_{biota,\ secpois,\ sw} / (BCF \times BMF_1) = 4.3 / (BCF \times BMF_1)$.

In this case, to be more critical than the $MPC_{sw,\ eco}$, the BCF x BMF_1 x BMF_2 has to be higher than 4.3 / 0.000081 = 53,100 L/kg. This value is more than a factor of 150 higher than the available BCFs and BAFs for fish (see section 3.5). This would mean the BMF_1 x BMF_2 would have to be higher than 150 (individual

BMF > 12 kg/kg) to arrive at an $MPC_{sw,\ secpois}$ which is lower than the $MPC_{sw,\ eco}$. Since biomagnification is not observed for silver, this is highly unlikely.

In view of the above, the chances are that a full literature search and assessment of the available BCF and BAF values would result in values for $MPC_{fw,\ secpois}$ or $MPC_{sw,\ secpois}$ that are more critical than the respective values for direct ecotoxicity. It can be concluded that the environmental risk of exposure to silver through secondary poisoning is lower than through direct toxicity and that deriving an MPC for secondary poisoning is deemed to be unnecessary. Therefore, further assessment of BCF studies with silver has not been performed.

5.3 $MPC_{dw,hh}$

No A1 value and DW standard are available for silver. With the TDI of 0.005 mg Ag/kg_{bw}.day a provisional $MPC_{dw,\ hh}$ can be calculated with the following formula: $MPC_{dw,\ hh} = 0.1 \times TL_{hh} \times BW / uptake_{dw}$ where the TL_{hh} is the TDI, BW is a body weight of 70 kg, and $uptake_{dw}$ is a daily uptake of 2 L. The provisional $MPC_{dw,\ hh}$ thus becomes: 0.1 x 0.005 x 70 / 2 = 0.018 mg Ag/L = 18 µg Ag/L. Since this value is higher than the other MPCs, no factor for removal efficiency during drinking water treatment has to be taken into account and no definitive $MPC_{dw,hh}$ needs to be derived (EC, 2011).

5.4 Derivation of MAA_{eco}

5.4.1 Fresh water

For fresh water, there is a complete acute base set and the $MAA_{fw,\ eco}$ is based on the lowest L(E)C50 value available. This is the value of 0.66 µg Ag/L for *Ceriodaphnia dubia*. Since the standard deviation of the log-transformed EC50 values is 0.52, an assessment factor of 100 should be used (WFD Guidance; EC, 2011), which results in a $MAA_{fw,\ eco}$ of 6.6 ng/L. This value is lower than the $MPA_{fw,\ eco}$ and it is deemed unrealistic for the $MAA_{fw,\ eco}$ to be lower than the $MPA_{fw,\ eco}$. Therefore, the $MAA_{fw,\ eco}$ is set equal to the $MPA_{fw,\ eco}$ at 10 ng Ag/L. Since background concentrations in fresh water are not available, this value is also valid as the $MAC_{fw,\ eco}$.

5.4.2 Salt water

Fish are absent from the acute dataset for marine species and thus the base set is not complete. However, because the valid data based on total concentrations show that fish are not the most sensitive species, an $MAA_{sw,\ eco}$ can still be derived.

When all toxicity data are used, regardless of the salinity at which the experiment was performed (Table 6), the lowest EC50 is 20.5 µg Ag/L for *Thalassiosira weissflogii*. The standard deviation of the log-transformed EC50 values is 0.63, and thus an assessment factor of 1,000 should be used, which results in an $MAA_{sw,\ eco}$ of 20.5 ng Ag/L. However, because the salinity influences the toxicity of silver in marine waters, this approach is not preferable.

When toxicity data are used which have been recalculated into concentrations of the free Ag^+ ion, the lowest EC50 is 0.012 ng free Ag^+/L for *Thalassiosira weissflogii*, and the standard deviation of the log-transformed EC50 values is 1.1. With an assessment factor of 1,000, this results in an $MAA_{sw,\ eco}$ of 1.2×10^{-5} ng free Ag^+/L. This value can be recalculated using CHEAQS (version 2011.2) into values for dissolved silver in waters with different salinities (assuming that all ions mentioned in section 4.2 vary in the same ratios with salinity):

Table 10. Calculated MAA$_{sw, eco}$ at different salinities, in ng dissolved Ag/L.

Salinity (‰)	**MAA$_{sw, eco}$ (ng/L, dissolved)**
20	2.76
25	6.20
30	11.7
34	17.5
35	19.8

However, all these values are lower than the respective MPA$_{fw, eco}$ values at the same salinities. It is deemed unrealistic for the MAA$_{sw, eco}$ to be lower than the MPA$_{sw, eco}$. Therefore the MAA$_{sw, eco}$ is set equal to the MPA$_{sw, eco}$, which is 81 ng dissolved Ag/L at a salinity of 34‰. Since background concentrations in salt water are not available, this value is also valid as the MAC$_{sw, eco}$.

5.5 Derivation of NC

Secondary poisoning is less critical than direct ecotoxicity and human consumption of fishery products is not relevant for silver. Derivation of the Negligible Concentration is therefore based on direct ecotoxicity. The NA$_{fw, eco}$ is set a factor of 100 lower than the MPA$_{fw, eco}$ at 0.10 ng Ag/L.

The NA$_{sw, eco}$ is set a factor of 100 lower than the MPA$_{sw, eco}$ and depends on the salinity of the system for which the MPA$_{sw}$ and NA$_{sw}$ are derived, according to the values reported in Table 8. For Dutch North Sea water with a salinity of 34‰, the resulting NA$_{sw}$ is 0.81 ng dissolved Ag/L.

In the absence of information on background concentrations, the NC is set equal to the NA. How the height of this value relates to the natural background concentration is not known. Thus, the value of the NC might be lower than the natural background concentration. When background concentrations are known, this value might be reconsidered.

5.6 Derivation of SRA$_{eco}$

The SRA$_{fw, eco}$ is determined by the geometric mean of all available chronic endpoints for freshwater: 1.32 µg Ag/L. Because background concentrations are not available, this value is used as SRC$_{fw, eco}$. Determination of the SRA$_{fw, eco}$ using acute data is not considered because of the complete chronic base set.

For the marine environment, the SRA$_{sw, eco}$ derived using the geometric mean of all NOEC/EC10 values (Table 6) is 15.8 µg/L. However, because the salinity influences the toxicity of silver in marine waters, this approach is not preferable.

When toxicity data are used which have been recalculated into concentrations of the free Ag^+ ion, the SRC based on the free Ag+ ion would be 0.034 ng free Ag^+/L. This value can be recalculated using CHEAQS (version 2011.2) into values for dissolved silver in waters with different salinities, as for the MPA and MAA:

Table 11. SRA$_{sw, eco}$ at different salinities, in μg dissolved Ag/L.

Salinity (‰)	**SRA$_{sw, eco}$ (μg/L, dissolved)**
20	7.82
25	17.6
30	33.2
34	49.6
35	56.0

In water with a salinity of 34‰, which is representative for Dutch North Sea water (Joop Bakker, Waterdienst, personal communication), the resulting SRA$_{sw, eco}$ is 49.6 μg dissolved Ag/L. Because information on background concentrations is not available, this value is also used as SRC$_{sw, eco}$.

6 Conclusions and recommendations

6.1 Derived ERLs

In this report, the risk limits Negligible Addition (NA), Maximum Permissible Addition (MPA), Maximum Acceptable Addition for ecosystems (MAA_{eco}), and Serious Risk Addition for ecosystems (SRA_{eco}) are derived for silver in fresh water and salt water. For silver, natural background concentrations are not available. The newly derived ERLs are lower than the current standards.

For salt water, the ERLs depend strongly on the salinity of the system for which the ERL is used. The calculated ERLs at salinities of 15‰ and lower are deemed to be invalid because of the speciation behaviour at these lower salinities. At salinities <15‰, the ERLs for fresh water should be used.

Because no data on background concentrations are available, for compliance check the effective background concentration is assumed to be zero and the MPA is used as the MPC. For the other ERLs, the same arguments apply. The $MPC_{dw, hh}$ already includes the background concentration.

Table 12. Derived MPA, NA, MAA_{eco}, SRA_{eco}, and $MPC_{dw, hh}$ values for dissolved silver.

	Salinity (‰)	**ERL (ng/L)** MPA	NA	MAA_{eco}	SRA_{eco}	$MPC_{dw, hh}$
fresh water		10	0.10	10	1,320	18,000
salt water	< 15	10	0.10	10	1,320	n.a.
	20	12.7	0.13	12.7	7,820	n.a.
	25	28.5	0.29	28.5	17,600	n.a.
	30	53.9	0.54	53.9	33,200	n.a.
	34	80.6	0.81	80.6	49,600	n.a.
	35	90.9	0.91	90.9	56,000	n.a.

n.a. = not applicable.

6.2 Monitoring data

Monitoring data from 2006 and onwards show that, for dissolved silver, none of the samples contained concentrations above the reporting limit of 0.1 to 1 μg/L (Van Duijnhoven, 2011). The newly derived ERLs in this report are all below this reporting limit. It cannot be concluded that the ERLs will be met.

6.3 Options for further research

To enable a better compliance check, analytical techniques should be improved (reporting limits lowered) so that monitoring data can be compared to the risk limits.

The current ERLs are derived based on dissolved silver; for salt water the derivation is based on free ion concentrations that are recalculated to a dissolved silver concentration at 34‰, which is considered most relevant for Dutch marine waters. It is assumed that ecotoxicological risks of nanosilver may partly be based on free ion concentrations of silver (see section 1.5). If these insights change, separate ERLs may have to be derived for nanosilver.

At present, no suitable and validated biotic ligand models for silver are available (see section 2.2). Once these models become available, the currently derived ERLs may have to be revised.

For the marine environment, speciation calculations were used to calculate the ERLs for silver. At higher salinities, the reliability of these calculations is high, since mainly chloride complexes play a role. At lower salinities, however, the speciation behaviour becomes more complex and calculations are therefore less reliable. When more insight is gained into the speciation behaviour and uptake mechanisms of silver, the calculations may need to be redone, and may also become appropriate for systems with lesser amounts of chloride.

The background concentration of silver is unknown (section 2.2), and according to the WFD methodology the derived standards are assumed to include the background concentrations in water (e.g., the MPA is assumed to be equal to the MPC). Once more knowledge on background concentrations is available, the background concentration should be added to the MPA and other ERLs to derive the final MPC.

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References

Asante K, Agusa T, Mochizuki H, Ramu K, Inoue S, Kubodera T, Takahashi S, Subramanian A, Tanabe S. 2008. Trace elements and stable isotopes (δ^{13}C and δ^{15}N) in shallow and deep-water organisms from the East China Sea. Environmental Pollution. 156: 862-873.

Bielmyer GK, Grosell M, Paquin PR, Mathews R, Wu KB, Santore RC, Brix KV. 2007. Validation study of the acute biotic ligand model for silver. Environmental Toxicology and Chemistry. 26: 2241-2246.

Campbell L, Norstrom R, Hobson K, Muir D, Backus S, Fisk A. 2005. Mercury and other trace elements in a pelagic Arctic marine food web (Northwater Polynya, Baffin Bay). Science of the Total Environment. 351-352: 247-263.

Cowan CE, Jenne EA, Crecelius EA. 1985. Silver speciation in seawater: The importance of sulfide and organic complexation. Marine and Estuarine Geochemistry. Chelsea, Michigan, USA, Lewis Publishers, Inc.

Ctgb. 2004. Toelating zilverthiofosfaat. Ctgb, Wageningen, the Netherlands.

EC. 2003. Technical Guidance Document on risk assessment in support of Commission Directive 93/67/EEC on risk assessment for new notified substances, Commission Regulation (EC) No 1488/94 on risk assessment for existing substances and Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. Ispra, Italy: European Commission Joint Research Centre.

EC. 2011. Technical guidance for deriving environmental quality standards. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Guidance Document No. 27. Brussels: European Communities.

Erdreich L, Bruins R, Withey J. 1985. Drinking Water Criteria Document for Silver (Final Draft). . Washington D.C., USA: U.S. Environmental Protection Agency. Report no. EPA/600/X-85/040 (NTIS PB86118288).

EU-ECB. 2000a. IUCLID dataset on silver. Brussels: European Commission - European Chemicals Bureau.

EU-ECB. 2000b. IUCLID dataset on silver nitrate. Brussels: European Commission - European Chemicals Bureau.

EU-JRC. 2011. European chemical Substances Information System (ESIS).

Fabrega J, Luoma SN, Tyler CR, Galloway TS, Lead JR. 2011. Silver nanoparticles: behaviour and effects in the aquatic environment. Environment International. 37: 517-531.

Faust RA. 1992. Toxicity summary for silver. Oak Ridge, USA: Oak Ridge National Laboratory.

Grasshof K. 1976. Methods of Sea Water Analysis, Weinheim, New York, USA, Verley Cheme.

Hogstrand C, Wood CM. 1998. Toward a better understanding of the bioavailability, physiology, and toxicity of silver in fish: Implications for water quality criteria. Environmental Toxicology and Chemistry. 17: 547-561.

HSDB. 2011. Hazardous Substances Data Bank (HSDB). National Library of Medicine's

Ikemoto T, Tu N, Okuda N, Iwata A, Omori K, Tanabe S, Tuyen B, I T. 2008. Biomagnification of the trace elements in the aquatic food web in the Mekong Delta, South Vietnam using stable carbon and nitrogen isotope analysis. Archives of Environmental Contamination and Toxicology. 54: 504-515.

INERIS. 2006. Argent. Verneuil en Halatte: Institut National de l'EnviRonnement industriel et des rISques (INERIS). Report no. draft.

Klimisch HJ, Andreae M, Tillman U. 1997. A systematic approach for evaluating the quality of experimental toxicological and ecotoxicological data. Regulatory Toxicology and Pharmacology. 25: 1-5.

Kreule P, Van den Berg R, Waitz MFW, Swartjes FA. 1995. Calculation of human-toxicological serious soil contamination concentrations and proposals for interventiion values for clean-up of soil and groundwater: Thirds series of compounds. Bilthoven: National Institute for Public Health and the Environment (RIVM). Report no. 715810010.

Lepper P. 2005. Manual on the Methodological Framework to Derive Environmental Quality Standards for Priority Substances in accordance with Article 16 of the Water Framework Directive (2000/60/EC). Schmallenberg, Germany: Fraunhofer-Institute Molecular Biology and Applied Ecology.

Lide DR (Ed.) 2005. CRC Handbook of Chemistry and Physics, Boca Raton, USA, CRC Press.

Ratte HT. 1999. Bioaccumulation and toxicity of silver compounds: A review. Environmental Toxicology and Chemistry. 18: 89-108.

Scown T, R VA, Tyler CR. 2010. Review: do engineered nanoparticles pose a significant threat to the aquatic environment? Critical Reviews in Toxicology. 40: 653-670.

Smit C, Wuijts S. 2012. Specifieke verontreinigende en drinkwater relevante stoffen onder de KRW. RIVM report number 601714022/2012. Bilthoven, the Netherlands: RIVM.

SRC. 2011. Interactive PhysProp Database Demo. SRC.

Van de Plassche EJ, Van den Hoop MAGT, Posthumus R, Crommentuijn T. 1999. Risk limits for boron, silver, titanium, tellurium, uranium and organosilicon compounds in the framework of EU Directive 76/464/EEC. Bilthoven, The Netherlands: National Institute of Public Health and the Environment (RIVM). Report no. 601501005.

Van Duijnhoven N. 2011. Inzicht in landelijke kwaliteitsdata 2006-2009. Achtergronddocument t.b.v. update stoffenlijst MR monitoring. Utrecht, the Netherlands: Deltares.

Van Vlaardingen PLA, Verbruggen EMJ. 2007. Guidance for the derivation of environmental risk limits within the framework of 'International and national environmental quality standards for substances in the Netherlands' (INS). Bilthoven, The Netherlands: National Institute of Public Health and the Environment (RIVM). Report no. 601782001.

Verweij W. 2011. CHEAQS pro: http://home.tiscali.nl/cheaqs/index.html.

Watanabe K, Monaghan M, Takemon Y, Omura T. 2008. Biodilution of heavy metals in a stream macroinvertebrate food web: Evidence from stable isotope analysis. Science of the Total Environment. 394: 57-67.

Wood CM, La Point TW, Armstrong DE, Birge WJ, Brauner CJ, Brix KV, Call DJ, Crecelius EA, Davies PH, Gorsuch JW, Hogstrand C, Mahony JD, McGeer JC, O'Connor TP. 2002. Biological Effects of Silver. IN Andren AW, Bober TW (Eds.) Silver in the Environment: Transport, Fate and Effects. Pensacola, Florida, USA, SETAC.

Yang X, Gondikas A, Marinakos S, Auffan M, Liu J, Hsu-Kim H, Meyer J. 2012. Mechanism of silver nanoparticle toxicity is dependent on dissolved silver and surface coating in *Caenorhabditis elegans*. Environmental Science & Technology. 46: 1119-1127.

List of abbreviations

BAF	Bioaccumulation Factor
BCF	Bioconcentration Factor
BMF	Biomagnification Factor
DOC	Dissolved Organic Carbon
EC_x	Concentration at which x-percent effect is observed
ERL	Environmental Risk Limit
INS	International and National Environmental Quality Standards for Substances in the Netherlands
LC_{50}	Concentration at which 50 percent mortality is observed
MAC_{eco}	Maximum Acceptable Concentration for ecosystems
$MAC_{fw, ecor}$	Maximum Acceptable Concentration for ecosystems in fresh water
$MAC_{sw, eco}$	Maximum Acceptable Concentration for ecosystems in the salt-water compartment
Marine species	Species that are representative for marine and brackish water environments and that are tested in water with salinity > 0.5‰.
MPA	Maximum Permissible Addition
MPC	Maximum Permissible Concentration
$MPA_{biota, secpois}$	Maximum Permissible Concentration in biota based on secondary poisoning
$MPA_{biota, secpois, fw}$	Maximum Permissible Concentration in biota in fresh water based on secondary poisoning
$MPA_{biota, secpois, sw}$	Maximum Permissible Concentration in biota in the salt-water compartment based on secondary poisoning
MPA_{fw}	Maximum Permissible Addition in fresh water
MPC_{fw}	Maximum Permissible Concentration in fresh water
MPA_{sw}	Maximum Permissible Addition in the salt-water compartment
MPC_{sw}	Maximum Permissible Concentration in the salt-water compartment
$MPA_{fw, eco}$	Maximum Permissible Addition in fresh water based on ecotoxicological data
$MPA_{sw, eco}$	Maximum Permissible Addition in the salt-water compartment based on ecotoxicological data
$MPA_{fw, secpois}$	Maximum Permissible Addition in fresh water based on secondary poisoning
$MPA_{sw, secpois}$	Maximum Permissible Addition in the salt-water compartment based on secondary poisoning
$MPA_{water, hh food}$	Maximum Permissible Addition in fresh water and salt water based on consumption of fish and shellfish by humans
$MPA_{dw, hh}$	Maximum Permissible Concentration in water used for abstraction of drinking water
NA	Negligible Addition
NC	Negligible Concentration
NA_{fw}	Negligible Concentration in fresh water
NA_{sw}	Negligible Concentration in the salt-water compartment
NOEC	No Observed Effect Concentration
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Level
SRA_{eco}	Serious Risk Addition for ecosystems
SRC_{eco}	Serious Risk Concentration for ecosystems

$SRA_{fw, eco}$	Serious risk Addition for fresh-water ecosystems
$SRA_{sw, eco}$	Serious risk Addition for salt-water ecosystems
TDI	Tolerable Daily Intake
TGD	Technical Guidance Document
WFD	Water Framework Directive (2000/60/EC)

Appendix 1 SCOPUS search profile

(((TITLE-ABS-KEY(**bioassay*** OR **toxic*** OR **ecotoxic*** OR **mortalit*** OR **phytotox*** OR **reproduct*** OR **lethal*** OR **growth** OR **teratogen***) OR TITLE-ABS-KEY(**ec50*** OR **ec20*** OR **ec10*** OR **lc50*** OR **lc20*** OR **lc10*** OR **noec*** OR **loec*** OR **matc** OR **tlm** OR **chv** OR **ecx** OR **bioassay***)) AND (TITLE-ABS-KEY(**silver*** OR **nanosilver***) OR CASREGNUMBER(**7440-22-4**))) OR ((TITLE-ABS-KEY(**bioconcentrat*** OR **bioaccumulat*** OR **uptake** OR **depuration** OR **food-web** OR **trophic** OR **biomagnificat*** OR **bcf*** OR **baf*** OR **fwmf*** OR **tmf*** OR **bmf*** OR **bsaf***)) AND (TITLE-ABS-KEY(**silver*** OR **nanosilver***) OR CASREGNUMBER(**7440-22-4**))) OR ((TITLE-ABS-KEY(**sorpt*** OR **adsorpt*** OR **freundlich** OR **koc*** OR **kd*** OR **kp*** OR **kf*** OR **partition-coefficient***)) AND (TITLE-ABS-KEY(**silver*** OR **nanosilver***) OR CASREGNUMBER(**7440-22-4**)))) AND NOT ((TITLE-ABS-KEY(**{silver eel}** OR **{silver eels}** OR **{silver catfish}** OR **{silver perch}** OR **{silver carp}** OR **{silver birch}**))) AND (LIMIT-TO(SUBJAREA, **'ENVI'**) OR LIMIT-TO(SUBJAREA, **'MULT'**)) AND (LIMIT-TO(PUBYEAR, **2010**) OR LIMIT-TO(PUBYEAR, **2009**) OR LIMIT-TO(PUBYEAR, **2008**) OR LIMIT-TO(PUBYEAR, **2007**) OR LIMIT-TO(PUBYEAR, **2006**) OR LIMIT-TO(PUBYEAR, **2005**) OR LIMIT-TO(PUBYEAR, **2004**) OR LIMIT-TO(PUBYEAR, **2003**) OR LIMIT-TO(PUBYEAR, **2002**) OR LIMIT-TO(PUBYEAR, **2001**) OR LIMIT-TO(PUBYEAR, **2000**) OR LIMIT-TO(PUBYEAR, **1999**) OR LIMIT-TO(PUBYEAR, **1998**))

Last search performed on 11 January 2011.

Appendix 2. Detailed ecotoxicity data

The data are included with hard copies of the report as a CD. With digital versions, the data are included as a separate pdf file.

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Acute toxicity of silver (Ag+) to freshwater organisms

- Validity according to Klimisch (1997); only records with a validity of 1 or 2 (green) can be used for ERL derivation.
- Bold records are selected for ERL derivation. These records are (1) valid; (2) based on measured dissolved concentrations of Ag+; (3) performed in water with DOC < 2 mg/L or labwater or filtered natural water or well water; (4) with a pH of 6-9; (5) EC50s/LC50s for acute and NOECs/EC10s for chronic studies.
- When for a certain species, data for different endpoints are available (e.g., growth, reproduction) the data for the most sensitive endpoint are selected. If there are more data for the same enpdoint, the geometric mean is used.

Species	Species properties	Analyzed	Test compound	Purity	Test type	Test water	Filtered y/n	pH	Temperature [°C]	Hardness [mg $CaCO_3$/L]	DOC mg/L	Exp time	Criterion	Test endpoint	Value total [µg Ag^+/L]	Value dissolved [µg Ag^+/L]	Value unkn. / nominal [µg Ag^+/L]	Validity	Notes	Reference
Bacteria																				
Escherichia coli	mid log phase	N	AgNO3		S	am			37			30 min	LC50	survival			591000	3	1, 2	Matsumura et al. 2003
Escherichia coli	strain K12	N	AgNO3		S	dtw		6,8	rt			15 min	LC50	survival			310	3	21	Bronk et al. 2001
Escherichia coli	strain K12	N	AgNO3		S	dtw		6,8	rt			15 min	LC50	survival			260	3	22	Bronk et al. 2001
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37			20 h	EC50	growth			10668	3	23	Gupta et al. 1998
Pseudomonas aeruginosa	ATCC 10145; log-phase	N	AgNO3		S	rw			25	0,029		8 h	EC100	inactivation			10	4	1,24	Hwang et al., 2006
Vibrio fischeri	Microtox assay	Y	AgNO3	AAS standard	S	dw		6,0	15	0	0	15 min	NOEC	luminescence	110			2	4,25,205,206	Fulladosa et al., 2005
Vibrio fischeri	Microtox assay	Y	AgNO3	AAS standard	S	dw		7,0	15	0	0	15 min	NOEC	luminescence	110			2	4,25,205,206	Fulladosa et al., 2005
Nitrifying bacteria	WWTP sludge	N	AgNO3		S	am		7,5					EC50	nitrification			810	3	1,2,26	Choi and Hu 2008
Nitrifying bacteria	WWTP sludge	N	AgNO3		S	am		7,5					EC50	nitrification			> 1000	4	27	Choi and Hu 2009
Nitrifying bacteria	WWTP sludge	Y			S			7				21 h	IC50	O2 consumption		20,8	330	4	27,28	Cecen et al. 2010
Nitrifying bacteria	WWTP sludge	Y			S			7				21 h	IC50	CO2 release		26,5	420	4	27,28	Cecen et al. 2010
Algae																				
Chlamydomonas reinhardtii	**exponential growth; 2x10^5 cells/mL**	**Y**	**AgNO3**		**S**	**am**		**7,45**	**25**	**65**	**0**	**1 h**	**EC50**	**photosynthethic yield**		**19,6**		**2**	**2,29,206**	**Navarro et al., 2008**
Chlamydomonas reinhardtii	**exponential growth; 2x10^5 cells/mL**	**Y**	**AgNO3**		**S**	**am**		**7,45**	**25**	**65**	**0**	**2 h**	**EC50**	**photosynthethic yield**		**17,8**		**2**	**2,29,206**	**Navarro et al., 2008**
Chlamydomonas reinhardtii	UTCC11		^{110m}Ag		F	am		7	20	15			EC50	growth rate			1,60	3	235	Hiriart-Baer et al., 2006
Chlamydomonas reinhardtii	UTCC11			ag	S	am			20			6 h	EC50	growth rate			1,29	3		Lee et al., 2005
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**		**7,2**	**rt**	**40**	**0**	**96 h**	**EC50**	**Cell density**		**22,15**		**2**	**3,4,33,34,35,206**	**Kolts et al., 2009**
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**			**rt**		**0**	**96 h**	**EC50**	**Cell density**		**21,7**		**2**	**3,4,30,31,34,206**	**Kolts et al., 2009**
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**		**7,2**	**rt**	**40**	**0**	**96 h**	**EC50**	**Cell density**		**13**		**2**	**3,4,30,32,34,206**	**Kolts et al., 2009**
Pseudokirchneriella subcapitata		**Y**	**AgNO3**		**S**	**am**		**7,2**	**rt**	**40**	**0**	**96 h**	**EC50**	**Cell density**		**6,47**		**2**	**3,4,30,33,34,206**	**Kolts et al., 2009**
Pseudokirchneriella subcapitata		**Y**	**AgNO3**		**S**	**am**		**7,2**	**rt**	**40**	**0**	**96 h**	**EC50**	**Cell density**		**9,47**		**2**	**3,4,32,34,35,206**	**Kolts et al., 2009**
Pseudokirchneriella subcapitata		N	AgNO3		S							10 d	EC50	growth			70	3	2,36	Schmittschmitt et al. 1996
Pseudokirchneriella subcapitata		N	Ag2SO4		S							10 d	EC50	growth			90	3	2,36	Schmittschmitt et al. 1996
Pseudokirchneriella subcapitata			AgNO3, AgSO4										EC50				> 125	4		Schmittschmitt et al. 1996 in Ratte 1999
Pseudokirchneriella subcapitata		Y	AgS2O3	formulation	S	am		7.8-8.2	23		0	72 h	EC50	growth rate	3,4			2	5,6,18,37,206,233	Oldersma et al 2003 in DAR silver thiosulphate
Pseudokirchneriella subcapitata			^{110m}Ag		F	am		7	20	15			EC50	growth rate			2,30	3	235	Hiriart-Baer et al., 2006
Pseudokirchneriella subcapitata				ag	S	am			20			6 h	EC50	growth rate			2,80	3		Lee et al., 2005

Macrophyta																
Elodea canadensis		N	AgNO3	S	am	6,7	24	10	24 h	EC50	photosynthesis		100	3	1	Brown and Rattigan 1979
Elodea canadensis		N	AgNO3	S	am	6,7	24	10	28 d	EC50	plant health		7500	3	1	Brown and Rattigan 1979
Lactuca sativa	seeds	N	AgNO3	S	dw		22		96 h	EC50	root length		1000	3	236	Fjällborg et al., 2006
Lemna minor		N	AgNO3	S	am	6,7	24	10	28 d	EC50	plant health		270	3	1	Brown and Rattigan 1979
Lemna minor		N	AgNO3	S	am	5,5	24		7 d	EC50	frond number		< 5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3	S	am	5,5	24		14 d	EC50	frond number		< 5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3	S	am	5,5	24		7 d	EC50	growth rate		7,5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3	S	am	5,5	24		14 d	EC50	growth rate		8,5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3	S	am	6,8	24		3 w	EC50	frond number		0,19	3	1, 2	Hutchinson and Czyrska 1975
Lemna minor	clone 7868	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		51	3	1	Topp et al. 2011
Lemna minor	clone 7766	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		65	3	1	Topp et al. 2011
Lemna minor	clone 9441	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		78	3	1	Topp et al. 2011
Lemna minor	clone 8389	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		94	3	1	Topp et al. 2011
Lemna minor	clone 7123	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		113	3	1	Topp et al. 2011
Lemna minor	clone 8292	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		168	3	1	Topp et al. 2011
Lemna minor	clone 8623	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		330	3	1	Topp et al. 2011
Lemna minor	clone 7194	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		525	3	1	Topp et al. 2011
Lemna minor	clone 7022	N	AgNO3	S	am	5,5	25	166	7 h	EC50	frond abscission		1294	3	1	Topp et al. 2011
Lemna minor	fronds	Y	AgNO3	S					7 d	EC50	growth rate	30		4	17	Naumann et al 2007 in REACH dossier
Lemna minor	fronds	Y	AgNO3	S					7 d	EC50	growth rate	81		4	17	Naumann et al 2007 in REACH dossier
Lemna minor	clone St; fronds	N	AgNO3	S	am	5,5	25	166	7 d	EC50	frond number		81	3	238	Naumann et al., 2007
Lemna minor	clone St; fronds	N	AgNO3	S	am	5,5	25	166	7 d	EC50	weight		30	3	238	Naumann et al., 2007
Lemna minor	clone St; fronds	N	AgNO3	S	am	5,5	25	166	7 d	EC50	chlorophyll		37	3	238	Naumann et al., 2007
Lemna paucicostata	strain 6746	N	AgNO3	S	am	4,1	25	700	7 d	EC50	frond number		970	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3	S	am	5,1	25	700	7 d	EC50	frond number		1100	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3	S	am	6,1	25	120	7 d	EC50	frond number		400	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3	S	am	7,1	25	120	7 d	EC50	frond number		200	3	1,2	Nasu and Kugimoto 1981
Salvinia natans		N	AgNO3	S	am	6,8	24		3 w	EC50	frond number		0,92 3		1,2	Hutchinson and Czyrska 1975
Fungi																
Saccharomyces cerevisiae	strain S288C	N	AgNO3	S	am		30		96 h	EC90	growth		270	3	38	Yang and Pon 2003
Saccharomyces cerevisiae	strain S288C	N	AgNO3	S	am		30		48 h	EC90	growth		539	3	38	Yang and Pon 2003
Cnidaria																
Hydra sp.										LC50	mortality		26	4		Brooke et al., 1986 in Wood et al., 2002
Platyhelmintes																
Dugesia dorotocephala			Ag2S						96 h	LC100	mortality		> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Dugesia dorotocephala			AgNO3						96 h	LC50	mortality		30	4	7	Ewell et al. 1993 in Ratte 1999
Dugesia dorotocephala			NaAgS2O3						96 h	LC100	immobility		> 1300	4	7	Ewell et al. 1993 in Ratte 1999

Rotifera																				
Philodina acuticornis		N	AgNO3		S	am		7.4-7.8	20	24		96 h	EC50	motion			14000	3	1	Buikema et al 1974
Nematoda																				
Caenorhabditis elegans	3-4 d	N	AgNO3	rg	S	am			20			96 h	LC50	mortality			100	3	237	Williams and Dusenbery, 1990
Mollusca																				
Aplexa hypnorum	adult	Y	AgNO3	99,99	R	nw	n	7,5	25,5	50,4	?	96 h	LC50	mortality	241			2	4,39,207	Holcombe et al. 1983
Aplexa hypnorum			AgNO3									96 h	LC50	mortality			400	4	7,40	Holcombe et al. 1983 in Ratte 1999
Aplexa hypnorum	adult	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	96 h	LC50	mortality	83			2	9,12,41,207	Holcombe et al. 1987
Corbicula fluminea	3-5mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	154,5	87,4		2	4,11,41,207	Diamond et al 1990
Lymnaea luteola	adult; 2.1 cm; 0.5 g		AgNO3	rg	R	dtw		7,4	32	195	510	96 h	LC50	mortality			4,2	3	58	Khangarot and Ray, 1988 BECT
Planorbis trivolis			Ag2S									96 h	LC100	mortality			> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Planorbis trivolis			AgNO3									96 h	LC50	mortality			30	4	7	Ewell et al. 1993 in Ratte 1999
Planorbis trivolis			NaAgS2O3									96 h	LC100	mortality			> 1300	4	7	Ewell et al. 1993 in Ratte 1999
Annelida																				
Lumbricus variegatus			Ag2S									96 h	LC100	mortality			> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Nephelopsis obscura	1.3 g	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	96 h	LC50	mortality	29			2	9,12,41,207	Holcombe et al. 1987
Tubifex tubifex	field collected	N	AgNO3	rg	R			7,6	30	245		96 h	LC50	mortality			31	3	1	Khangarot 1991
Tubifex tubifex																	30	4		Khangarot 1991, in Kangharot & Das, 2009
Crustacea																				
Alona affinis													LC50	mortality			37	4		Ghosh et al. 1990 in Wood et al., 2002
Caecidotea intermedia			Ag2S									96 h	LC100	mortality			> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Cambarus diogenes diogenes	adult	Y	AgNO3	tmg	F	rtw		8,2	15	120	0	96 h	LC50	mortality	65,85			1	206	Bianchini et al. 2002a
Cambarus diogenes diogenes	early juvenile	Y	AgNO3	tmg	F	rtw		8,2	15	120	0	96 h	LC50	mortality			0,9	1	2,43,206	Bianchini et al. 2002a
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**ag**	**R**	**am**		**7.4-7.8**	**25**	**80-100**	**≤ 0.4**	**48 h**	**LC50**	**mortality**		**0,31**		**2**	**6,44,47**	**Kolts et al 2008**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**ag**	**R**	**am**		**7.4-7.8**	**25**	**80-100**	**1.8-2.0**	**48 h**	**LC50**	**mortality**		**0,53**		**2**	**45,47**	**Kolts et al 2008**
Ceriodaphnia dubia	< 24 h	Y	AgNO3	ag	R	am		7.4-7.8	25	80-100	2.0-2.1	48 h	LC50	mortality		0,32		2	46,47	Kolts et al 2008
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**ag**	**R**	**am**		**7.4-7.8**	**25**	**80-100**	**1.9-2.0**	**48 h**	**LC50**	**mortality**		**6,1**		**2**	**47,48**	**Kolts et al 2008**
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	am		7.4-7.8	25±2	80-100	0	48 h	LC50	mortality	0,5			2	9,14,49,50,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	am		7.4-7.8	25±2	80-100	0	96 h	LC50	mortality	0,5			2	9,14,50,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	am		7.4-7.8	25±2	80-100	0	8 d	LC50	mortality	0,3			2	9,14,50,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgGSH		R	am		7.4-7.8	25±2	80-100	0	96 h	LC50	mortality	2,5			2	9,14,50,51,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgGSH		R	am		7.4-7.8	25±2	80-100	0	8 d	LC50	mortality	2,2			2	9,14,50,51,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgCys		R	am		7.4-7.8	25±2	80-100	0	48 h	LC50	mortality	4,7			2	9,14,50,52,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgCys		R	am		7.4-7.8	25±2	80-100	0	96 h	LC50	mortality	4,7			2	9,14,50,52,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgCys		R	am		7.4-7.8	25±2	80-100	0	8 d	LC50	mortality	4,7			2	9,14,50,52,206	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h					am			25			48 h	LC50	mortality	0,6			4		Peng et al. 2002
Ceriodaphnia dubia													LC50	mortality	0,9			4		Rodgers et al. 1997 in Peng et al. 2002
Ceriodaphnia dubia	24 h	Y	AgNO3		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		0,92		2	8,53,207	Rodgers et al. 1997a
Ceriodaphnia dubia	24 h	Y	AgCl		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		> 1930		2	8.207	Rodgers et al. 1997a
Ceriodaphnia dubia	24 h	Y	AgS2O3		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		> 12000		2	8.207	Rodgers et al. 1997a
Ceriodaphnia dubia													LC50	mortality	0,8			4		Diamond et al. 1997 in Peng et al. 2002
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**0,86**		**2**	**54.171.206.234**	**Diamond et al. 1997**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**0,7**		**2**	**54.171.206.234**	**Diamond et al. 1997**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**0,55**		**2**	**54.171.206.234**	**Diamond et al. 1997**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**nw**	**n**	**6,8**	**20**	**74**	**1,2**	**48 h**	**LC50**	**mortality**		**3,8**		**2**	**171.217**	**Diamond et al. 1997**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**nw**	**n**	**7,2**	**20**	**90**	**1,4**	**48 h**	**LC50**	**mortality**		**1,2**		**2**	**171.218**	**Diamond et al. 1997**
Ceriodaphnia dubia	< 24 h	Y	AgNO3		R	nw	n	7,5	20	76	2,8	48 h	LC50	mortality		1,6		2	171.219	Diamond et al. 1997
Ceriodaphnia dubia	< 24 h	Y	AgNO3		R	nw	n	7	20	106	5,5	48 h	LC50	mortality		1,1		2	171.220	Diamond et al. 1997
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	8,10	26	225	5,66	48 h	LC50	immobility/ mortality		3,24		1	55,56,208	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	8,04	26	197	11,5	48 h	LC50	immobility/ mortality		1,45		1	55,57,209	Bielmyer et al 2007
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**rg**	**S**	**nw**	**y**	**8,14**	**26**	**131**	**1,77**	**48 h**	**LC50**	**immobility/ mortality**		**0,34**		**1**	**55,56,210**	**Bielmyer et al 2007**

Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	7,75	26	28	3,85	48 h	LC50	immobility/ mortality		1,28		1	55,56,211	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	7,84	26	129	4,34	48 h	LC50	immobility/ mortality		4,24		1	55,57,212	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	dtw		8,07	26	63	4,55	48 h	LC50	immobility/ mortality		0,76		1	55.213	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	7,20	26	39	6,16	48 h	LC50	immobility/ mortality		1,15		1	55,57,214	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	7,82	26	80	12	48 h	LC50	immobility/ mortality		9,52		1	55,56,215	Bielmyer et al 2007
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	S	nw	y	6,84	26	12	5,02	48 h	LC50	immobility/ mortality		1,69		1	55,56,216	Bielmyer et al 2007
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**rg**	**R**	**rw**		**7.4-7.8**	**25**	**80-100**	**0**	**48 h**	**EC50**	**immobility/ mortality**	**0,19**	**0,1**		**1**	**6,58,206**	**Kolts et al 2006**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**rg**	**R**	**rw**		**7.4-7.8**	**25**	**80-100**	**0**	**48 h**	**EC50**	**immobility/ mortality**	**0,72**	**0,41**		**1**	**6,58,206**	**Kolts et al 2006**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**	**rg**	**R**	**rw**		**7.4-7.8**	**25**	**80-100**	**0**	**48 h**	**EC50**	**immobility/ mortality**	**0,42**	**0,3**		**1**	**6,58,206**	**Kolts et al 2006**
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	0,76	0,1		3	6,59	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	0,91	0,56		3	6,59	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	0,72	0,23		3	6,59	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	29	9,8		3	6,60	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	35	14,1		3	6,60	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	39	14,5		3	6,61	Kolts et al 2006
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	rw		7.4-7.8	25	80-100		48 h	EC50	immobility/ mortality	38	15,7		3	6,62	Kolts et al 2006
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	S	nw	y	8	23	240		48 h	LC50	mortality			1,4	3	12,58	Elnabarawy et al., 1986
Ceriodaphnia reticulata	< 4 h	N			S	nw	n	7.2-7.4	24-25	45		48 h	LC50				11	3		Mount and Norberg, 1984
Ceriodaphnia pulex	< 24 h	N	AgNO3	>99	R	dtw		8,2	25	142		48 h	LC50	mortality			160	3	1	Griffitt et al 2008
cladocerans					S	am		7	20	16		48 h	LC50	mortality			27	3	63	Hook and Fisher 2001
Crangonyx pseugracilis	4 mm	N	AgNO3	ag	R	tw/dw		6,75	13	45-55		48 h	LC50	mortality			6	3	58	Martin and Holdich, 1986
Crangonyx pseugracilis	4 mm	N	AgNO3	ag	R	tw/dw		6,75	13	45-55		96 h	LC50	mortality			5	3	58	Martin and Holdich, 1986
Cypris subglobosa	collected at fish ponds	N	AgNO3	rg (>98%)	R	nw	y	7,6	21	245		24 h	EC50	immobility			37	3	1	Khangarot & Das, 2009
Cypris subglobosa	collected at fish ponds	N	AgNO3	rg (>98%)	R	nw	y	7,6	21	245		48 h	EC50	immobility			13	3	1	Khangarot & Das, 2009
Daphnia magna	< 24 h	Y	AgNO3	tmg	R	rtw		8,2	20	115	0	48 h	LC50	mortality	0,26			2	221	Bianchini et al. 2002b
Daphnia magna	adult	Y	AgNO3	tmg	R	rtw		8,2	20	115	0	48 h	LC50	mortality			0,34	2	2,43,221	Bianchini et al. 2002b
Daphnia magna	**neonates**	**Y**	**AgNO3**		**R**	**am**		**8,2**	**20**			**48 h**	**LC50**	**mortality**		**0,22**		**2**	**4,8,206**	**Bianchini et al. 2002a**
Daphnia magna	**neonates**	**Y**	**AgNO3**		**R**	**am**		**8,2**	**20**			**48 h**	**LC50**	**mortality**		**0,28**		**2**	**4,8,64,206**	**Bianchini et al. 2002a**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**8,2**	**20**	**115**		**48 h**	**LC50**	**mortality**	**6,88**	**3,09**		**2**	**4,8,65,206**	**Bianchini and Wood 2008**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**8,2**	**20**	**115**		**48 h**	**LC50**	**mortality**	**8,28**	**3,21**		**2**	**4,8,65,66,206**	**Bianchini and Wood 2008**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**8,2**	**20**	**460**		**48 h**	**LC50**	**mortality**	**8,2**	**3,54**		**2**	**4,8,65,206**	**Bianchini and Wood 2008**
Daphnia magna	neonates	Y	AgNO3		R	rtw		8,2	20			48 h	LC50	mortality	6,9			2*	5,67	Bianchini and Wood 2001 in Bianchini and Wood 2002
Daphnia magna	< 24 h	N	AgNO3	ag	S	am		7,6	20	92		48 h	LC50	mortality			0,47	3	68	Bury et al. 2002
Daphnia magna	< 24 h	N	AgNO3	ag	S	am		7,6	20	92		48 h	LC50	mortality			1,2	3	69	Bury et al. 2002
Daphnia magna	< 24 h	N	AgNO3	ag	S	am		7,6	20	92		48 h	LC50	mortality			2,77	3	70	Bury et al. 2002
Daphnia magna	< 24 h	N	AgNO3	ag	S	am		7,6	20	92		48 h	LC50	mortality			26,84	3	71	Bury et al. 2002
Daphnia magna																	14	4		Khangarot and Ray 1989 or Rathore 2001 in Kangharot & Das, 2009
Daphnia magna		N		rg	S	nw	y	7.2-7.8	11.5-14.5	240		48 h	LC50	mortality			10	3	1	Khangarot and Ray 1989b
Daphnia magna		N	AgNO3		S	am		7,6	13	240		48 h	EC50	immobility			10	3	1	Khangarot and Ray 1987b

Daphnia magna			Ag2S									48 h	EC50	mobility			> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Daphnia magna			Ag2SO4									48 h	LC50	mortality			20	4	7	Ewell et al. 1993 in Ratte 1999
Daphnia magna			AgNO3									96 h	LC50	mortality			5	4	7	Ewell et al. 1993 in Ratte 1999
Daphnia magna	< 24 h	Y	AgNO3	rg	S	nw	n (well water)	7,5	20	38		48 h	LC50	mortality	1,1			2	4.207.222	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	S	nw	n (well water)	7,5	20	40		48 h	LC50	mortality	0,6			2	4.207.222	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	S	nw	n (well water)	7,5	20	33		48 h	LC50	mortality	1,1			2	4,72,207,222	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	S	nw	n (well water)	7,5	20	33		48 h	LC50	mortality	12,5			3	4,15,72,207,222	Nebeker et al. 1983
Daphnia magna		Y	Ag2+		S			7,2	19,5	33		48 h	EC50		1,1			2*	4,72	Nebeker 1983 DAR silver thiosulphate
Daphnia magna		Y	Ag2+		S			7,2	19,5	33		48 h	EC50		12,5			2*	4,15,72	Nebeker 1983 DAR silver thiosulphate
Daphnia magna	< 24 h	Y	AgNO3		S			7,5	19,5	38-40		48 h	EC50		1,1			2*	4	Nebeker 1983 DAR silver thiosulphate
Daphnia magna	< 24 h	Y	AgNO3		S			7,5	19,5	38-40		48 h	EC50		0,6			2*	4	Nebeker 1983 DAR silver thiosulphate
Daphnia magna			NaAgS2O3									96 h	LC50	mortality			> 1330	4	7	Nebeker et al. 1983 in Ratte 1999
Daphnia magna			AgNO3									48 h	LC50	mortality			0,9	4	73	Nebeker et al. 1983 in Ratte 1999
Daphnia magna			AgNO3									48 h	LC50	mortality			12,5	4*		Nebeker et al. 1983 in Ratte 1999
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	7,8	20	255		48 h	LC50	mortality	51			2	4,74,207, 239	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	8,6	20	73		48 h	LC50	mortality	11			2	4,75,207	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	7,2	20	60		48 h	LC50	mortality	0,81			2	4,76,207	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	7,7	20	46		48 h	LC50	mortality	0,64			2	4,77,207	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	7,4	20	46		48 h	LC50	mortality	0,96			2	4,78,207	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		S	nw	n (well water)	7	20	54		48 h	LC50	mortality	2,9			2	4.207	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	dtw		8,1	20	49	1,2	48 h	LC50	mortality	1			2	2,4,217	Erickson et al 1998
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	dtw		8,1	20	49	1,2	48 h	LC50	mortality	7,8			3	2,4,15	Erickson et al 1998
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	dtw		8,1	20	49	1,2	48 h	LC50	mortality	1,3			2	2,4,16,217	Erickson et al 1998
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	dtw		8,1	20	49	1,2	48 h	LC50	mortality	11,1			3	2,4,15,16	Erickson et al 1998
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	dtw		7,9	20	48	1,5	48 h	LC50	mortality	0,58			2	4,79,223	Erickson et al 1998
Daphnia magna	< 24 h	Y	AgNO3	99,70%	S	nw	y	8,0	20	81	18,5	48 h	LC50	mortality	35			2	4,80,224	Erickson et al 1998
Daphnia magna		N	AgNO3		S	rw		8.0-8.2	22	250		48 h	EC84	immobility/ mortality			0,15	3	1,17,81	Fjällborg et al., 2006
Daphnia magna		N	AgNO3		S			7.2-7.6	22	45		48 h	EC84	immobility/ mortality			0,06	3	1,17,81	Fjällborg et al., 2006
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**< 0.4**	**48 h**	**EC50**	**immobility/ mortality**	**0,29**	**0,23**		**1**	**4,82,83**	**Glover et al 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**0,57**	**48 h**	**EC50**	**immobility/ mortality**	**1,4**	**1,35**		**2**	**4,82,225**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**0,99**	**48 h**	**EC50**	**immobility/ mortality**	**1,48**	**1,41**		**2**	**4,82,226**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**1,86**	**48 h**	**EC50**	**immobility/ mortality**	**1,84**	**1,72**		**2**	**4,82,227**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**0,89**	**48 h**	**EC50**	**immobility/ mortality**	**1,59**	**1,56**		**2**	**4,82,228**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**1,91**	**48 h**	**EC50**	**immobility/ mortality**	**2,29**	**2,33**		**2**	**4,82,229**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**1,46**	**48 h**	**EC50**	**immobility/ mortality**	**3,51**	**2,84**		**2**	**4,82,230**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**1,34**	**48 h**	**EC50**	**immobility/ mortality**	**2,8**	**2,08**		**2**	**4,82,231**	**Glover et al. 2005**
Daphnia magna	**< 24 h**	**Y**	**AgNO3**		**R**	**rw**		**8**	**20-22**	**115**	**1,26**	**48 h**	**EC50**	**immobility/ mortality**	**2**	**1,41**		**2**	**4,82,232**	**Glover et al. 2005**
Daphnia magna	< 24 h	Y	AgNO3		R	rw		8	20-22	115		48 h	EC50	immobility/ mortality	1.31-16.42	1.29-16.65		3	4,82,84	Glover et al 2005: ETC 24: 2934
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	0	48 h	LC50	mortality	0,844			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	0	48 h	LC50	mortality	1,01			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	0	48 h	LC50	mortality	0,941			1	4,85	Karen et al. 1999

Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	0	48 h	LC50	mortality	1,374			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	0	48 h	LC50	mortality	1,009			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	0	48 h	LC50	mortality	0,578			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	0	48 h	LC50	mortality	1,37			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	0	48 h	LC50	mortality	1,138			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	2	48 h	LC50	mortality	2,74			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	2	48 h	LC50	mortality	1,393			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	2	48 h	LC50	mortality	1,27			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	2	48 h	LC50	mortality	1,479			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	2	48 h	LC50	mortality	1,559			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	2	48 h	LC50	mortality	1,443			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	2	48 h	LC50	mortality	1,774			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	2	48 h	LC50	mortality	1,466			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	5	48 h	LC50	mortality	3,256			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	5	48 h	LC50	mortality	2,502			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	5	48 h	LC50	mortality	1,666			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	5	48 h	LC50	mortality	2,947			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	5	48 h	LC50	mortality	2,006			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	5	48 h	LC50	mortality	1,993			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	5	48 h	LC50	mortality	2,039			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	5	48 h	LC50	mortality	1,532			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	10	48 h	LC50	mortality	2,595			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	10	48 h	LC50	mortality	2,641			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	10	48 h	LC50	mortality	2,317			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	100	10	48 h	LC50	mortality	2,513			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	10	48 h	LC50	mortality	2,561			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	10	48 h	LC50	mortality	3,794			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	10	48 h	LC50	mortality	2,503			1	4,85	Karen et al. 1999
Daphnia magna	neonates	Y	AgNO3	rg	R	am		8,3	22	200	10	48 h	LC50	mortality	3,124			1	4,85	Karen et al. 1999
Daphnia magna		Y	Ag		S	am		7.8-8.1				48 h	EC50	immobility	0,26			2	4,5,18,37,206	DAR silver thiosulphate
Daphnia magna	< 24 h	N	Ag	≥80%	S	am		6.7-8.1	22	72		48 h	LC50	mortality			1,5	3		LeBlanc 1980
Daphnia magna	24 h	Y	AgNO3		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		1,06		2	8,89,207	Rodgers et al. 1997a
Daphnia magna	24 h	Y	AgCl		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		>1930		2	8.207	Rodgers et al. 1997a
Daphnia magna	24 h	Y	AgS2O3		S	nw	n	7.5-8.2	20	68-70	?	96 h	LC50	mortality		>12000		2	8.207	Rodgers et al. 1997a
Daphnia magna	< 24 h	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	48 h	LC50	mortality	0,9			2	9,12,41,207	Holcombe et al. 1987
Daphnia magna		N	AgNO3		S	rw						48 h	LC50	mortality			7,7	3	15	Brooke et al. 1994
Daphnia magna		N	AgNO3		S	rw						48 h	LC50	mortality			1,1	3	1	Brooke et al. 1994
Daphnia magna		N	AgNO3		S	rw						48 h	LC50	mortality			11,2	3	15,16	Brooke et al. 1994
Daphnia magna		N	AgNO3		S	rw						48 h	LC50	mortality			1,4	3	15,16	Brooke et al. 1994
Daphnia magna	< 24 h	N	AgNO3	rg	S	nw	y	8	23	240		48 h	LC50	mortality			1,5	3	12,58	Elnabarawy et al., 1986
Daphnia magna		N	AgNO3		S	rtw		8.0-8.2	22	250		48 h	EC84	mortality			0,15	3	17	Fjällborg et al., 2006
Daphnia magna		N	AgNO3		S	rtw		7.2-7.6	22	45		48 h	EC84	mortality			0,06	3	17	Fjällborg et al., 2006
Daphnia pulex	adult	N	AgNO3	>99	R	dtw		8,2	25	142		48 h	LC50	mortality			8	3	1	Griffitt et al 2008
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			0,3	3	90	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			0,6	3	68	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,1	3	91	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,3	3	92	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,8	3	93	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			2,6	3	94	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,2	3	95	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,2	3	96	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			0,9	3	97	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	ag	S	am		6,8	20	6		48 h	LC50	mortality			1,1	3	98	Bury et al. 2002
Daphnia pulex	< 24 h	N	AgNO3	rg	S	nw	y	8	23	240		48 h	LC50	mortality			1,9	3	12,58	Elnabarawy et al., 1986
Daphnia pulex	< 24 h	N			S	nw	n	7.2-7.4	24-25	45		48 h	LC50				14	3		Mount and Norberg, 1984
Gammarus fasciatus			Ag2S									96 h	LC50	mortality			> 1000000	4	7	Ewell et al. 1993 in Ratte 1999
Gammarus pseudolimnaeus	0.67 mm	Y	AgNO3	rg	F	nw		7,4	19,9	44,3	?	96 h	LC50	mortality	4,5			2	4	Lima et al 1982
Gammarus pseudolimnaeus		Y	AgNO3		S			7,4	20			96 h	LC50	mortality	4,5			2*		Lima 1982 in DAR silver thiosulphate
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			2,1	3	99	Bury et al. 2002
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			4,9	3	100	Bury et al. 2002
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			5,9	3	101	Bury et al. 2002
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			2,1	3	102	Bury et al. 2002
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			8,5	3	103	Bury et al. 2002
Gammarus pulex		N	AgNO3	ag	R	am		7,6	10	85		48 h	LC50	mortality			4,3	3	104	Bury et al. 2002
Hyalella azteca	1-11 d	Y	metalloid Ag		S	dtw		7,39	24-25	124	1,1	7 d	LC50	mortality			1,05	3	12,13,105	Borgmann et al 2005

Hyalella azteca	1-11 d	Y	metalloid Ag		S	10% dtw, 90% dw		8,21	24-25	18	0,28	7 d	LC50	mortality	0,25			2	4.105	Borgmann et al 2005
Hyalella azteca	2-5mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	1,9	0,8		2	4,11,42	Diamond et al 1990
Hyalella azteca								7,7		35,2		4 d	LC50	mortality			1,9	4*		Diamond et al., 1990 in Borgmann et al., 2005
Hyalella azteca	2-3 weeks	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		6,8		2	8.106.207	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		> 1930		2	8.207	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	AgS2O3		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		> 12000		2	8.207	Rodgers et al. 1997a
Hyalella azteca								6.9-7.5		10-15		4 d	LC50	mortality			6,8	4*		Rodgers et al., 1997 in Borgmann et al., 2005
Hyalella azteca	2-3 weeks	Y	AgNO3		S	am		6.9-7.5	20	10-15	?	10 d	NOEC	survival		4		2	4,8	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	AgCl		S	am		6.9-7.5	20	10-15	?	10 d	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	Ag(S2O3)n		S	am		6.9-7.5	20	10-15	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Hyalella azteca			AgNO3									10 d	NOEC	mortality			4	4*	86	Rodgers et al, 1997 in INERIS, 2006 en Stoffdatenblatt, 1999
Hyalella azteca	**7-14 d**	**Y**	**AgNO3**		**F**	**dtw**		**7,17**	**22,9**	**50,7**		**10 d**	**LC50**	**mortality**	**5,4**	**4,9**		**2**	**4**	**Call et al 2006**
Hyalella azteca			AgNO3									10 d	LC50				397700	3	87	Ratte 1999
Hyalella azteca	2-3 weeks	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		5,8		2	8,88	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		> 1930		2	8	Rodgers et al. 1997a
Hyalella azteca	2-3 weeks	Y	AgS2O3		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		> 12000		2	8	Rodgers et al. 1997a
Hyalella azteca								6.9-7.5		10-15		10 d	LC50	mortality			5,8	4*		Rodgers et al., 1997 in Borgmann et al., 2005
Moina dubia													LC50	mortality			4,5	4		Ghosh et al., 1990 in Wood et al., 2002
Orconectes immunis	adult	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	48 h	LC50	mortality	560			2	9,12,41,207	Holcombe et al. 1987
Simocephalus vetulus	< 24 h	N			S	nw	n	7.2-7.4	24-25	45		48 h	LC50	mortality			15	3		Mount and Norberg, 1984
Insecta																				
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			25-28			96 h	LC50	mortality			4200	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			20-26			96 h	LC50	mortality			4500	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			25			96 h	LC50	mortality			4200	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			35			96 h	LC50	mortality			7800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			30			96 h	LC50	mortality			7800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			28			96 h	LC50	mortality			9800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			25			96 h	LC50	mortality			9800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			23			96 h	LC50	mortality			7800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			20			96 h	LC50	mortality			4800	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			15			96 h	LC50	mortality			3900	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus plumosus	larvae	Y	AgCl	ag	S	dtw			10			96 h	LC50	mortality			3100	4	9,10	Vedamanikam and Shazilli, 2008
Chironomus tentans	larvae	N	AgNO3		S	nw	n	6,3	14	25		48 h	EC50	mobility			10,4	3	1	Khangarot and Ray 1989a
Chironomus tentans																	10	4		Khangarot and Ray 1989 in Kangharot & Das, 2009
Chironomus tentans	2nd instar	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		676		2	8.107	Rodgers et al. 1997a
Chironomus tentans	2nd instar	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		>1930		2	8.107	Rodgers et al. 1997a
Chironomus tentans	2nd instar	Y	AgS2O3		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		>12000		2	8	Rodgers et al. 1997a
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			25-28			96 h	LC50	mortality			400	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			20-26			96 h	LC50	mortality			600	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			25			96 h	LC50	mortality			400	4	9,10,108	Vedamanikam and Shazilli, 2008

Culicoides furens	larvae	Y	AgCl	ag	S	dtw			35			96 h	LC50	mortality			34100	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			30			96 h	LC50	mortality			42200	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			28			96 h	LC50	mortality			42200	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			25			96 h	LC50	mortality			42200	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			23			96 h	LC50	mortality			37100	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			20			96 h	LC50	mortality			34000	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			15			96 h	LC50	mortality			34100	4	9,10,108	Vedamanikam and Shazilli, 2008
Culicoides furens	larvae	Y	AgCl	ag	S	dtw			10			96 h	LC50	mortality			25600	4	9,10,108	Vedamanikam and Shazilli, 2008
Isonychia bicolor	5-8mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	6,8	3,2		2	4,11,42	Diamond et al 1990
Leuctra sp.	6-8mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	2,5	1,2		2	4,11,42	Diamond et al 1990
Psephenus herricki	< 5mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	>306			2	4,11	Diamond et al 1990
Stenonema modestum	4-6mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	3,9	1,8		2	4,11,42	Diamond et al 1990
Tanytarsus dissimilis	3rd instar	Y	AgNO3	rg	S	nw	n	7,4	20	44,3	?	48 h	LC50	mortality	3160			2	4.109	Lima et al 1982
Tanytarsus dissimilis	3rd instar	Y	AgNO3		S	nw	n	7,4	20	44		48 h	LC50	mortality	3160			2*		Lima 1982 in DAR silver thiosulphate
Tanytarsus dissimilis	3rd & 4th instar	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	48 h	LC50	mortality	420			2	9,12,41	Holcombe et al. 1987
Pisces																				
Anguilla anguilla	58,5	N	AgNO3		R	rw		5,92		24		24 h	LC50	mortality			750	3	1	Grosell et al. 1998
Anguilla anguilla	58,5	N	AgNO3		R	rw		8,22		328		24 h	LC50	mortality			100000	3	1	Grosell et al. 1998
Anguilla anguilla			AgNO3		S							24 h	LC50	mortality			100	4	7	Grosell et al. 1998 in Ratte 1999
Anguilla anguilla	adults; 60 g	N	AgNO3		F	dtw			14	1		96 h	LC50	mortality			34,4	3		Grossell et al., 2000
Channa punctatus	60-80 mm; 1.8-3.5 g	N	AgNO3		R	dtw		7,3	30	250		96 h	LC50	mortality			18,89	3	58	Khangarot and Ray, 1988 AHH
Cottus baridi													LC50	mortality			5,3	4		Goettl and Davies, 1978 in Wood et al., 2002
Cottus baridi													LC50	mortality			13,6	4		Goettl and Davies, 1978 in Wood et al., 2002
Cyprinus carpio													LC50	mortality			2,7	4		Rao et al., 1975 in Wood et al., 2002
Danio rerio	adult	N	AgNO3	>99	R	dtw		8,2		142		48 h	LC50	mortality			22,2	3	1	Griffitt et al 2008
Danio rerio	juvenile, < 24 h	N	AgNO3	>99	R	dtw		8,2		142		48 h	LC50	mortality			> 10000	3	7	Griffitt et al 2008
Gambusia affinis	4-5 cm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	23,5	20,1		2	4,11	Diamond et al 1990
Gasterosteus aculeatus			Ag+										LC50	mortality			3	4	5.110	Bard et al. 1976 in Ratte 1999
Gasterosteus aculeatus			Ag+										LC50	mortality			3	4	5	McKee and Wolf 1963 in Bard et al 1976
Ictalurus punctatus	14.2 g	Y	AgNO3	99,99	F	nw	n	7.2-7.3	23,1	40,6	?	96 h	LC50	mortality	17,3			2	4.111	Holcombe et al. 1983
Ictalurus punctatus			AgNO3		F							96 h	LC50	mortality			17	4*		Holcombe et al. 1983 in Ratte 1999
Jordanella floridae	0.044 g, 30d	Y	AgNO3	rg	F	nw	n	7,4	24,7	44,3	?	96 h	LC50	mortality	9,2			2	4	Lima et al 1982
Jordanella floridae	30 days, 0.044 g	Y	AgNO3		F	nw	n	7,4		44		48 h	LC50	mortality	9,2			2*		Lima 1982 in DAR silver thiosulphate
Lebistes reticulatus	10-14 mm; 0.18-0.20 g	N	AgNO3		R	dtw		7,3	30	250		96 h	LC50	mortality			6,44	3	58	Khangarot and Ray, 1988 AHH
Lepomis macrochirus	62 d	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	96 h	LC50	mortality	31,7	24,3		2	4,11,42	Diamond et al 1990
Lepomis macrochirus	2.9 g	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	96 h	LC50	mortality	13			2	9,12,41	Holcombe et al. 1987
Leptophlebia sp.													LC50	mortality			2,2	4		Brooke et al., 1986 in Wood et al., 2002
Oncorhynchus kisutch													LC50	mortality			11,1	4		Nishiuchi, 1979 in Wood et al., 2002
Oncorhynchus kisutch													LC50	mortality			12,5	4		Nishiuchi, 1979 in Wood et al., 2002
Oncorhynchus kisutch	juveniles	N	AgNO3		S			6.9-7.9		41		96 h	LC50	mortality			12,5	4		Buhl and Hamilton, 1991 in REACH dossier

Oncorhynchus kisutch	alevin	N	AgNO3		S			6.9-7.9		41		96 h	LC50	mortality			11,1	4		Buhl and Hamilton, 1991 in REACH dossier
Oncorhynchus mykiss	juvenile, 2.2 g	Y	AgNO3	tmg		rtw		8,2	15	120	0	96 h	LC50	mortality			65,85	2	2,43	Bianchini et al. 2002a
Oncorhynchus mykiss	juveniles	N	AgNO3		S			6.9-7.9		41		96 h	LC50	mortality			19,2	4		Buhl and Hamilton, 1991 in REACH dossier
Oncorhynchus mykiss	alevin	N	AgNO3		S			6.9-7.9		41		96 h	LC50	mortality			16,1	4		Buhl and Hamilton, 1991 in REACH dossier
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,2	17	5,2	0,3	96 h	LC50	mortality	7,5			2	4.112	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,3	17	5,6	0,3	96 h	LC50	mortality	9,2			2	4.113	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,6	17	7,9	0,3	96 h	LC50	mortality	18,5			2	4.114	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,7	17	9,5	0,3	96 h	LC50	mortality	25,6			2	4.115	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,6	17	51	0,3	96 h	LC50	mortality	9,9			2	4.116	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,5	17	233	0,3	96 h	LC50	mortality	10,5			2	4.117	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,7	17	3,5	1,6	96 h	LC50	mortality	18,4			2	4.118	Bury et al 1999
Oncorhynchus mykiss	2.2 g	Y	AgNO3		R	am		6,7	17	3,8	5,8	96 h	LC50	mortality	27,7			2	4.119	Bury et al 1999
Oncorhynchus mykiss	69-173 mm	Y	AgNO3					6.6-6.9		20-31		96 h	LC50	mortality			6,5	3	12,13	Davies et al 1978
Oncorhynchus mykiss	167 mm	Y	AgNO3					8		350		96 h	LC50	mortality			13	3	12,13	Davies et al 1978
Oncorhynchus mykiss			AgNO3		F					25		96 h	LC50	mortality			6,5	4*	7.120	Davies and Ginneverl 1979 in Ratte 1999
Oncorhynchus mykiss			AgNO3		F					350		96 h	LC50	mortality			8,3	4	7.120	Davies and Ginneverl 1979 in Ratte 1999
Oncorhynchus mykiss	60 d	Y	AgNO3	rg	R	nw	n	7,8	12	34,8	?	144 h	LC50	mortality	4,8	3,8		2	4,11,42	Diamond et al 1990
Oncorhynchus mykiss	**juveniile, 5.17 g**	**Y**	**AgNO3**		**R**	**am**		**7.9-8.2**	**15,5**		**?**	**168 h**	**LC50**	**mortality**	**3,2**	**2,6**		**2**	**4.121**	**Galvez and Wood 1997**
Oncorhynchus mykiss	juvenile, 5.17 g	Y	AgNO3		R	am		7.9-8.2	15,5		?	168 h	LC50	mortality	> 4.5	> 3.1		2	4.122	Galvez and Wood 1997
Oncorhynchus mykiss		Y	AgNO3		F	dtw		8	14.5-15.5	120		96 h	LC50	mortality	11,6			2	4.123	Galvez and Wood 2002
Oncorhynchus mykiss		Y	AgNO3		F	dtw		8	14.5-15.5	120		168 h	LC50	mortality	14,9			2	4.123	Galvez and Wood 2002
Oncorhynchus mykiss		Y	AgNO3		F	dtw		8	14.5-15.5	120		168 h	LC50	mortality	> 55			3	4.124	Galvez and Wood 2002
Oncorhynchus mykiss		Y	AgNO3		F	dtw		8	14.5-15.5	120		168 h	LC50	mortality	> 40			3	4.125	Galvez and Wood 2002
Oncorhynchus mykiss	juveniles; 25 g	N	AgNO3		F	dtw			14	1		96 h	LC50	mortality			10,2	3		Grossell et al., 2000
Oncorhynchus mykiss		Y	AgNO3		F	nw	n	6.4-8.3				96 h	LC50	mortality			28,8	3	126	Hale 1977
Oncorhynchus mykiss			Ag+									168 h	LC50	mortality			3,2	4	127	Hogstrand and Wood 1998
Oncorhynchus mykiss			Ag+		S							168 h	LC50	mortality			3,2	4*		Hogstrand and Wood 1998 in Ratte 1999
Oncorhynchus mykiss	1-4 g	Y	AgNO3	ag	R	dtw		7.9-8.2	15	100	?	96 h	LC50	mortality	11,8			2	4.128	Hogstrand et al. 1996
Oncorhynchus mykiss	1-4 g	Y	AgNO3	ag	R	dtw		7.9-8.2	15	100	?	168 h	LC50	mortality	9,1			2	4.128	Hogstrand et al. 1996
Oncorhynchus mykiss	1-4 g	Y	Ag(S2O3)n		R	dtw		7.9-8.2	15	100	?	96 h	LC50	mortality	161000			2	4.128	Hogstrand et al. 1996
Oncorhynchus mykiss	1-4 g	Y	Ag(S2O3)n		R	dtw		7.9-8.2	15	100	?	168 h	LC50	mortality	137000			2	4.128	Hogstrand et al. 1996
Oncorhynchus mykiss	1-4 g		AgCl		R	dtw		7.9-8.2	15	100	?	168 h	LC50	mortality	>1000			2	4.128	Hogstrand et al. 1996
Oncorhynchus mykiss	1-4 g		AgCl		R	dtw		7.9-8.2	15	100	?	168 h	LC50	mortality	>100000	>120		2	4.128.129	Hogstrand et al. 1996
Oncorhynchus mykiss			AgNO3		S							96 h	LC50	mortality			12	4*		Hogstrand et al. 1996 in Ratte 1999
Oncorhynchus mykiss			AgNO3		S							168 h					9,1	4*		Hogstrand et al. 1996 in Ratte 1999
Oncorhynchus mykiss		Y	Ag(S2O3)n		SS	rw		7.9-8.2		-7		96 h	LC50	mortality			161000	4*	4.130	Hogstrand et al., 1996 in Van der Plassche et al 1999
Oncorhynchus mykiss		Y	AgCln		SS	rw		7.9-8.2		-7		96 h	LC50				>100000	4	4.130.131	Hogstrand et al., 1996 in Van der Plassche et al 1999
Oncorhynchus mykiss			NaAg2S2O3		S							96 h	LC50	mortality			161000	4*		Hogstrand et al. 1996 in Ratte 1999
Oncorhynchus mykiss			NaAg2S2O3		S							168 h					137000	4*		Hogstrand et al. 1996 in Ratte 1999
Oncorhynchus mykiss			AgCl		S							168 h	LC50	mortality			>100000	4*		Hogstrand et al. 1996 in Ratte 1999
Oncorhynchus mykiss	1.2 g	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	96 h	LC50	mortality	6			2	9,12,41	Holcombe et al. 1987
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	0	96 h	LC50	mortality	1,48			2	4.132	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	60	0	96 h	LC50	mortality	3,579			2	4.132	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	0	96 h	LC50	mortality	3,39			2	4.133	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	0	96 h	LC50	mortality	2,421			2	4.133	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	0	96 h	LC50	mortality	3,764			2	4.133	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	2,5	96 h	LC50	mortality	5,571			2	4.134	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	5	96 h	LC50	mortality	9,462			2	4.135	Karen et al. 1999

Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	2,5	96 h	LC50	mortality	17,07			2	4.136	Karen et al. 1999
Oncorhynchus mykiss	20 days	Y	AgNO3	rg	F	am		9	10-12	30	5	96 h	LC50	mortality	28,42			2	4.137	Karen et al. 1999
Oncorhynchus mykiss													LC50	mortality			6,9	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			8,4	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			9,7	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			11,5	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			14	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			17,87	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			240	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss													LC50	mortality			170	4		Lemke, 1981 in Wood et al., 2002
Oncorhynchus mykiss	**juvenile, <1g**	**Y**	**AgNO3**		**R**	**dtw**			**14**			**96 h**	**LC50**	**mortality**	**14,7**	**12,6**		**2**	**4,8,138**	**Mann et al. 2004**
Oncorhynchus mykiss	juvenile, < 1 g	Y	AgNO3		R	dtw			14			96 h	LC50	mortality	40,7	24,3		3	4,8,138,139	Mann et al. 2004
Oncorhynchus mykiss	**6.3 g**	**Y**	**AgNO3**		**F**	**am**		**7**	**10**	**10**	**0,7**	**96h**	**LC50**	**mortality**	**13,3**	**3,3**		**2**	**4.140**	**Morgan and Wood 2004**
Oncorhynchus mykiss	6.6 g	Y	AgNO3	rg	S	nw	n (well water)	7,5	10	40		96 h	LC50	mortality	72,9			2	4, 240	Nebeker et al. 1983
Oncorhynchus mykiss	6.6 g	Y	AgNO3	rg	S	nw	n (well water)	7,5	9	37		96 h	LC50	mortality	84,4			2	4, 240	Nebeker et al. 1983
Oncorhynchus mykiss	0.2 g	Y	AgNO3	rg	S	nw	n (well water)	7,5	12	26		96 h	LC50	mortality	10,9			2	4.141	Nebeker et al. 1983
Oncorhynchus mykiss	0.3 g	Y	AgNO3	rg	S	nw	n (well water)	7,5	12	35		96 h	LC50	mortality	8,5			2	4.141	Nebeker et al. 1983
Oncorhynchus mykiss	0.2 g	Y	AgNO3	rg	F	nw	n (well water)	7,5	12	29		96 h	LC50	mortality	8,6			2	4	Nebeker et al. 1983
Oncorhynchus mykiss	0.4 g	Y	AgNO3	rg	F	nw	n (well water)	7,5	12	42		96 h	LC50	mortality	9,7			2	4	Nebeker et al. 1983
Oncorhynchus mykiss	0.2 g	Y	AgNO3	rg	F	nw	n (well water)	7,5	12	36		96 h	LC50	mortality	9,2			2	4	Nebeker et al. 1983
Oncorhynchus mykiss			AgNO3		F							96 h	LC50	mortality			9,2	4*		Nebeker et al. 1983 in Ratte 1999
Oncorhynchus mykiss			AgNO3		S							96 h	LC50	mortality			79	4*	142	Nebeker et al. 1983 in Ratte 1999
Oncorhynchus mykiss			AgNO3		S							96 h	LC50	mortality			9,8	4*		Nebeker et al. 1983 in Ratte 1999
Oncorhynchus mykiss			AgNO3		F							96 h	LC50	mortality			9,2	4*		Nebeker et al. 1983 in Ratte 1999
Oncorhynchus mykiss		Y	AgNO3		F			7	12			96 h	LC50	mortality	9,2			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		F				12			96 h	LC50	mortality	8,6			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		F				12			96 h	LC50	mortality	9,7			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		S				10			96 h	LC50	mortality	72,9			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		S				9			96 h	LC50	mortality	84,4			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		S				12			96 h	LC50	mortality	10,9			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss		Y	AgNO3		S				12			96 h	LC50	mortality	8,5			2*	4	Nebeker et al. 1993 in DAR silver thiosulphate
Oncorhynchus mykiss	**juvenile**	**Y**			**F**	**am**			**10-12**	**30**	**0**	**96 h**	**LC50**	**mortality**	**1,48**	**1,02**		**2**	**4.143.144**	**Ownby et al. 2001**
Oncorhynchus mykiss	**juvenile**	**Y**			**F**	**am**			**10-12**	**70**	**0**	**96 h**	**LC50**	**mortality**	**3,58**	**3,18**		**2**	**4.143.145**	**Ownby et al. 2001**
Oncorhynchus mykiss	**juvenile**	**Y**			**F**	**am**			**10-12**	**30**	**0**	**96 h**	**LC50**	**mortality**	**3,39**	**2,57**		**2**	**4.143.146**	**Ownby et al. 2001**
Oncorhynchus mykiss	**juvenile**	**Y**			**F**	**am**			**10-12**	**30**	**0**	**96 h**	**LC50**	**mortality**	**2,42**	**2,19**		**2**	**4.143.147**	**Ownby et al. 2001**
Oncorhynchus mykiss	**juvenile**	**Y**			**F**	**am**			**10-12**	**30**	**0**	**96 h**	**LC50**	**mortality**	**3,77**	**1,64**		**2**	**4.143.148**	**Ownby et al. 2001**
Oncorhynchus mykiss	juvenile	Y			F	am			10-12	30	2,5	96 h	LC50	mortality	5,57	4,17		2	4.143.149	Ownby et al. 2001
Oncorhynchus mykiss	juvenile	Y			F	am			10-12	30	5	96 h	LC50	mortality	9,46	5,64		2	4.143.150	Ownby et al. 2001
Oncorhynchus mykiss	juvenile	Y			F	am			10-12	30	2,5	96 h	LC50	mortality	17,1	15,3		2	4.143.151	Ownby et al. 2001

Oncorhynchus mykiss	juvenile	Y			F	am			10-12	30	5	96 h	LC50	mortality	28,4	21,1		2	4.143.152	Ownby et al. 2001
Oncorhynchus sp.			Ag+										LC50	mortality			3,5	4	5.153	Bard et al. 1976 in Ratte 1999
Oncorhynchus sp.			Ag+										LC50	mortality			3 - 4	4	5	McKee and Wolf 1963 in Bard et al 1976
Oreochromis niloticus	15.7 cm; 61.5 g	N	AgNO3		R	dtw		8,32	20	340		16 d	LC100	mortality			≤50	3	154	Öner et al 2008, 2009
Oryzias latipes	4-5 months	N	AgNO3	99%	F			7-8	25			96 h	LC50	mortality			36,5	3	155	Chae et al 2009
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	8,1	26	225	5,66	96 h	LC50	mortality		20,9		1	55,56	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	10% dtw, 90% dw		6,17	26	6	2,42	96 h	LC50	mortality		1,99		1	55	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	10% dtw, 90% dw		6,17	26	6	2,42	96 h	LC50	mortality		2,18		1	55.156	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	8,04	26	197	11,5	96 h	LC50	mortality		44		1	55,57	Bielmyer et al 2007
Pimephales promelas	**7 d**	**Y**	**AgNO3**	**rg**	**S**	**nw**	**y**	**8,14**	**26**	**131**	**1,77**	**96 h**	**LC50**	**mortality**		**6,02**		**1**	**55,56**	**Bielmyer et al 2007**
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	7,75	26	28	3,85	96 h	LC50	mortality		2,44		1	55,56,156	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	7,75	26	28	3,85	96 h	LC50	mortality		5,23		1	55,56	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	7,84	26	129	4,34	96 h	LC50	mortality		16		1	55,57	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		3,37		1	55	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	7,2	26	39	6,16	96 h	LC50	mortality		20,2		1	55,57	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	7,79	26	85	12,4	96 h	LC50	mortality		44,1		1	55,56	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	6,84	26	12	5,02	96 h	LC50	mortality		2,49		1	55,56	Bielmyer et al 2007
Pimephales promelas	7 d	Y	AgNO3	rg	S	nw	y	6,84	26	12	5,02	96 h	LC50	mortality		2,96		1	55,56,156	Bielmyer et al 2007
Pimephales promelas	1 d; 0.16 mg	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		1,200		1	55	Bielmyer et al 2007
Pimephales promelas	4 d; 0.5 mg	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		1,20		1	55	Bielmyer et al 2007
Pimephales promelas	7 d; 0.86 mg	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		3,37		1	55	Bielmyer et al 2007
Pimephales promelas	27 d; 192 mg	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		5,90		1	55	Bielmyer et al 2007
Pimephales promelas	41 d; 880 mg	Y	AgNO3	rg	S	dtw		7,74	26	76	4,44	96 h	LC50	mortality		10,4		1	55	Bielmyer et al 2007
Pimpehales promelas	30 d	N			R	rw				50		96 h	LC50	mortality				3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw				130		96 h	LC50	mortality			8,3	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw				250		96 h	LC50	mortality			13,5	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw		7,2				96 h	LC50	mortality			3,1	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw		7,6				96 h	LC50	mortality			5,8	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw		8,6				96 h	LC50	mortality			9	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			4,6	3	1.157	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			16	3	1.158	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			19,6	3	1.159	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			7,8	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			5	3	1.160	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			8,2	3	1.161	Brooke et al. 1994
Pimpehales promelas	30 d	N			F	rw						96 h	LC50	mortality			9,5	3	1,15	Brooke et al. 1994
Pimpehales promelas	30 d	N			F	rw						96 h	LC50	mortality			4,9	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			19,4	3	1,15	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			10	3	1	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			14,2	3	1,15,16	Brooke et al. 1994
Pimpehales promelas	30 d	N			R	rw						96 h	LC50	mortality			6,2	3	1,16	Brooke et al. 1994
Pimpehales promelas			Ag+		S					50		96 h	LC50	mortality			5	4*		Brooke et al. 1994 in Ratte 1999
Pimpehales promelas			Ag+		S					250		96 h	LC50	mortality			13	4*		Brooke et al. 1994 in Ratte 1999
Pimpehales promelas			Ag+		S			7,2				96 h	LC50	mortality			2,5	4		Brooke et al. 1994 in Ratte 1999
Pimpehales promelas			Ag+		S			8,6				96 h	LC50	mortality			8	4		Brooke et al. 1994 in Ratte 1999
Pimpehales promelas			Ag+		S							96 h	LC50	mortality			5	4	162	Brooke et al. 1994 in Ratte 1999
Pimpehales promelas			Ag+		S							96 h	LC50	mortality			19	4*	159	Brooke et al. 1994 in Ratte 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,2	17	5,2	0,3	96 h	LC50	mortality	6,7			2	4.163	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,3	17	5,6	0,3	96 h	LC50	mortality	7,5			2	4.164	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,6	17	7,9	0,3	96 h	LC50	mortality	7,7			2	4.165	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,7	17	9,5	0,3	96 h	LC50	mortality	8,8			2	4.166	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,6	17	51	0,3	96 h	LC50	mortality	7,8			2	4.167	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,5	17	233	0,3	96 h	LC50	mortality	9,9			2	4.168	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,7	17	3,5	1,6	96 h	LC50	mortality	13,3			2	4.169	Bury et al 1999
Pimpehales promelas	0.23 g	Y	AgNO3		R	am		6,7	17	3,8	5,8	96 h	LC50	mortality	18			2	4.170	Bury et al 1999
Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**3,6**		**2**	**171**	**Diamond et al. 1997**
Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**5,6**		**2**	**171**	**Diamond et al. 1997**
Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**5,2**		**2**	**171**	**Diamond et al. 1997**

Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**20**	**70-90**	**0**	**48 h**	**LC50**	**mortality**		**3,5**		**2**	**171**	**Diamond et al. 1997**
Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**nw**	**n**	**6,8**	**20**	**74**	**1,2**	**48 h**	**LC50**	**mortality**		**13**		**2**	**171**	**Diamond et al. 1997**
Pimpehales promelas	**1-7 d**	**Y**	**AgNO3**		**R**	**nw**	**n**	**7,2**	**20**	**90**	**1,4**	**48 h**	**LC50**	**mortality**		**7,7**		**2**	**171**	**Diamond et al. 1997**
Pimpehales promelas	1-7 d	Y	AgNO3		R	nw	n	7,5	20	76	2,8	48 h	LC50	mortality		12,2		2	171	Diamond et al. 1997
Pimpehales promelas	1-7 d	Y	AgNO3		R	nw	n	7	20	103	5,5	48 h	LC50	mortality		4,3		2	171	Diamond et al. 1997
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**50**	**1,2**	**96 h**	**LC50**	**mortality**	**5,27**	**5,27**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**120**	**1,2**	**96 h**	**LC50**	**mortality**	**8,26**	**8,26**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**250**	**1,2**	**96 h**	**LC50**	**mortality**	**13,4**	**13,4**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**7,2**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**3,1**	**3,1**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**7,7**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**5,7**	**5,7**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,6**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**8,8**	**8,8**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**4,5**	**4,5**		**2**	**4,19,172**	**Erickson et al 1998**
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	R	dtw		8,1	25	49	3,7	96 h	LC50	mortality	16	16		2	4,19,173	Erickson et al 1998
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	R	dtw		8,1	25	49	11,2	96 h	LC50	mortality	19,9	19,9		2	4,19,174	Erickson et al 1998
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**7,8**	**7,8**		**2**	**4,19**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**8,1**	**8,1**		**2**	**4,19,175**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**R**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**5**	**5**		**2**	**4,19,176**	**Erickson et al 1998**
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**F**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**4,7**	**4,7**		**2**	**2,4,19**	**Erickson et al 1998**
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	F	dtw		8,1	25	49	1,2	96 h	LC50	mortality	9,4	9,4		3	2,4,15,19	Erickson et al 1998
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**S**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**9,7**	**9,7**		**2**	**2,4,19**	**Erickson et al 1998**
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	S	dtw		8,1	25	49	1,2	96 h	LC50	mortality	19,4	19,4		3	2,4,15,19	Erickson et al 1998
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**S**	**dtw**		**8,1**	**25**	**49**	**1,2**	**96 h**	**LC50**	**mortality**	**5,9**	**5,9**		**2**	**2,4,16,19**	**Erickson et al 1998**
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	S	dtw		8,1	25	49	1,2	96 h	LC50	mortality	14	14		3	2,4,15,16,19	Erickson et al 1998
Pimpehales promelas	**juvenile**	**Y**	**AgNO3**	**99,7%**	**S**	**dtw**		**7,94**	**25**	**48**	**1,5**	**96 h**	**LC50**	**mortality**	**10,4**	**10,4**		**2**	**4,19,177**	**Erickson et al 1998**
Pimpehales promelas	juvenile	Y	AgNO3	99,7%	S	nw	n	8,02	25	81	18.5 (TOC)	96 h	LC50	mortality	106	106		2	4,19,178	Erickson et al 1998
Pimpehales promelas			AgNO3		S					130		96 h	LC50	mortality			8000	4	7,20	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S					249		96 h	LC50	mortality			12000	4	7,20	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S			7,17				96 h	LC50	mortality			3000	4	7,20	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S			7,65				96 h	LC50	mortality			5500	4	7,20	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S			8,58				96 h	LC50	mortality			8500	4	7,20	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S							96 h	LC50	mortality			5000	4	7,20,157	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S							96 h	LC50	mortality			15000	4	7,20,179	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S							96 h	LC50	mortality			19000	4	7,20,159	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			AgNO3		S	nw						96 h	LC50	mortality			106000	4*	180	Erickson et al. 1998 in Ratte 1999
Pimpehales promelas			Ag2S		S							96 h	LC50	mortality			>1000000	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			Ag2S		F							96 h	LC50	mortality			>240000	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgSCN		S							96 h	LC50	mortality			150	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgO2CCOCH3		S							96 h	LC50	mortality			110	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgNO3/XSNaCl		F							96 h	LC50	mortality			> 4600	3	7.181	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			Ag3PO4		S							96 h	LC50	mortality			280	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			Ag3AsO4		S							96 h	LC50	mortality			230	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgVO3		S							96 h	LC50	mortality			170	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			Ag2CO3		S							96 h	LC50	mortality			120	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgCNO		S							96 h	LC50	mortality			230	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgC6H5CO2		S							96 h	LC50	mortality			280	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			Ag2SO4		S							96 h	LC50	mortality			20	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgO2CCOH3		S							96 h	LC50	mortality			20	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgNO3		S							96 h	LC50	mortality			20 - 110	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			NaAgS2O3		F							96 h	LC50	mortality			> 28000	4	7	Ewell et al. 1993 in Ratte 1999

Pimpehales promelas			AgF3CCO2		S							96 h	LC50	mortality			80	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgNO3		F							96 h	LC50	mortality			16	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgNO3		S					48		96 h	LC50	mortality			5000	4		Hogstrand et al. 1996 in Ratte 1999
Pimpehales promelas	32-33 days, 0.15 g	Y	AgNO3	99,99	F	nw	n	7.2-7.3	23,1	44,4	?	96 h	LC50	mortality	6,7			2	4.111	Holcombe et al. 1983
Pimpehales promelas	32-33 days, 0.15 g	Y	AgNO3	99,99	S	nw	n	7.2-7.3	23,5	44,8	?	96 h	LC50	mortality	14			2	4.111	Holcombe et al. 1983
Pimpehales promelas			AgNO3		F							96 h	LC50	mortality			6,7	4*		Holcombe et al. 1983 in Ratte 1999
Pimpehales promelas			AgNO3		S							96 h	LC50	mortality			14	4*		Holcombe et al. 1983 in Ratte 1999
Pimpehales promelas	0.2 g	Y	AgNO3		F	nw	n	7,4	17,2	44,7	?	96 h	LC50	mortality	9			2	9,12,41	Holcombe et al. 1987
Pimpehales promelas	3 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			3,6	3	1,2,183,186	Klaine et al. 1996
Pimpehales promelas	3 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			7,3	3	1,2,184,186	Klaine et al. 1996
Pimpehales promelas	3 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			9,6	3	1,2,185,186	Klaine et al. 1996
Pimpehales promelas	28 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			21,8	3	1,2,183,186	Klaine et al. 1996
Pimpehales promelas	28 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			23,7	3	1,2,184,186	Klaine et al. 1996
Pimpehales promelas	28 days	N	AgNO3		S	rw		8,26	22	52		96 h	LC50	mortality			29,4	3	1,2,185,186	Klaine et al. 1996
Pimpehales promelas	24 days		AgNO3		S							96 h	LC50	mortality			19.6-24.3	4	183.186	Klaine et al. 1996 in Ratte 1999
Pimpehales promelas	24 days		AgNO3		S							96 h	LC50	mortality			21.8-26.2	4	184.186	Klaine et al. 1996 in Ratte 1999
Pimpehales promelas	24 days		AgNO3		S							96 h	LC50	mortality			26-338	4	185.186	Klaine et al. 1996 in Ratte 1999
Pimpehales promelas	24 days		AgNO3		S							96 h	NOEC				10	4*		Klaine et al. 1996 in Ratte 1999
Pimpehales promelas	embryos	N						8.3-8.5	25	227		96 h	LC50	mortality			15	3	1	Laban et al 2010
Pimpehales promelas		**Y**	**AgNO3**		**F**	**nw**	**n (well water)**	**7.2-8.4**	**25**	**38**	**?**	**96 h**	**LC50**	**mortality**	**16**	**16**		**2**	**4.187**	**LeBlanc et al 1984**
Pimpehales promelas		Y	AgS2O3		F	nw	n (well water)	7.2-8.4	25	38	?	96 h	LC50	mortality	280000-360000			2	4	LeBlanc et al 1984
Pimpehales promelas		Y	Ag2S		F	nw	n (well water)	7.2-8.4	25	38	?	96 h	LC50	mortality	> 240000			2	4	LeBlanc et al 1984
Pimpehales promelas		Y	AgCl		F	nw	n (well water)	7.2-8.4	25	38	?	96 h	LC50	mortality	> 4600			2	4.188	LeBlanc et al 1984
Pimpehales promelas		Y	AgCl		F	nw	n (well water)	7.2-8.4	25	38	?	96 h	LC50	mortality	>13000			2	4.189	LeBlanc et al 1984
Pimpehales promelas		Y	Ag(S2O3)n		CF	rw		7.2-8.4		38		96 h	LC50				>280000	4*	4;130,190	LeBlanc et al., 1984 in Van der Plassche et al 1999
Pimpehales promelas		Y	Ag2?S		CF	rw		7.2-8.4		38		96 h	LC50				>240000	4*	4.130.191	LeBlanc et al., 1984 in Van der Plassche et al 1999
Pimpehales promelas		Y	Ag2?S		CF	rw		7.2-8.4		38		96 h	LC50				>13000	4*	4.192	LeBlanc et al., 1984 in Van der Plassche et al 1999
Pimpehales promelas		Y	AgCln		CF	rw		7.2-8.4		38		96 h	LC50				>4600	4*	4.130.193	LeBlanc et al., 1984 in Van der Plassche et al 1999
Pimpehales promelas			Ag2S		F							96 h	LC50	mortality			240000	4*	194	Le Blanc et al. 1984 in Ratte 1999
Pimpehales promelas			AgCl		F							96 h	LC50	mortality			> 4600	4*	195	Le Blanc et al. 1984 in Ratte 1999
Pimpehales promelas			AgNO3		F							96 h	LC50	mortality			16	4*		Le Blanc et al. 1984 in Ratte 1999
Pimpehales promelas			NaAgS2O3		F							96 h	LC50	mortality			280000-160000	4*		Le Blanc et al. 1984 in Ratte 1999
Pimpehales promelas		Y	AgNO3		F			7.2-8.4		38		96 h	LC50	mortality	16			2*	4	Le Blanc 1984 in DAR silver thiosulphate
Pimpehales promelas		Y	AgS2O3		F			7.2-8.4		38		96 h	LC50	mortality	>280000			2*	4	Le Blanc 1984 in DAR silver thiosulphate
Pimpehales promelas		Y	Ag2S		F			7.2-8.4		38		96 h	LC50	mortality	>240000			2*	4	Le Blanc 1984 in DAR silver thiosulphate
Pimpehales promelas		Y	AgCl		F			7.2-8.4		38		96 h	LC50	mortality	>4600			2*	4	Le Blanc 1984 in DAR silver thiosulphate
Pimephales promelas													LC50	mortality			3,9	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality			5	4		Lemke, 1981 in Wood et al., 2002

Pimephales promelas													LC50	mortality		5,3	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		5,6	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		6,3	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		7,4	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		10,98	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		11,1	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		11,75	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		110	4		Lemke, 1981 in Wood et al., 2002
Pimephales promelas													LC50	mortality		150	4		Lemke, 1981 in Wood et al., 2002
Pimpehales promelas		Y	AgNO3		S				20			96 h	LC50	mortality	9,4		2*	4	Nebeker 1983 in DAR silver thiosulphate
Pimpehales promelas		Y	AgNO3		S				21			96 h	LC50	mortality	9,7		2*	4	Nebeker 1983 in DAR silver thiosulphate
Pimpehales promelas		Y	AgNO3		F				22			96 h	LC50	mortality	5,6		2*	4	Nebeker 1983 in DAR silver thiosulphate
Pimpehales promelas		Y	AgNO3		F				22			96 h	LC50	mortality	7,4		2*	4	Nebeker 1983 in DAR silver thiosulphate
Pimpehales promelas		Y	AgNO3	rg	S	nw	n (well water)	7,5	20	38		96 h	LC50	mortality	9,4		2	4	Nebeker et al. 1983
Pimpehales promelas		Y	AgNO3	rg	S	nw	n (well water)	7,5	21	39		96 h	LC50	mortality	9,7		2	4	Nebeker et al. 1983
Pimpehales promelas		Y	AgNO3	rg	F	nw	n (well water)	7,5	22	40		96 h	LC50	mortality	5,6		2	4	Nebeker et al. 1983
Pimpehales promelas		Y	AgNO3	rg	F	nw	n (well water)	7,5	22	36		96 h	LC50	mortality	7,4		2	4	Nebeker et al. 1983
Pimpehales promelas			AgNO3		F					26-42		96 h	LC50	mortality		9,2	3	199	Nebeker et al. 1983 in Ratte 1999
Pimpehales promelas			AgNO3		S					26-42		96 h	LC50	mortality		6,5	4	200	Nebeker et al. 1983 in Ratte 1999
Pimephales promelas		Y	AgNO3		R					44-49		7 d	LC50	mortality	8,2		4		Norberg-King, 1989 in REACH dossier
Pimephales promelas		Y	AgNO3		R					44-49		96 h	LC50	mortality	8,2		4		Norberg-King, 1989 in REACH dossier
Pimpehales promelas	0.079 g, 30 days	Y	AgNO3	rg	F	nw	n	7,4	24,7	44,3	?	96 h	LC50	mortality	10,7		2	4	Lima et al 1982
Pimpehales promelas	30 days, 0.079 g	Y	AgNO3		F	nw	n	7,4		44		48 h	LC50	mortality	10,7		2*		Lima 1982 in DAR silver thiosulphate
Pimpehales promelas			AgNO3									96 h	LC50	mortality		30	4	5	Ter Haar et al 1972 in Bard et al 1976
Pimpehales promelas			AgS2O3									96 h	LC50	mortality		>250000	4	5	Ter Haar et al 1972 in Bard et al 1976
Poecilia reticulata			Ag+										LC50	mortality		4	4	5.203	Bard et al. 1976 in Ratte 1999
Poecilia reticulata			Ag+										LC50	mortality		4	4	5	McKee and Wolf 1963 in Bard et al 1976
Poecilia reticulata			NaAgS2O3; AgBr										LC50	mortality		100000; 3750	3	5.204	NAPM 1974 in Ratte 1999
Poecilia reticulata													LC50	mortality		6,44	4		Khangarot and Ray, 1988a in Wood et al., 2002
Puntius sophore	40-60 mm; 1.56-2 g	N	AgNO3		R	dtw		7,3	30	250		96 h	LC50	mortality		7,55	3	58	Khangarot and Ray, 1988 AHH
Rhinichthys osculus													LC50	mortality		4,9	4		Goettl and Davies, 1978 in Wood et al., 2002
Rhinichthys osculus													LC50	mortality		13,6	4		Goettl and Davies, 1978 in Wood et al., 2002
Salmo trutta													LC50	mortality		1,17	4		Davies et al., 1998 in Wood et al., 2002
Thymallus arcticus													LC50	mortality		6,7	4		Nishiuchi, 1979 in Wood et al., 2002
Thymallus arcticus													LC50	mortality		11,1	4		Nishiuchi, 1979 in Wood et al., 2002

Thymallus arcticus	juveniles	N	AgNO3		S			6.9-7.9		41	96 h	LC50	mortality	11,1	4		Buhl and Hamilton, 1991 in REACH dossier
Thymallus arcticus	alevin	N	AgNO3		S			6.9-7.9		41	96 h	LC50	mortality	6,7	4		Buhl and Hamilton, 1991 in REACH dossier
Amphibia																	
Bufo melanostictus	1.95 cm, 100 mg	N	AgNO3		S	nw	n	7,4	31	185	96 h	LC50	mortality	4,1	3	1	Khangarot and Ray 1987a
Rana hexadactyla	tadpoles; 20 mm; 500 mg	N	AgNO3	rg	R			6,1	15	20	96 h	LC50	mortality	25,7	3		Khangarot et al., 1985

Notes with acute freshwater toxicity table

1 Test concentration not measured
2 Endpoint determined with data from graph
3 Endpoint determined from original data
4 Endpoint based on measured concentrations
5 Original reference not available
6 Endpoint based on concentrations measured at the start of the experiment
7 Original reference does not contain the cited data
8 Analysis performed after filtration over 0.45 µm filter
9 Measured concentrations within 20% of nominal
10 Unclear if reported concentrations are Ag+ or AgCl
11 Measured concentrations <80% of nominal
12 Endpoint based on nominal concentrations
13 Results of analysis not reported
14 Endpoint based on concentrations measured at the start and end of the experiment, not at each renewal
15 Animals were fed during the test
16 Aged test water was used
17 Test performed according to ISO standard
18 Test performed according to OECD guideline
19 Results for dissolved silver reported to be similar to the results for total silver
20 Unit probably wrong
21 Survival monitored with Polarized Light Scattering
22 Survival monitored with CFU
23 Growth perfromed in Luria-Bertani broth
24 Unclear description of test conditions; test water was synthetic drinking water; background concentration of Ag in medium was employed but the concentration is not clearly reported
25 AAS standard solutions were used to prepare toxicant solutions, hence purity of the test compound was high, although not specifically reported; medium contained 0.34 M NaNO3 instead of NaCl to prevent precipitation of AgCl; due to steepness of dose response curve, EC20 could not be derived, result is highest concentration that did not result in effect (interpreted as NOEC)
26 The tested metals were added to the collected culture and the bioassay is performed straight thereafter. The time of the assay (exposure time) is unknown; Effects in nitrifying cultures in batch reactor setup are not deemed to represent to surface water conditions.
27 Effects in nitrifying cultures in batch reactor setup aimed to represent WWTPs instead of surface water.
28 Result expressed as dissolved Ag was recalculated from nominal value of 0.33 mg/L by difference between nominal and analysed soluble Ag concentration (6.3%);
29 pH, hardness, temperature and medium composition derived from cited reference (Facheur et al., 2005)
30 1 replicate
31 Fritz medium without EDTA
32 Woods hole medium with 13 µm EDTA
33 Woods hole medium without EDTA
34 No information on perfomance of control in similar medium
35 EC50 is average of 2 replicate studies
36 Observed biostimulation not included in estimation
37 Silver was tested as active ingredient in the plant protection product Florisant 100
38 Reported as minimum inhibitory concentration; glycerol as growth substrate
39 From citation in Holcome et al., 1987 it appears that endpoint refers to Ag, not to AgNO3
40 Probably recalculated as AgNO3
41 Simultaneous exposure of different species in different sections of the same basin
42 Dissolved endpoint calculated from difference in recovery between unfiltered and filtered samples
43 Based on free Ag+

44 Medium containing ≤ 0.4 mg DOC/L; 0.058 mM Cl-; 0.0055 mM NO3-; 0.94 mM SO4 2-; 0.37 mM Ca2+; 0.056 mM K+; 0.54 mM Mg2+ and 1.21 mM Na+

45 Medium containing 1.8 to 2.0 mg DOC/L; 1.54 mM Cl-; 0.45 mM NO3-; 1.18 mM SO4 2-; 0.91 mM Ca2+; 0.16 mM K+; 0.76 mM Mg2+ and 2.52 mM Na+; DOC originated from Desjardins canal, Hamilton Canada

46 Medium containing 2.0 to 2.1 mg DOC/L; 0.068 mM Cl-; 0.048 mM NO3-; 0.94 mM SO4 2-; 0.37 mM Ca2+; 0.056 mM K+; 0.54 mM Mg2+ and 1.27 mM Na+; DOC originated from the Suwannee river

47 geomeatric mean of the lowest and highest value of a range, values in between not reported

48 Medium containing 1.9 to 2.0 mg DOC/L; 0.064 mM Cl-; 0.0062 mM NO3-; 0.93 mM SO4 2-; 0.37 mM Ca2+; 0.065 mM K+; 0.53 mM Mg2+ and 1.20 mM Na+; DOC originated from yeast-Cerophyll-trout chow slurry

49 Detection limit was 2 μg/L, several concentrations were below LOD

50 Daily renewal; 10 replicates per treatment; composition of medium: 3.8 g NaHCO3, 2.4 g CaSO4.2H2O, 2.4 g MgSO4, 1.6 g of KCl per 40L

51 AgGSH = silver glutathionate

52 AgCys = silver cysteinate

53 95% confidence interval around LC50 0.69-1.23 mg/L

54 Water composition taken over from reference

55 Water chemistry well described for use in biotic ligand model;

56 Water contained no visible suspended solids

57 Water was filtered to remove suspended solids

58 Animals wer not fed

59 Animals were fed immediately after transfer to exposure solutions and after renewal

60 Animals were fed 30 min before transfer

61 Animals were fed 60 min before transfer

62 Animals were fed 120 min before transfer

63 Test performed with Ceriodaphnia dubia and Simocephalus sp. together

64 In the presence of 25 nM zinc sulfide;

65 Measured concentration 65 - 100% of nominal

66 Sulfide present in the medium

67 Test conditions and result similar to those reported in Bianchini and Wood, 2002

68 Basic medium (0.05 mM KCl)

69 Basic medium with 1 mM KCl

70 Basic medium with 10 mg/L humic acid

71 Basic medium with 0.5 μm 3-mercaptoproprionic acid

72 Stock solutions of silver was prepared by dissolving of silver wire in nitric acid

73 Value is mean of three tests, 0.6, 1.1 and 1.1 (see original reference: Nebeker 1983)

74 Geometric mean of two tests (48, 55)

75 Geometric mean of two tests (8.4,14.9)

76 Geometric mean of two tests (1.1,0.6)

77 Geometric mean of two tests (0.63,0.66)

78 Geometric mean of two tests (0.9,1.03)

79 Laboratory water DOC 1.5 mg C/L

80 River water DOC 18.5 mg C/L

81 Not clear how EC84 was calculated

82 Concentrations measured using radiolabeled Ag

83 DOC concentration < 0.4 mg/L

84 Various amounts of organic matter added from different sources DOC concentrations exceeding 2 mg/L

85 No significant difference in LC50 was observedat different Cl- concentrations and different hardness

86 Deemed to be less reliable in the INERIS report because natural water was used and Ag bioavailability might have been much less; original paper reviewed, values based on measured dissolved Ag

87 From the original reference it appeared that these values are sediment concentrations, not water concentrations
88 95% confidence interval around LC50 5.21-6.51 mg/L
89 95% confidence interval around LC50 0.99-1.14 mg/L
90 Basic medium (0.025 mM KCl)
91 Basic medium with 0.75 mM KCl
92 Basic medium with 1.5 mM KCl
93 Basic medium with 0.5 μm Na2(SO3)2
94 Basic medium with 1 μm Na2(SO3)2
95 Basic medium with 2.5 mM NaNO3
96 Basic medium with 5 mM NaNO3
97 Basic medium with 1 mM Ca(NO3)2
98 Basic medium with 2 mM Ca(NO3)2
99 Basic medium with 50 μm Ca(NO3)2
100 Basic medium with 500 μm Ca(NO3)2
101 Basic medium with 1500 μm Ca(NO3)2
102 Basic medium with 50 μm KCl
103 Basic medium with 500 μm KCl
104 Basic medium with 1500 μm KCl
105 Test was conducted using atomic absorption standards as source for metalloids
106 95% confidence interval around LC50 6.22-7.53 mg/L
107 95% confidence interval around LC50 444-2033 mg/L
108 Values from two experiments do not match
109 Fine sand layer present
110 Cited from McKee and Wolf, 1963
111 From citation in Holcombe et al., 1987 it appears that endpoint refers to Ag, not to AgNO3
112 Ratio Cl:Ca:DOC = 50:50:0.3; corresponding calculated ionic silver concentration 5.6 ug/L
113 Ratio Cl:Ca:DOC = 250:50:0.3; corresponding calculated ionic silver concentration 5.2 ug/L
114 Ratio Cl:Ca:DOC = 800:50:0.3; corresponding calculated ionic silver concentration 6.1 ug/L
115 Ratio Cl:Ca:DOC = 1500:50:0.3; corresponding calculated ionic silver concentration 5.3 ug/L
116 Ratio Cl:Ca:DOC = 50:500:0.3; corresponding calculated ionic silver concentration 8.0 ug/L
117 Ratio Cl:Ca:DOC = 50:2000:0.3; corresponding calculated ionic silver concentration 8.9 ug/L
118 Ratio Cl:Ca:DOC = 50:50:1; corresponding calculated ionic silver concentration 10.6ug/L
119 Ratio Cl:Ca:DOC = 50:50:5; corresponding calculated ionic silver concentration 5.1 ug/L
120 Reference is probably Davies et al 1978
121 Chloride concentration 50 μM
122 Chloride concentration 225 μM
123 Geomean of values read from graph and highest and lowest values reported
124 Preexposed to 3 μg/L silver for 23 days;
125 Preexposed to 5 μg/L silver for 15 days;
126 Unknown if results based on measured or on nominal concentrations
127 Endpoint is based on results presented in two other papers: Galvez and Wood 1997 and Hogstrand et al 1996
128 Hardness derived from Ca concentration as given in paper
129 AgCl produced by addition of AgNO3 to water with 50 mM NaCl; endpoint for dissolved refers to calculated concentration
130 Not re-evaluated
131 Water supplemented with 50 mM NaCl; fish acclimated to test water for 2 weeks prior to testing and then exposed to AgNO3; speciation calculations showed that dissolved AgCln was 120 mg Ag/l using speciation calculations; no effects were observed when AgCln was directly added to test water up to 1 mg Ag/L
132 Cl- concentration of 0 mg/L and DOC concentration of 0 mg/L;
133 Cl- concentration of 3, 20 and 40 mg/L and DOC concentration of 0 mg/L
134 Cl- concentration of 0 mg/L and DOC concentration of 2.5 mg/L

135 Cl- concentration of 0 mg/L and DOC concentration of 5 mg/L
136 Cl- concentration of 3 mg/L and DOC concentration of 2.5 mg/L
137 Cl- concentration of 40 mg/L and DOC concentration of 5 mg/L
138 Lowest endpoint selected from probit and spearman-karber calculation
139 In the presence of 100 nM zinc sulfide
140 Calculated ionic silver 1.4 µg/L
141 No aeration
142 Mean of two values, 72.9 and 84.4 (see original reference Nebeker et al. 1983)
143 Analysis after filtration over 0.2 µm
144 Predicted Ag+ 1.99 µg/L
145 Predicted Ag+ 3.73 µg/L
146 With additional Cl- (3 mg/L); predicted Ag+ 2.88 µg/L
147 With additional Cl- (20 mg/L); predicted Ag+ 3.73 µg/L
148 With additional Cl- (40 mg/L); predicted Ag+ 1.02 µg/L
149 With additional DOC (2.5 mg/L); predicted Ag+ 2.66 µg/L
150 With additional DOC (5 mg/L); predicted Ag+ 1.58 µg/L
151 With additional Cl- (3 mg/L) and additional DOC (2.5 mg/L); predicted Ag+ 3.25 µg/L
152 With additional Cl- (40 mg/L) and additional DOC (5 mg/L); predicted Ag+ 1.26 µg/L
153 Cited from McKee and Wolf, 1963
154 Biomass 16 g/L
155 For 96 hour exposure no significant difference with nanosilver
156 fish were acclimated to the test water 7 days before testing
157 Concentration organic carbon: 1 mg C/L
158 Concentration organic carbon: 3.5 mg C/L
159 Concentration organic carbon: 11 mg C/L
160 0.2 mM NaCl
161 2.0 mM Na2SO4
162 Concentration organic carbon: 4 mg C/L
163 Ratio Cl:Ca:DOC = 50:50:0.3; corresponding calculated ionic silver concentration 4.9 ug/L
164 Ratio Cl:Ca:DOC = 250:50:0.3; corresponding calculated ionic silver concentration 4.1 ug/L
165 Ratio Cl:Ca:DOC = 800:50:0.3; corresponding calculated ionic silver concentration 2.3 ug/L
166 Ratio Cl:Ca:DOC = 1500:50:0.3; corresponding calculated ionic silver concentration 1.7 ug/L
167 Ratio Cl:Ca:DOC = 50:500:0.3; corresponding calculated ionic silver concentration 6.1 ug/L
168 Ratio Cl:Ca:DOC = 50:2000:0.3; corresponding calculated ionic silver concentration 8.4 ug/L
169 Ratio Cl:Ca:DOC = 50:50:1; corresponding calculated ionic silver concentration 6.2 ug/L
170 Ratio Cl:Ca:DOC = 50:50:5; corresponding calculated ionic silver concentration 0.4 ug/L
171 Endpoint recalculated on the basis of 78% dissolved silver
172 TOC concentration 1.2 mg C/L; figure legend reads mg/L for the silver concentration, since all other figures give ug/L, this is most likely a mistake
173 Humic acid added to increase TOC concentration by 2.5 mg C/L
174 Humic acid added to increace TOC concentration by 10 mg C/L
175 2 meq/L Na2SO4 added
176 0.2 meq NaCl added
177 Laboratory water DOC 1.5 mg C/L
178 River water DOC 18.5 mg C/L
179 Concentration organic carbon: 1.5 mg C/L
180 Unit in original ref is ug/L
181 median lethal concentration > solubility
186 3-60 mg/L chloride
187 Dissolved concentration measured with ion specific electrode; the mean measured concentration is reported to be similar to the mean freesilver concentration
188 2000 mg/L Cl- present
189 Tested as slurry
190 Calculated ionic Ag+ concentration: 0.12 ng/l

191 Tested as dispersion; calculated ionic Ag+ concentration: <10-5 ng/l

192 Tested as slurry; calculated ionic Ag+ concentration: <10-5 ng/L

193 Tested in the presence of 2,000 mg/l Cl-; calculated ionic Ag+ concentration: 0.103 mg/l; percent mortality was 40 at 4.6 mg/l

194 Test performed with dispersed solution; In this case it is unclear if the values given are for the salt tested or for the free cation. It is presumed that the values given are for salt tested and all values are recalculated to Ag+

195 Test performed with AgCl complexes; In this case it is unclear if the values given are for the salt tested or for the free cation. It is presumed that the values given are for salt tested and all values are recalculated to Ag+

196 Normal flow through conditions

197 High flow through conditions

198 Increased Cl- levels of 60 mg/L; mortality in control >30%

199 Reported as mean of two values; values in original reference are 9.4 and 9.7 (see original reference Nebeker et al 1983), mean should be 9.6

200 Mean of two values, 5.6 and 7.4 (see original reference Nebeker et al 1983)

203 Cited from McKee and Wolf, 1963

204 Tested in mixture

205 NaCl in the medium replaced by NaNO3 to prevent precipitation

206 No DOC present

207 Concentration DOC unknown

208 DOC concentration: 5.66 mg/L

209 DOC concentration: 11.5 mg/L

210 DOC concentration: 1.77 mg/L

211 DOC concentration: 3.85 mg/L

212 DOC concentration: 4.34 mg/L

213 DOC concentration: 4.55 mg/L

214 DOC concentration: 6.16 mg/L

215 DOC concentration: 12.0 mg/L

216 DOC concentration: 5.02 mg/L

217 DOC concentration: 1.2 mg/L

218 DOC concentration: 1.4 mg/L, DOC geometric mean of two values

219 DOC concentration: 2.8 mg/L

220 DOC concentration: 5.5 mg/L, DOC geometric mean of two values

221 DOC concentration: < 0.1 mg/L, NaCl 0.6 mmol/L

222 Dissolved chloride concentrations ranging from 3.0 to 21.0 mg/L

223 DOC concentration: 1.5 mg/L

224 DOC concentration: 18.5 mg/L

225 DOC concentration: 0.57 mg/L

226 DOC concentration: 0.99 mg/L

227 DOC concentration: 1.86 mg/L

228 DOC concentration: 0.89 mg/L

229 DOC concentration: 1.91 mg/L

230 DOC concentration: 1.46 mg/L

231 DOC concentration: 1.34 mg/L

232 DOC concentration: 1.26 mg/L

233 Actual testmedium not define in the summary in the DAR

234 Geomean of 4 experiments

235 Turbidostat experiment, where concentrations in the turbidostat were increased by one step every day.

236 Not a freshwater species

237 M;edium with E.coli as food

238 Medium with EDTA

239 Outlier due to high hardness, not taken up in aggregated data table

240 Outlier due to size effects; not taken up in aggregated data table.

Chronic toxicity of silver (Ag+) to freshwater organisms

- Validity according to Klimisch (1997); only records with a validity of 1 or 2 (green) can be used for ERL derivation.
- Bold records are selected for ERL derivation. These records are (1) valid; (2) based on measured dissolved concentrations of Ag+; (3) performed in water with DOC < 2 mg/L or labwater or filtered natural water or well water; (4) with a pH of 6-9; (5) EC50s/LC50s for acute and NOECs/EC10s for chronic studies.
- When for a certain species, data for different endpoints are available (e.g., growth, reproduction) the data for the most sensitive endpoint are selected. If there are more data for the same enpdoint, the geometric mean is used.

Species	Species properties	Analyzed	Test Compound	Purity	Test type	Test water	Fil-tered y/n	pH	Tempe-rature [°C]	Hardness [mg $CaCO_3$/L]	DOC mg/L	Exp time	Criterion	Test endpoint	Value total [µg Ag^+/L]	Value dissolved [µg Ag^+/L]	Value unkn. / nominal [µg Ag^+/L]	Validity	Notes	Reference
Bacteria																				
Aeromonas hydrophila			AgNO3		S	dtw		7	4	140		24 h	EC100	bacterial count			100	3	82	Silvestrty-Rodriguez et al 2007 in REACH dossier
Escherichia coli		N	AgNO3		S	am		7	37			24 h	NOEC	growth			40	3	34	Cunningham et al 2008
Escherichia coli	mid log phase	Y	AgNO3		S	am			37			30 m	NOEC	survival			< 500	3		Matsumura et al 2003
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37			20 h	NOEC	growth			5393	3	15	Gupta et al. 1998
Pseudomonoas aeruginosa			AgNO3		S	dtw		7	24	140		24 h	EC100	bacterial count			100	3	82	Silvestrty-Rodriguez et al 2007 in REACH dossier
Pseudomonoas aeruginosa			AgNO3		S	dtw		9	24	140		24 h	EC100	bacterial count			100	3	82	Silvestrty-Rodriguez et al 2007 in REACH dossier
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		9	25			3 h	NOEC	growth			200	3	1	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		9	25			3 h	NOEC	growth			20	3	1,35	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		6	25		0	24 h	NOEC	growth			20	3	1	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		6	25		0	24 h	NOEC	growth			200	3	1,35	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		7,5	25			24 h	NOEC	growth			200	3	1	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		7,5	25			24 h	NOEC	growth			200	3	1,35	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		9	25			24 h	NOEC	growth			200	3	1	Fabrega et al 2009
Pseudomonas fluorescencens		N	AgNO3	ag	S	am		9	25			24 h	NOEC	growth			200	3	1,35	Fabrega et al 2009
Pseudomonas putida		N	AgNO3		S	am		7	25			16 h	NOEC	growth			6	3	1	Bringmann and Kühn, 1977
Pseudomonas putida		N	AgNO3		S	am		7		42,5		16 h	NOEC	growth			6	3*	1	Bringmann and Kühn, 1977 in Van de Plassche et al 1999
Pseudomonas putida		N	AgNO3		S	am		7	25	42,5		16 h	NOEC	growth			6	3	1	Bringmann and Kühn, 1980 Wat Res.
Pseudomonas putida	KT2440 strain with lux gene	N	AgNO3		S	am			25	102		1 h	NOEC	lumines-cence			100	3	1	Gajjar et al 2009
Sulfer oxidizing bacteria		N			S	am		2.5-7	30			120 h	NOEC	sulfate formation			≥ 1000	3	36	Chen and Lin 2009
Mixed culture		N	AgNO3		S	am		7	37			24 h	NOEC	growth			3	3	34	Cunningham et al 2008
Nitrifying bacteria		N	AgNO3	ag	S	am		7,5					EC10	nitrification			100	3	2,37	Fabrega et al 2009
Nitrifying bacteria		Y			S			7				21 h	IC10	respiration		4,4		4	38	Cecen et al 2010
Cyanobacteria																				
Microcystis aeruginosa		N	AgNO3		S	am		7,0	27	28,7		8 d	NOEC	growth			0,70	3	1	Bringmann and Kühn, 1978 in Vom Wasser and in Mitt. Internat. Verein.Limnol
Microcystis aeruginosa		N	AgNO3		S	am		7,0		28,7		8 d	NOEC	growth			0,70	3*		Bringmann and Kühn, 1978 in Van de Plassche et al 1999
Nostoc muscorum					S	am		7,5	25			15 d	EC10	yield			0,66	2	72	Publication 1987' in REACH dossier
Nostoc muscorum					S	am		7,5	25			15 d	EC10	yield			0,57	2	72	Publication 1987' in REACH dossier
Nostoc muscorum					S	am		7,5	25			15 d	EC10	yield			0,16	2	72	Publication 1990' in REACH dossier
Nostoc muscorum			AgCl		S	am		7,5	25			15 d	EC10	yield			0,45	2	72	Publication 1985' in REACH dossier

Algae																			
Chlamydomonas reinhardtii	UTCC11		^{110m} Ag		S	am	7.0-4.5	20	15		4 d	NOEC	cell density			>1.08	3	83	Hiriart-Baer et al., 2006
Chlorella fusca		N	Ag		S	am	6,8	28			12 d	NOEC	Cell density			30	3	39,41	Stokes et al 1973
Chlorella vulgaris		N	Ag		S	am	6,8	28			12 d	NOEC	Cell density			10	3	40,41	Stokes et al 1973
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**	**7,2**	**room temperature**	**40**	**0**	**96 h**	**EC10**	**Cell density**		**7,97**		**2**	**3,4,19,20,21**	**Kolts et al, 2009**
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**		**room temperature**		**0**	**96 h**	**EC10**	**Cell density**		**6,3**		**2**	**3,4,16,17,20**	**Kolts et al, 2009**
Chlorella vulgaris		**Y**	**AgNO3**		**S**	**am**	**7,2**	**room temperature**	**40**	**0**	**96 h**	**EC10**	**Cell density**		**4,66**		**2**	**3,4,16, 18,20**	**Kolts et al, 2009**
Green algae			NaAgS2O3									NOEC				5000	4	7	Ewell et al. 1993 in Ratte 1999
Green algae			NaAgS2O3									NOEC				≥ 1000	4	7	Ewell et al. 1993 in Ratte 1999
Pseudokirchneriella		**Y**	**AgNO3**		**S**	**am**	**7,2**	**room**	**40**	**0**	**96 h**	**EC10**	**Cell density**		**0,94**		**2**	**3,4,16,19,20**	**Kolts et al, 2009**
Pseudokirchneriella subcapitata		**Y**	**AgNO3**		**S**	**am**	**7,2**	**room temperature**	**40**	**0**	**96 h**	**EC10**	**Cell density**		**2,61**		**2**	**3,4,18,20,21**	**Kolts et al, 2009**
Pseudokirchneriella subcapitata			NaAgS2O3								7 d	NOEC				10000	4	7	Ewell et al. 1993 in Ratte 1999
Pseudokirchneriella subcapitata		Y	AgS2O3	formulation	S	am	7.8-8.2	23		0	72 h	NOEC	growth rate	0,56			2	6,14,22	DAR silver thiosulphate
Scenedesmus acutiformis		N	Ag		S	am	6,8	28			12 d	NOEC	Cell density			50	3	39,41	Stokes et al 1973
Scenedesmus acuminatus		N	Ag		S	am	6,8	28			12 d	NOEC	Cell density			10	3	40,41	Stokes et al 1973
Scenedesmus quadricauda		N	AgNO3		S	am	7,0		28,7		8 d	NOEC	growth			9,5	3		Bringmann and Kühn, 1978 in Van de Plassche et al 1999
Scenedesmus quadricauda		N	AgNO3		S	am	7,0	27	28,7		8 d	NOEC	growth			9,5	3		Bringmann and Kühn, 1978 Vom Wasser and Mitt. Internat. Verein.Limnol
Scenedesmus quadricauda		N	AgNO3		S	am	7,0	27			8 d	NOEC	growth			9,5	3		Bringmann and Kuhn 1977
Scenedesmus quadricauda		N	AgNO3		S	am	7,0	27	28,7		8 d	NOEC	growth			9,5	3		Bringmann and Kühn, 1980 Wat. Res.
Scenedesmus quadricauda			AgNO3								96 h	NOEC	growth			50	4	31,42	Bringmann and Kühn, 1959 in INERIS, 2006
Protozoa																			
Chilomonas paramaecium		N	AgNO3		S	am	6,9		42,3		48 h	NOEC	growth			2,6	3	31	Bringmann and Kühn, 1980a in Van de Plassche et al 1999
Entosiphon sulcatum		N	AgNO3		S	am	5,9		35,3		72 h	NOEC	growth			580	3	31	Bringmann, 1978 in Van de Plassche et al 1999
Entosiphon sulcatum		N	AgNO3		S	am	5,9	25	35,3		72 h	NOEC	growth			580	3		Bringmann and Kuhn, 1980, Wat. Res.
Uronema parduczi		N	AgNO3		S	am	6,9		35,3		20 h	NOEC	growth			100	3		Bringmann and Kühn, 1980b in Van de Plassche et al 1999
Uronema parduczi		N	AgNO3		S	am	6,9	25	35,3		20 h	NOEC	growth			100	3		Bringmann and Kühn, 1980b
Macrophyta																			
Lemna minor		N	AgNO3		S	am	6,8	24			3 w	EC10	frond number			0,085	3	1,2	Hutchinson and Czyrska 1975
Lemna minor		N	AgNO3		S	am	5,5	24			7 d	EC10	frond number			< 5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3		S	am	5,5	24			14 d	EC10	frond number			< 5	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3		S	am	5,5	24			7 d	EC10	growth rate			1,2	3	1	Gubbins et al 2011
Lemna minor		N	AgNO3		S	am	5,5	24			14 d	EC10	growth rate			2,1	3	1	Gubbins et al 2011
Lemna minor	fronds	Y	AgNO3		S						7 d	NOEC	frond number		6		4	90	Naumann et al 2007 in REACH dossier
Lemna minor	fronds	Y	AgNO3		S						7 d	NOEC	weight		7		4	90	Naumann et al 2007 in REACH dossier
Lemna minor	clone St; fronds	N	AgNO3		S	am	5,5	25	166		7 d	EC10	frond number			6	3	89,90	Naumann et al., 2007
Lemna minor	clone St; fronds	N	AgNO3		S	am	5,5	25	166		7 d	EC10	weight			7	3	89,90	Naumann et al., 2007

Lemna minor	clone St; fronds	N	AgNO3		S	am		5,5	25	166		7 d	EC10	chlorophyll			14	3	89,90	Naumann et al., 2007
Lemna paucicostata	strain 6746	N	AgNO3		S	am		4,1	25	700		7 d	EC10	frond number			26	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3		S	am		5,1	25	700		7 d	EC10	frond number			16	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3		S	am		6,1	25	120		7 d	EC10	frond number			1,8	3	1,2	Nasu and Kugimoto 1981
Lemna paucicostata	strain 6746	N	AgNO3		S	am		7,1	25	120		7 d	EC10	frond number			2,5	3	1,2	Nasu and Kugimoto 1981
Potamogeton crispus		N	AgNO3		S	am			22,5			120 h	NOEC	photosynthesis			< 540	3	43	Xu et al 2010
Salvinia natans		N	AgNO3		S	am		6,8	24			3 w	EC10	frond number			0,03	3	1,2	Hutchinson and Czyrska 1975
Fungi																				
Saccharromyces cerevisiae	strain S288C	N	AgNO3		S	am			30			96 h	EC90	growth			270	3	44	Yang and Pon 2003
Saccharromyces cerevisiae	strain S288C	N	AgNO3		S	am			30			48 h	EC90	growth			539	3	45	Yang and Pon 2003
Cnidaria																				
Phymactis cavernata			AgNO3									28 d	NOEC	growth			8,5	4	7	Breteler et al., 1982 in INERIS, 2006
Mollusca																				
Corbicula fluminea		Y	AgNO3		R	nw		7,8		43,8		21 d	NOEC	mortality			7,8	4		Diamond et al., 1990 in Van de Plassche et al 1999
Corbicula fluminea		Y	AgNO3		R	nw		7,8		43,8		21 d	NOEC	growth			2,6	4		Diamond et al., 1990 in Van de Plassche et al 1999
Corbicula fluminea	3-5mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	20 d	NOEC	mortality	7,8	4,4		2	4,10,23	Diamond et al 1990
Corbicula fluminea	3-5mm, field collected	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	20 d	NOEC	growth	2,6	1,5		2	4,10,23	Diamond et al 1990
Linguinia spp.			NaAgS2O3									10 w	NOEC				2220	4	7	Ewell et al. 1993 in Ratte 1999
Margaritifera spp.			NaAgS2O3									10 w	NOEC				2220	4	7	Ewell et al. 1993 in Ratte 1999
Mytilus edulis			AgNO3									28 d	NOEC	growth			8,5	4	7	Breteler et al., 1982 in INERIS, 2006
Crustacea																				
Ceriodaphnia dubia			AgNO3									10 d	NOEC	reproduction			0,53	4		Rodgers et al, 1997 in INERIS, 2006 en Stoffdatenblatt, 1999
Ceriodaphnia dubia	24 h	Y	AgNO3		S	nw	n	7.5-8.2	20	68-70	?	10 d	NOEC	reproduction		0,53		2	4,8	Rodgers et al. 1997
Ceriodaphnia dubia	24 h	Y	AgCl		S	nw	n	7.5-8.2	20	68-70	?	10 d	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997
Ceriodaphnia dubia	24 h	Y	Ag(S2O3)n		S	nw	n	7.5-8.2	20	68-70	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997
Ceriodaphnia dubia			AgNO3										NOEC	reproduction			4,5	4		Birge & Zuiderveen 1995 cited in Ratte 1999, in Stoffdatenblatt, 1999
Ceriodaphnia dubia			AgNO3										NOEC	reproduction			4	4	5	Webber et al 1989 in Birge and Zuiderveen 1995
Ceriodaphnia dubia			AgNO3										NOEC	reproduction			5	4	5	Webber et al 1989 in Birge and Zuiderveen 1995
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**25**	**80-100**	**0**	**7 d**	**NOEC**	**mortality**		**0,37**		**2**	**6,13,46**	**Kolts et al., 2009**
Ceriodaphnia dubia	**< 24 h**	**Y**	**AgNO3**		**R**	**am**		**7.4-7.8**	**25**	**80-100**	**0**	**7 d**	**NOEC**	**mortality**		**2,9**		**2**	**6,29,46**	**Kolts et al., 2009**
Ceriodaphnia dubia	< 24 h	Y	AgNO3		R	am		7.4-7.8	25	80-100	0	7 d	NOEC	reproduction		≥ 0.70		2	6,46	Kolts et al., 2009
Ceriodaphnia dubia	< 24 h	Y	AgNO3		R	am		7.4-7.8	25	80-100	0	7 d	EC10	reproduction		2,1		2	3,6,29,46	Kolts et al., 2009
Ceriodaphnia dubia			AgNO3										NOEC	reproduction			4,5	4	5	Birge & Zuiderveen 1995 in Ratte, 1999
Ceriodaphnia dubia	< 24 h	Y	AgNO3	rg	R	am		7.4-7.8	25	80-100		8 d	NOEC	reproduction	0,001			3	10,11,24,25	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgGSH		R	am		7.4-7.8	25	80-100		8 d	NOEC	reproduction	0,1			3	10,11,24,25,26	Bielmyer et al. 2002
Ceriodaphnia dubia	< 24 h	Y	AgCys		R	am		7.4-7.8	25	80-100		8 d	LOEC	reproduction	0,001			3	10,11,24,25,26,27	Bielmyer et al. 2002
Ceriodaphnia dubia	< 12 h	Y	AgNO3	>99.7	R			7.8-8.4	25	88		7 d	EC10	reproduction			10,1	2	72,81	Study report, 2007'in REACH dossier
Ceriodaphnia dubia	< 12 h	Y	AgNO3	>99.7	R			7.8-8.4	25	88		7 d	EC10	reproduction			6,48	2	72,81	Study report, 2007'in REACH dossier

Ceriodaphnia dubia	< 12 h	Y	AgNO3	>99.7	R			7.8-8.4	25	88		7 d	EC10	reproduction			8,69	2	72,81	Study report, 2007'in REACH dossier
Ceriodaphnia dubia	< 24 h	Y	AgNO3		R	rw		7.4-7.8	25	80-100		7 d	EC10	reproduction			2,48	2	72,81	Study report, 2009'in REACH dossier
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	mortality		11,5		2	81	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	EC10	mortality		11,1		2	81,85	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	reproduction		8,01		2	81	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	EC10	reproduction		10,4		2	81,85	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	mortality		11,4		2	81	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	reproduction		4,19		2	81	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	EC10	reproduction		7,9		2	81,85	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	5,11	7 d	NOEC	mortality		11,5		2	81,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	5,11	7 d	EC10	mortality		10,4		2	81,85,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	5,11	7 d	NOEC	reproduction		7,87		2	81,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	5,11	7 d	EC10	reproduction		9,3		2	81,85,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	mortality		17,5		2	81,88	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	EC10	mortality		14,5		2	81,85,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	NOEC	reproduction		9,94		2	81,88	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia dubia	< 12 h	Y	AgNO3	> 99.7	R	nw	n	7.8-8.4	25	88	4,74	7 d	EC10	reproduction		13		2	81,85,87	Naddy et al., 2007 Aquat Tox.
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw		8	23	240		7 d	EC50	reproduction			0,8	3*	13, 72	Publication 1986' in REACH dossier
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw		8	23	240		7 d	EC50	mortality			6,4	3*	13, 72	Publication 1986' in REACH dossier
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw		8	23	240		7 d	NOEC	reproduction			1	3*	13, 72	Publication 1986' in REACH dossier
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		7 d	EC50	reproduction			0,8	3	1,11,13	Elnabarawy et al., 1986
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		7 d	LC50	mortality			6,4	3	1,11,13	Elnabarawy et al., 1986
Ceriodaphnia reticulata	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		7 d	NOEC	reproduction			1	3	1,11,13	Elnabarawy et al., 1986
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	115		21 d	LC10	mortality		1,83		2	4,8,30, 91	Bianchini and Wood 2008
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	115		21 d	LC10	mortality		2,99		2	4,8,30,47, 92	Bianchini and Wood 2008
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	460		21 d	LC10	mortality		3,18		2	4,8,30, 93	Bianchini and Wood 2008
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	115		21 d	EC10	reproduction		2,88		2	4,8,30, 94	Bianchini and Wood 2008
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	115		21 d	EC10	reproduction		2,40		2	4,8,30,47, 95	Bianchini and Wood 2008
Daphnia magna	< 24 h	Y	AgNO3		R	am		8,2	20	460		21 d	EC10	reproduction		1,98		2	4,8,30, 96	Bianchini and Wood 2008
Daphnia magna	neonates	Y	AgNO3		R	am		8,2	20	115		21 d	NOEC	reproduction	< 5	<2		2		Bianchini and Wood 2002
Daphnia magna	< 24 h	Y	AgNO3	rg	R	nw		7,2	19,5	60		21 d	NOEC	reproduction	1,6			2	4	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3		R			7,2	19,5	60		21 d	NOEC	reproduction	1,6			2*	4	Nebeker et al 1983 in DAR silver thiosulphate
Daphnia magna	< 24 h	Y	AgNO3	rg	R	am		7,2	19,5	75		21 d	NOEC	reproduction	8,8			2	4	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	R	am		7,2	19,5	180		21 d	NOEC	reproduction	3,4			2	4	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3		R	nw		8,6		73	?	21 d	NOEC	reproduction	14,5			2	4,48	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		R	nw		7,2		60	?	21 d	NOEC	reproduction	3,6			2	4,49	Nebeker 1982
Daphnia magna	< 24 h	Y	AgNO3		R	nw		7,7		46	?	21 d	NOEC	reproduction	2,7			2	4	Nebeker 1982
Daphnia magna	24 h	Y	AgNO3		R	nw		7,2		60		21 d	NOEC	reproduction			1,6	4*		Nebeker et al., 1983 in Van de Plassche et al 1999
Daphnia magna	24 h	Y	AgNO3		R	nw		7,2		75		21 d	NOEC	reproduction			8,8	4*		Nebeker et al., 1983 in Van de Plassche et al 1999
Daphnia magna	24 h	Y	AgNO3		R	nw		7,2		180		21 d	NOEC	reproduction			3,4	4*		Nebeker et al., 1983 in Van de Plassche et al 1999
Daphnia magna	< 24 h	Y	AgNO3		R	nw	n (well water)	7,2	19,5	60		21 d	EC50	reproduction	2,9			2	4	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	R	am		7,2	19,5	75		21 d	EC50	reproduction	3,6			2	4	Nebeker et al. 1983
Daphnia magna	< 24 h	Y	AgNO3	rg	R	am		7,2	19,5	180		21 d	EC50	reproduction	3,9			2	4	Nebeker et al. 1983
Daphnia magna			AgNO3							60			EC50	reproduction			2,9	4*		Nebeker et al. 1983 in Ratte 1999

Daphnia magna			AgNO3							75			EC50	reproduction			3,6	4*		Nebeker et al. 1983 in Ratte 1999
Daphnia magna			AgNO3							180			EC50	reproduction			3,9	4*		Nebeker et al. 1983 in Ratte 1999
Daphnia magna	24 h	Y	AgNO3		S	am		7.5-8.2	20	68-70	?	10 d	NOEC	reproduction		0,8		2	4,8	Rodgers et al. 1997a
Daphnia magna	24 h	Y	AgCl		S	am		7.5-8.2	20	68-70	?	10 d	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997a
Daphnia magna	24 h	Y	Ag(S2O3)n		S	am		7.5-8.2	20	68-70	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Daphnia magna			AgNO3									10 d	NOEC	reproduction			0,8	4*		Rodgers et al, 1997 in INERIS, 2006 en Stoffdatenblatt, 1999
Daphnia magna	24 h	Y	AgNO3		S	am		7.5-8.2	20	68-70	?	10 d	LC50	mortality		1,06		2	8,50	Rodgers et al. 1997a
Daphnia magna	24 h	Y	AgCl		S	am		7.5-8.2	20	68-70	?	10 d	LC50	mortality		>930		2	8	Rodgers et al. 1997a
Daphnia magna	24 h	Y	AgS2O3		S	am		7.5-8.2	20	68-70	?	10 d	LC50	mortality		>12000		2	8	Rodgers et al. 1997a
Daphnia magna	< 24 h	Y	AgNO3		R	am		7,2	20			21 d	NOEC	mortality	4,1			4		Publication, 1983' in REACH dossier
Daphnia magna	< 24 h		AgNO3		R	am		7,2	20	60		21 d	EC10	reproduction	2,2			4	79	Publication, 1983' in REACH dossier (probably Nebeker).
Daphnia magna	< 24 h		AgNO3		R	am		7,2	20	75		21 d	EC10	reproduction	9,1			4	79	Publication, 1983' in REACH dossier
Daphnia magna	< 24 h		AgNO3		R	am		7,2	20	180		21 d	EC10	reproduction	5,3			4	79	Publication, 1983' in REACH dossier
Daphnia magna	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	EC50	reproduction			2,2	3*	13	Publication, 1986' in REACH dossier
Daphnia magna	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	LC50	mortality			3,6	3*	13	Publication, 1986' in REACH dossier
Daphnia magna	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	NOEC	reproduction			< 0.56	3*	13	Publication, 1986' in REACH dossier
Daphnia magna	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	NOEC	mortality			>5.6	3	1,11,13	Elnabarawy et al., 1986
Daphnia magna	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	EC50	reproduction			2,2	3	1,11,13	Elnabarawy et al., 1986
Daphnia magna	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	LC50	mortality			3,6	3	1,11,13,86	Elnabarawy et al., 1986
Daphnia magna	< 24 h	Y	AgNO3	> 99.7	R	nw	n	7.9-8.6	20-22	160	2	21 d	NOEC	mortality		2,37		2	81	Naddy et al., 2007 Aquat Tox.
Daphnia magna	< 24 h	Y	AgNO3	> 99.7	R	nw	n	7.9-8.6	20-22	160	2	21 d	NOEC	reproduction		2,37		2	81	Naddy et al., 2007 Aquat Tox.
Daphnia magna	**< 24 h**	**Y**	**AgNO3**	**> 99.7**	**R**	**nw**	**n**	**7.9-8.6**	**20-22**	**160**	**2**	**21 d**	**NOEC**	**growth**		**2,37**		**2**	**81**	**Naddy et al., 2007 Aquat Tox.**
Daphnia pulex	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	EC50	reproduction			1,2	3*	13	Publication, 1986' in REACH dossier
Daphnia pulex	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	LC50	mortality			2,7	3*	13	Publication, 1986' in REACH dossier
Daphnia pulex	< 24 h	Y	AgNO3	rg	R	nw		8	23	240		14 d	NOEC	mortality			3,2	3*	13	Publication, 1986' in REACH dossier
Daphnia pulex	< 24 h		AgNO3	rg	R	nw		8	23	240		14 d	NOEC	reproduction			<0.56	3*	13	Publication, 1986' in REACH dossier
Daphnia pulex	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	NOEC	mortality			3,2	3	1,11,13	Elnabarawy et al., 1986
Daphnia pulex	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	NOEC	reproduction			<0.56	3	1,11,13	Elnabarawy et al., 1986
Daphnia pulex	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	EC50	reproduction			1,2	3	1,11,13	Elnabarawy et al., 1986
Daphnia pulex	< 24 h	N	AgNO3	rg	R	nw	y	8	23	240		14 d	LC50	mortality			2,7	3	1,11,13	Elnabarawy et al., 1986
Hyalella azteca	6-8mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	21 d	NOEC	mortality	0,9	0,58		2	4,10,23	Diamond et al 1990
Hyalella azteca	6-8mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	21 d	NOEC	growth	>1.9	≥ 1.2		2	4,10,23	Diamond et al 1990
Hyalella azteca		Y	AgNO3		R	nw	n	7,8		34,8		21 d	NOEC	mortality			0,9	4*		Diamond et al., 1990 in Van de Plassche et al 1999
Insecta																				
Chironomus tentans	11 day old	Y	AgNO3		F	dtw		7,4	23	52	?	10 d	LC50	mortality	63	57		2	54,55	Call et al. 1999
Chironomus tentans	**11d larvae**	**Y**	**AgNO3**		**F**	**dtw**		**7,4**	**23**	**52,1**	**?**	**10 d**	**NOEC**	**growth**		**13**		**2**	**54,55,56**	**Call et al. 1999**
Chironomus tentans			AgNO3									10 d	NOEC	growth			13	4*		Call et al., 1999 in INERIS, 2006
Chironomus tentans			AgNO3									10 d	EC50				259000	4	57	Rodgers et al, 1994
Chironomus tentans			AgNO3									10 d	EC50	emergence			259000	4*		Rodgers et al. 1994 in Ratte 1999
Chironomus tentans	2nd instar	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		259		2	4,8,58	Rodgers et al. 1997a
Chironomus tentans	2nd instar	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	10 d	NOEC	survival		125		2	4,8	Rodgers et al. 1997a
Chironomus tentans	2nd instar	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997a
Chironomus tentans	2nd instar	Y	AgS2O3		S	am		6.9-7.5	20	10-15	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Chironomus tentans			AgNO3			nw						10 d	NOEC	growth			125	4*		Rodgers et al, 1997 in INERIS, 2006 en Stoffdatenblatt, 1999

Chironomus sp.			NaAgS2O3									58 d	NOEC				> 444	4	7	Ewell et al. 1993 in Ratte 1999
Isonychia bicolor	< 4 th instar; 3-5mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	14 d	NOEC	mortality	3,1	1,7		2	4,10,23	Diamond et al 1990
Isonychia bicolor	< 4 th instar; 3-5mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	14 d	NOEC	growth	>31	≥ 17		2	4,10,23	Diamond et al 1990
Isonychia bicolor	< 4 th instar; 3-5mm	Y	AgNO3	rg	R	nw	n	7,8	20	34,8	?	14 d	NOEC	molts	0,31	0,17		2	4,10,23	Diamond et al 1990
Isonychia bicolor		Y	AgNO3		R	nw	n	7,8		34,8		14 d	NOEC	mortality			3,1	4*		Diamond et al., 1990 in Van de Plassche et al 1999
Isonychia bicolor		Y	AgNO3									14 d	NOEC	development			0,31	4*		Diamond et al., 1990 in Stoffdatenblatt, 2009
Notonecta sp.			Ag2S									58 d	LC50				> 435	4	7	Ewell et al. 1993 in Ratte 1999
Stenonema modestum			AgNO3									14 d	NOEC	growth			1,84	4	7	Diamond et al., 1992 in INERIS, 2006
Stenonema modestum													NOEC				1,84	4		Diamond et al., 1992 in Wood et al., 2002
Stenonema modestum													LOEC				3,4	4		Diamond et al., 1992 in Wood et al., 2002
Stenonema modestum	**larvae; 4-6 mm**	**Y**	**AgNO3**	**rg**	**R**	**tw**	**y**	**7,7**	**12**	**48,5**		**14 d**	**NOEC**	**molting**	**1,84**	**1**		**2**	**4,84**	**Diamond et al., 1992**
Stenonema modestum	larvae; 4-6 mm	Y	AgNO3	rg	R	tw	y	7,7	12	48,5		7 d	EC10	survival		3,6		2	4,84,85	Diamond et al., 1992
Stenonema modestum	larvae; 4-6 mm	Y	AgNO3	rg	R	tw	y	7,7	12	48,5		14 d	EC10	survival		3,9		2	4,84,85	Diamond et al., 1992
Pisces																				
Carassius auratus	embryo	N	AgNO3		R	rw				100-200		els	LC50	mortality			20	3	1	Birge and Zuiderveen 1995
Carassius auratus	embryo larvae		AgNO3									> 6 d	LC50	mortality			20	3*		Birge and Zuiderveen 1995 in Ratte 1999
Carassius auratus	embryo	N	AgNO3		R	rw				100-200		els	LC10	mortality			4	3	1	Birge and Zuiderveen 1995
Ictalurus punctatus	embryo	N	AgNO3		R	rw				100-200		els	LC50	mortality			10	3	1	Birge and Zuiderveen 1995
Ictalurus punctatus	embryo larvae		AgNO3									> 6 d	LC50	mortality			10	3*		Birge and Zuiderveen 1995 in Ratte 1999
Ictalurus punctatus	embryo	N	AgNO3		R	rw				100-200		els	LC10	mortality			2	3	1	Birge and Zuiderveen 1995
Lepomis macrochirus	2.94 g, 14.7 cm	Y	AgNO3		R	tw		7,5	23,9	180		6 m	NOEC	growth			70	4	11,12	Coleman and Cearley, 1974
Lepomis macrochirus			AgNO3									6 m	NOEC	growth			70	4*		Coleman and Cearley, 1974 in INERIS, 2006
Micropterus salmoides	9.6 g, 24.6 cm	Y	AgNO3		R	tw		7,5	23,9	180		6 m	NOEC	mortality			7	4	11,12	Coleman and Cearley, 1974
Micropterus salmoides			AgNO3									6 m	NOEC	growth			7	4*		Coleman and Cearley, 1974 in INERIS, 2006
Micropterus salmonides	embryo	N	AgNO3		R	rw				100-200		els	LC50	mortality			110	3	1	Birge and Zuiderveen 1995
Micropterus salmonides	embryo	N	AgNO3		R	rw				100-200		els	LC10	mortality			18	3	1	Birge and Zuiderveen 1995
Micropterus salmonides			AgNO3									> 6 d	LC50	mortality			110	4*		Birge and Zuiderveen 1995 in Ratte 1999
Oncorhynchus kisutch																				
Oncorhynchus mykiss	embryo	N	AgNO3		R	rw				100-200		els	LC50	mortality			10	3	1	Birge and Zuiderveen 1995
Oncorhynchus mykiss			AgNO3									> 6 d	LC50	mortality			10	4*		Birge and Zuiderveen 1995 in Ratte 1999
Oncorhynchus mykiss	embryo	N	AgNO3		R	rw				100-200		els	LC10	mortality			0,8	3	1	Birge and Zuiderveen 1995
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7.5-8.0	12	95	2,86	75 d	NOEC	mortality		0,13		2	59	Brauner and Wood 2002a
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7.5-8.0	12	95	2,86	75 d	NOEC	growth		< 0.13		2	59	Brauner and Wood 2002a
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7.5-8.0	12	95	14,9	51 d	NOEC	mortality		0,02		3	59	Brauner and Wood 2002a
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7.5-8.0	12	95	14,9	51 d	NOEC	growth		0,02		3	59	Brauner and Wood 2002a
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7.5-8.0	12	95	1,3	75 d	NOEC	mortality	0,098			2	4,59	Brauner and Wood 2002b
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		F	am		7,5	13,5	95	1,3	37 d	NOEC	growth	0,098			2	4,59	Brauner and Wood 2002b
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.8-7.3	4-9	30,4	?	10 w	NOEC	mortality	0,6			2	60	Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.8-7.3	4-9	30,4	?	10 w	NOEC	growth	< 0.6			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.6-7.4	3-17	27,5	?	18 m	NOEC	mortality	0,09			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.6-7.4	3-17	27,5	?	2 m	NOEC	growth	0,09			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.6-7.4	3-17	27,5	?	3 m	NOEC	growth	0,17			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.6-7.4	3-17	27,5	?	3.5 m	NOEC	growth	0,34			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	tw		6.6-7.4	3-17	27,5	?	18 m	NOEC	growth	0,34			2		Davies et al, 1978
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	nw		6.8-7.3		30,4		10 w	NOEC	mortality			< 0.6	4*	61	Davies et al, 1978 in Van de Plassche et al 1999
Oncorhynchus mykiss	eyed eggs	Y	AgNO3		F	nw		6.6-7.4		27,5		18 m	NOEC	mortality			0,09	2*		Davies et al, 1978 in Van de Plassche et al 1999

Oncorhynchus mykiss	eyed eggs	Y	AgNO3	F	nw		6.6-7.7		27,5		2 m	NOEC	growth		0,09	2*		Davies et al, 1978 in Van de Plassche et al 1999
Oncorhynchus mykiss	eyed eggs	Y	AgNO3	F	nw		6.6-7.4		27,5		3 m	NOEC	growth		0,17	2*		Davies et al, 1978 in Van de Plassche et al 1999
Oncorhynchus mykiss	eyed eggs	Y	AgNO3	F	nw		6.6-7.4		27,5		3.5 m	NOEC	growth		0,34	2*		Davies et al, 1978 in Van de Plassche et al 1999
Oncorhynchus mykiss											60 d	LOEC	mortality	0,69		4	4,62,66	Davies et al, 1978, in Dethloff et al., 2007
Oncorhynchus mykiss											60 d	LOEC	growth	0,17		4	4,62,66	Davies et al, 1978, in Dethloff et al., 2007
Oncorhynchus mykiss											18 mo	LOEC	hatching	0,17		4	4,62,66	Davies et al, 1978, in Dethloff et al., 2007
Oncorhynchus mykiss												NOEC			0,15	4		Davies et al., 1998 in Wood et al., 2002
Oncorhynchus mykiss												LOEC			0,22	4		Davies et al., 1998 in Wood et al., 2002
Oncorhynchus mykiss			AgNO3								28 d	NOEC	growth		0,7	4	7	Galvez et al., 1998 in INERIS, 2006
Oncorhynchus mykiss	3.0 g, juvenile	Y	AgNO3	F	dtw		8	15.5-17.5	140		28 d	NOEC	growth		0,5	3	11,12	Galvez et al., 1998
Oncorhynchus mykiss	3.0 g, juvenile	Y	AgNO3	F	dtw		8	15.5-17.5	140		28 d	NOEC	mortality		0,5	3	11,12	Galvez et al., 1998
Oncorhynchus mykiss		Y	AgNO3	F	dtw		8	14.5-15.5	120		23 d	NOEC	food consumption	3		2	4	Galvez and Wood 2002
Oncorhynchus mykiss		Y	AgNO3	F	dtw		8	14.5-15.5	120		23 d	NOEC	weight	3		2	4	Galvez and Wood 2002
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3		dtw		7,5	12,3	120	0,76	32 d	NOEC	mortality	1,22		2	63	Guadagnolo et al., 2001
Oncorhynchus mykiss											32 d	LOEC	hatching	≥ 13.5		4	4,64,66	Guadagnolo et al., 2001, in Dethloff et al., 2007
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	2	0,5	64 d	NOEC	reproduction	0,09		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	2	0,5	64 d	NOEC	mortality	0,09		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	150	0,5	64 d	NOEC	reproduction	≥1.21		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	150	0,5	64 d	NOEC	mortality	0,1		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	400	0,5	64 d	NOEC	reproduction	≥ 0.79		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	am		7	11,1	400	0,5	64 d	NOEC	mortality	≥ 0.79		3	4,59	Morgan et al. 2005
Oncorhynchus mykiss											60 d	LOEC	mortality	0,51		4*	4,65,66	Nebeker et al, 1983, in Dethloff et al., 2007
Oncorhynchus mykiss											60 d	LOEC	growth	0,1		4*	4,65,66	Nebeker et al, 1983, in Dethloff et al., 2007
Oncorhynchus mykiss											60 d	LOEC	growth	0,36		4*	4,65,66	Nebeker et al, 1983, in Dethloff et al., 2007
Oncorhynchus mykiss	eggs	Y	AgNO3	F	nw		7		36		60 d	NOEC	growth		0,36	4*		Nebeker et al., 1983 in Van de Plassche et al 1999
Oncorhynchus mykiss	eggs	Y	AgNO3	F	nw		7		36		60 d	NOEC	growth		0,1	4*		Nebeker et al., 1983 in Van de Plassche et al 1999
Oncorhynchus mykiss	embryos	N	AgNO3	F				9-12			60 d	NOEC	mortality		0,36	4*		Nebeker 1983 in DAR silver thiosulphate
Oncorhynchus mykiss	embryos	N	AgNO3	F				9-12			60 d	NOEC	growthrate		<0.1	4		Nebeker 1983 in DAR silver thiosulphate
Oncorhynchus mykiss	embryos	Y	AgNO3	F	nw	n (well water)	7,5	9-12	36	?	60 d	LOEC	survival	0,51		2		Nebeker et al. 1983
Oncorhynchus mykiss	embryos	Y	AgNO3	F	nw	n (well water)	7,5	9-12	36	?	60 d	NOEC	survival	0,36		2		Nebeker et al. 1983
Oncorhynchus mykiss	embryos	Y	AgNO3	F	nw	n (well water)	7,5	9-12	36	?	60 d	NOEC	hatching	0,2		2		Nebeker et al. 1983
Oncorhynchus mykiss	embryos	Y	AgNO3	F	nw	n (well water)	7,5	9-12	36	?	60 d	NOEC	growth	< 0.1		2		Nebeker et al. 1983
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	nw			9-12			60 d	LC100	mortality		1,3	4	80	Publication, 1983' in REACH dossier (probably Nebeker et al., 1983
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	nw			9-12			60 d	EC10	mortality		0,39	4	79, 80	Publication, 1983' in REACH dossier (probably Nebeker et al., 1983
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	nw			9-12			60 d	EC10	length		0,72	4	79, 80	Publication, 1983' in REACH dossier (probably Nebeker et al., 1983
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	nw			9-12			60 d	EC10	weight		0,68	4	79, 80	Publication, 1983' in REACH dossier (probably Nebeker et al., 1983
Oncorhynchus mykiss	fertilised eggs	Y	AgNO3	F	nw			9-12			60 d	NOEC	growth		<0.1	4	80	Publication, 1983' in REACH dossier (probably Nebeker et al., 1983

Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.0	12	30-36	2.3-3.0	73 d	NOEC	mortality		≥ 1.25		1	4,67,68,69	Dethloff et al 2007
Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.1	12	30-34	2.4-3.5	77 d	NOEC	mortality		1,09		1	4,68,69,70	Dethloff et al 2007
Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.0	12	30-36	2.3-3.0	73 d	NOEC	hatching		≥ 1.25		1	4,67,68,69	Dethloff et al 2007
Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.1	12	30-34	2.4-3.5	77 d	NOEC	hatching		≥ 2.26		1	4,68,69,70	Dethloff et al 2007
Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.0	12	30-36	2.3-3.0	73 d	NOEC	development /weight		≥ 1.25		1	4,67,68,69	Dethloff et al 2007
Oncorhynchus mykiss	eggs	Y	AgNO3		100%	CF	nw	y	7.3-8.1	12	30-34	2.4-3.5	77 d	NOEC	development /weight		0,21		1	4,68,69,70	Dethloff et al 2007
Oncorhynchus mykiss													58 d	NOEC	growth	< 0.9			4	4,66	Brauner et al., 2003, in Dethloff et al., 2007
Oncorhynchus mykiss													58 d	LOEC	hatching	≥ 0.9			4	4,66	Brauner et al., 2003, in Dethloff et al., 2007
Oncorhynchus mykiss	embryos	Y	AgNO3			F	am			12,5	20	0,3	58 d	NOEC	growth		<0.1		2	9,11,74	Brauner et al., 2003
Oncorhynchus mykiss	**embryos**	**Y**	**AgNO3**			**F**	**am**			**12,5**	**20**	**0,3**	**58 d**	**NOEC**	**growth**		**0,1**		**2**	**9,11,74**	**Brauner et al., 2003**
Oncorhynchus mykiss	fry 22 d	Y	AgNO3	rg		R	nw	n	7,8	20	34,8	?	7 d	NOEC	mortality	≥6.7	≥ 2.3		2	10,23	Diamond et al 1990
Oncorhynchus mykiss		Y	AgNO3			F	nw	well water	6,93	13,1	24,7		196 d	EC10	mortality		0,17		2	71,72	Grey literature, 1998' in REACH dossier
Oncorhynchus mykiss		Y	AgNO3			F	nw	well water	7,53	13,1	195		196 d	EC10	mortality		0,3		2	71,72	Grey literature, 1998' in REACH dossier
Oncorhynchus mykiss		Y	AgNO3			F	nw	well water	7,62	13,1	466		196 d	EC10	mortality		0,63		2	71,72	Grey literature, 1998' in REACH dossier
Pimephales promelas	<24 h	Y	AgNO3			S	nw	n	7.2-7.7		45,1		28 d	NOEC	larval development			1,07	4*		Holcombe et al., 1983 in Van de Plassche et al 1999
Pimephales promelas	<24 h	Y	AgNO3			S	nw	n	7.2-7.7		45,1		28 d	NOEC	reproduction			0,37	4*		Holcombe et al., 1983 in Van de Plassche et al 1999
Pimephales promelas	<24 h	Y	AgNO3			S	nw	n	7.2-7.7		45,1		28 d	NOEC	growth			0,65	4*		Holcombe et al., 1983 in Van de Plassche et al 1999
Pimephales promelas	embryos, <24 h	Y	AgNO3		99,99	S	nw	n	7.2-7.7	25	45,1	?	28 d	NOEC	larval development	1,07			2		Holcombe et al., 1983
Pimephales promelas	embryos, <24 h	Y	AgNO3		99,99	S	nw	n	7.2-7.7	25	45,1	?	28 d	NOEC	survival	0,37			2		Holcombe et al., 1983
Pimephales promelas	embryos, <24 h	Y	AgNO3		99,99	S	nw	n	7.2-7.7	25	45,1	?	28 d	NOEC	growth/weight	0,65			2		Holcombe et al., 1983
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	0	96 h	LC50	mortality	2,43			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	5	96 h	LC50	mortality	6,05			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	10	96 h	LC50	mortality	9,79			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	0	96 h	LC50	mortality	2,67			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	5	96 h	LC50	mortality	9,72			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	10	96 h	LC50	mortality	12,28			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	0	96 h	LC50	mortality	1,97			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	5	96 h	LC50	mortality	4,23			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	10	96 h	LC50	mortality	3,56			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	0	96 h	LC50	mortality	5,5			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	5	96 h	LC50	mortality	8,89			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	50	10	96 h	LC50	mortality	9,82			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	0	96 h	LC50	mortality	2,24			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	5	96 h	LC50	mortality	5,39			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	10	96 h	LC50	mortality	8,46			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	0	96 h	LC50	mortality	2,34			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	5	96 h	LC50	mortality	9,06			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	10	96 h	LC50	mortality	11,18			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	0	96 h	LC50	mortality	2,06			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	5	96 h	LC50	mortality	4,41			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	10	96 h	LC50	mortality	5,63			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	0	96 h	LC50	mortality	5,63			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	5	96 h	LC50	mortality	8,39			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	100	10	96 h	LC50	mortality	10,19			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	0	96 h	LC50	mortality	2,79			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	5	96 h	LC50	mortality	6,83			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	10	96 h	LC50	mortality	8,5			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	0	96 h	LC50	mortality	3,19			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	5	96 h	LC50	mortality	8,7			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	10	96 h	LC50	mortality	8,44			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	0	96 h	LC50	mortality	2,75			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	5	96 h	LC50	mortality	4,19			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	10	96 h	LC50	mortality	4,32			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	0	96 h	LC50	mortality	5,47			1	4	Karen et al. 1999
Pimpehales promelas	< 24 h	Y	AgNO3	rg		S	am		8,3	22	200	5	96 h	LC50	mortality	8,98			1	4	Karen et al. 1999

Pimpehales promelas	< 24 h	Y	AgNO3	rg	S	am		8,3	22	200	10	96 h	LC50	mortality	13,35			1	4	Karen et al. 1999
Pimpehales promelas	embryos	Y	Ag2S		F	nw	n (well water)	7.2-8.4	25	38	?	30 d	NOEC	growth	≥ 11000			2	4	LeBlanc et al 1984
Pimpehales promelas	embryos	Y	Ag2S		F	nw	n (well water)	7.2-8.4	25	38	?	30 d	NOEC	survival	1800			2	4	LeBlanc et al 1984
Pimpehales promelas	embryos	Y	AgS2O3		F	nw	n (well water)	7.2-8.4	25	38	?	30 d	NOEC	survival	35000			2	4	LeBlanc et al 1984
Pimpehales promelas	embryos	Y	AgS2O3		F	nw	n (well water)	7.2-8.4	25	38	?	30 d	NOEC	growth	16000			2	4	LeBlanc et al 1984
Pimpehales promelas			Ag2S		F							30 d	MATC				>11000	4*		LeBlanc et al. 1984 in Ratte 1999
Pimephales promelas		Y	AgS4		CF	rw		7.2-8.4	38			until 30 d p.h.	NOEC				>11000	4*	4,75,76	LeBlanc et al., 1984 in Van de Plassche et al 1999
Pimpehales promelas	larvae	Y	Ag2S		S			7.2-8.4	25			30 d	NOEC	growth rate	11000			2*	4,77	LeBlanc 1984 in DAR silver thiosulphate
Pimephales promelas		Y	Ag(S2O3)n		CF	rw		7.2-8.4	38			until 30 d p.h.	NOEC				16000	4*	4,75	LeBlanc et al., 1984 in Van de Plassche et al 1999
Pimpehales promelas	larvae	Y	AgS2O3		S			7.2-8.4	25			30 d	NOEC	growth rate	16000			2*	4,77	LeBlanc 1984 in DAR silver thiosulphate
Pimpehales promelas	30 days old embryo-larvae		Ag2S		F								MATC				>4800	4		Ewell et al. 1993 and Le Blanc et al. 1984 in Ratte 1999
Pimpehales promelas	30 days old embryo-larvae		NaAgS2O3		F								MATC				16000	4*		Ewell et al. 1993 and Le Blanc et al. 1984 in Ratte 1999
Pimephales promelas	larvae	Y	AgNO3	rg	R	nw	n			44-49	?	7 d	NOEC	growth	0,729			2		Norberg-King, 1989
Pimephales promelas			AgNO3									7 d	NOEC	development			0,729	4*		Norberg-King, 1989 in Stoffdatenblatt, 2009
Pimpehales promelas			Ag2S		F							12 w	NOEC				800000	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			NaAgS2O3		F							10 w	NOEC				5000	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas			AgNO3		F							30 d	MATC				4	4	7	Ewell et al. 1993 in Ratte 1999
Pimpehales promelas	fertilised eggs	Y	AgNO3		F	nw	y		25	20-35	2,4	32 d	NOEC	survival	0,9	0,35		2	4,32	Naddy et al 2007 ETC
Pimpehales promelas	fertilised eggs	Y	AgNO3		F	nw	y		25	20-35	2,4	32 d	NOEC	growth	0,9	0,35		2	4,32	Naddy et al 2007 ETC
Pimpehales promelas	fertilised eggs	Y	AgNO3		F	nw	y		25	20-35	2,4	32 d	NOEC	hatching, survival, growth	0,48			2	4,33	Naddy et al 2007 ETC
Pimpehales promelas	fertilised eggs	Y	AgNO3		F	nw	y		25	20-35	2,4	32 d	NOEC	growth	0,54			2	4,33,78	Naddy et al 2007 ETC
Pimpehales promelas	fertilised eggs	Y	AgNO3		F	nw	y		25	20-35	2,4	32 d	NOEC	survival			1,5	3	4,33,78	Naddy et al 2007 ETC
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw	y		25	20-35	2,4	7 d	LC50	mortality		> 0.606		2	4,32	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw	y		25	20-35	2,4	7 d	NOEC	mortality, growth		> 0.606		2	4,32	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw			25	20-35	2,4	7 d	LC50	mortality			1	3	10,11,33	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw	y		25	20-35	2,4	7 d	NOEC	mortality, growth		0,81		2	4,33	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw			25	20-35	2,4	7 d	LC50	mortality			2,1	3	10,11,33,78	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw	y		25	20-35	2,4	7 d	NOEC	mortality		> 2.42		2	4,33,78	Naddy et al 2007
Pimpehales promelas	< 24 h	Y	AgNO3		F	nw	y		25	20-35	2,4	7 d	NOEC	growth		0,54		2	4,33,78	Naddy et al 2007
Pimpehales promelas	**24-48 h**	**Y**	**AgNO3**		**S**	**am**		**6.9-7.5**	**20**	**10-15**	**?**	**10 d**	**NOEC**	**mortality**		**2**		**2**	**2,4,8**	**Rodgers et al. 1997a**
Pimpehales promelas	24-48 h	Y	AgCl		S	am		6.9-7.5	20	10-15	?	10 d	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	Ag(S2O3)n		S	am		6.9-7.5	20	10-15	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		11,6		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	AgNO3		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		10,6		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		>1930		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	AgCl		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		>930		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	Ag(S2O3)n		S	nw	n	6.9-7.5	20	10-15	?	96 h	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Pimpehales promelas	24-48 h	Y	Ag(S2O3)n		S	nw	n	6.9-7.5	20	10-15	?	10 d	LC50	mortality		>12000		2	4,8	Rodgers et al. 1997a
Pimephales promelas	fertilised eggs	Y	AgNO3		F	nw	n	7.3-8.2	25	30,5		32 d	NOEC	survival, growth		0,351		4*	72,73	Publication, 2007' in REACH dossier (probably Naddy et al?)
Pimephales promelas	fertilised eggs	Y	AgNO3									32 d	EC10	growth rate		0,39		4*	72,73, 79	Publication, 2007' in REACH dossier (probably Naddy et al?)
Pimephales promelas	fertilised eggs	Y	AgNO3									32 d	EC10	mortality			0,44	4*	72,73, 79	Publication, 2007' in REACH dossier (probably Naddy et al?)
Pimephales promelas	< 24 h	Y	AgNO3		R	rtw		8,2	25	79,2	4,4	96 h	LC50	mortality	6,2	4,5		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3		R	rtw		8,2	25	80,5	3,3	96 h	LC50	mortality	21,4	16,8		2	87	VanGenderen et al., 2003

Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,1	25	79,2	5,1	96 h	LC50	mortality	16	13,4		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	81,8	4	96 h	LC50	mortality	14,3	10,1		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	80,5	3,6	96 h	LC50	mortality	13,4	11,5		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	80,5	3,5	96 h	LC50	mortality	13,7	12,4		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	80,5	4,5	96 h	LC50	mortality	22,5	15,2		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	80,5	3,8	96 h	LC50	mortality	32,9	23,3		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8	25	83,2	3,8	96 h	LC50	mortality	23,3	18,3		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,2	25	90	<1	96 h	LC50	mortality	3,8	3,1		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8	25	87,1	5,1	96 h	LC50	mortality	7,6	7,2		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8	25	91,1	7,1	96 h	LC50	mortality	9,2	6,7		2	87	VanGenderen et al., 2003
Pimephales promelas	< 24 h	Y	AgNO3	R	rtw		8,1	25	91,1	14	96 h	LC50	mortality	9,9	9		2	87	VanGenderen et al., 2003
Salmo trutta												NOEC				0,2	4		Davies et al., 1998 in Wood et al., 2002
Salmo trutta												LOEC				0,25	4		Davies et al., 1998 in Wood et al., 2002
Salmo trutta	**eggs**	**Y**	**AgNO3**	**F**	**nw**	**well water**	**6,8**	**13,3**	**27,9**		**217 d**	**EC10**	**mortality**		**0,19**		**2**	**71, 72**	**grey literature, 1998' in REACH dossier (probably Davies et al., 1998)**
Salmo trutta	eggs	Y	AgNO3	F	nw	well water	7,5	13,3	200		217 d	EC10	mortality		0,75		2	71, 72, 97	grey literature, 1998' in REACH dossier (probably Davies et al., 1998)
Salmo trutta	eggs	Y	AgNO3	F	nw	well water	7,5	13,3	400		217 d	EC10	mortality		1,23		2	71, 72, 97	grey literature, 1998' in REACH dossier (probably Davies et al., 1998)
Amphibia																			
Ambystoma opacum	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			240	3	1	Birge and Zuiderveen 1995
Ambystoma opacum	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			30	3	1	Birge and Zuiderveen 1995
Ambystoma opacum			AgNO3									LC50	mortality			240	4*		Birge and Zuiderveen 1995 in Ratte 1999
Bufo fowleri	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			230	3	1	Birge and Zuiderveen 1995
Bufo fowleri	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			4	3	1	Birge and Zuiderveen 1995
Bufo fowleri			AgNO3									LC50	mortality			230	4*		Birge and Zuiderveen 1995 in Ratte 1999
Gastrophryne caroliensis	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			10	3	1	Birge and Zuiderveen 1995
Gastrophryne caroliensis	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			2	3	1	Birge and Zuiderveen 1995
Gastrophryne caroliensis			AgNO3									LC50	mortality			10	4*		Birge and Zuiderveen 1995 in Ratte 1999
Rana catesbeiana	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			20	3	1	Birge and Zuiderveen 1995
Rana catesbeiana	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			3	3	1	Birge and Zuiderveen 1995
Rana catesbeiana			AgNO3									LC50	mortality			20	4*		Birge and Zuiderveen 1995 in Ratte 1999
Rana palustris	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			10	3	1	Birge and Zuiderveen 1995
Rana palustris	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			1	3	1	Birge and Zuiderveen 1995
Rana palustris			AgNO3									LC50	mortality			10	4*		Birge and Zuiderveen 1995 in Ratte 1999
Rana pipiens	embryo	N	AgNO3	R	rw				100-200		els	LC50	mortality			10	3	1	Birge and Zuiderveen 1995
Rana pipiens	embryo	N	AgNO3	R	rw				100-200		els	LC10	mortality			0,7	3	1	Birge and Zuiderveen 1995
Rana pipiens			AgNO3									LC50	mortality			10	4*		Birge and Zuiderveen 1995 in Ratte 1999

Notes with chronic freshwater toxicity table

1 Test concentration not measured
2 Endpoint determined with data from graph
3 Endpoint determined from original data
4 Endpoint based on measured concentrations
5 Original reference not available
6 Endpoint based on concentrations measured at the start of the experiment
7 Original reference does not contain the cited data
8 Analysis performed after filtration over 0.45 µm filter
9 Measured concentrations within 20% of nominal
10 Measured concentrations <80% of nominal
11 Endpoint based on nominal concentrations
12 Results of analysis not reported
13 Animals were fed during the test
14 Test performed according to OECD guideline
15 Growth perfromed in Luria-Bertani broth
16 1 replicate
17 Fritz medium without EDTA
18 Woods hole medium with 13 µm EDTA
19 Woods hole medium without EDTA
20 No information on perfomance of control in similar medium
21 EC10 is average of 2 replicate studies
22 Silver was tested as active ingredient in the plant protection product Florisant 100
23 Dissolved endpoint calculated from difference in recovery between unfiltered and filtered
24 Detection limit was 2 µg/L, several concentrations were below LOD
25 Daily renewal; 10 replicates per treatment.
26 AgGSH = silver glutathionate
27 AgCys = silver cysteinate
28 Animals were fed immediately after transfer to exposure solutions and after renewal
29 Animals were fed 30 min before transfer
30 Measured concentration 65 - 100% of nominal
31 Not re-evaluated
32 Normal flow through conditions
33 High flow through conditions
34 With synthethic wastewater including meat extract
35 humic acid added 10 mg/L
36 In the presence of sediment
37 The tested metals were added to the collected culture and the bioassay is performed straight thereafter. The time of the assay (exposure time) is unknown
38 Endpoint recalculated from nominal endpoint of 0.07 mg/L by difference between nominal and analysed soluble Ag concentrations (6.3%); Effects in nitrifying cultures in batch reactor setup aimed to represent WWTPs instead of surface water
39 Strain isolated from contaminated lake
40 Laboratory strain
41 Not clear whether endpoints refer to measured or nominal, most likely nominal
42 Original reference is pobably not correct
43 Effect on photosynthesis monitored as chlorophyl a content, chlorophyl a fluorescence and visual observation of damage to chloroplasts
44 Reported as minimum inhibitory concentration; glycerol as growth substrate
45 Reported as minimum inhibitory concentration; glucose or raffinose as growth substrate
46 Medium without EDTA
47 Sulfide present in the medium
48 Geometric mean of two tests NOEC 10.5 and 20 µg/L
49 Geometric mean of three tests NOEC 1.6, 8.8 and 3.4 µg/L
50 95% confidence interval around LC50 0.99-1.14 mg/L

51 Deemed to be less reliable in the INERIS report because natural water was used and Ag bioavailability might have been much less; original paper reviewed, values based on measured dissolved Ag
52 From the original reference it appeared that these values are sediment concentrations, not water concentrations
53 95% confidence interval around LC50 5.21-6.51 mg/L
54 Analysis after filtration over 0.2 µm filter
55 A layer of quartz sand was added to each test chamber
56 11.1% effect on dry weight was observed at this NOEC.
57 Summary of several tests; no information on test conditions; unit probably wrong, value of 259 ug/L is reported in Rodgers et al., 1997
58 95% confidence interval around LC50 192-371 mg/L
59 Only two concentrations tested with a spacing of two magnitudes; in the experiment with DOC added there was an effect of DOC on survival and growth.
60 At 1.2 ug/L, 25% mortality was reached within 39 d; at 10 ug/L 50% mortatity was reached within 5 d
61 NOEC mortality 0.6 ug/L in original reference, NOEC growth < 0.6
62 Original reference contains NOECs, see Davies et al 1978
63 Concentration dissolved organic matter: 1.3 mg/L
64 Original reference contains NOEC, see Guadagnolo et al. 2001
65 Original reference contains NOECs, see Nebeker et al. 1983
66 ELS test
67 No NaCl added 1.8-2.8 mg Cl/L
68 According to ASTM method
69 Maximum loading was 5 g/L
70 NaCl added at 26.9-32.0 mg Cl/L
71 Equivalant to or similar to OECD guideline 210
72 "Key study" in REACH dossier
73 According to ASTM E1241-98 guideline
74 Measured water concentrations of filtered samples equal to unfiltered samples
75 Tested as slurry
76 Embryo-larval test with exposure until 30 days post-hatch
77 Original reference included
78 NaCl added 60 mg Cl/L
79 EC10 value reported in REACH dossier was a recalculation from original data
80 According to ASTM E729-80 guideline
81 According to 7d US EPA guideline, 2002
82 Bacterial colonies counted on TSA plates; only one concentration used
83 Only one concentration tested
84 Larvae from unpolluted source
85 EC10 calculated using data reported by author
86 EC50 does not seem to be correct, since at all concentrations upto the highest concentration (5.6 µg/L) survival was 100%
87 NOM added
88 Sulfide added
89 Medium with EDTA
90 According to ISO standard
91 EC10 calculated via logistic dose-response function using EC20 (2.14 ug/L) and EC50 (2.81 ug/L) reported by author
92 EC10 calculated via logistic dose-response function using EC20 (3.00 ug/L) and EC50 (3.12 ug/L) reported by author
93 EC10 calculated via logistic dose-response function using EC20 (3.31 ug/L) and EC50 (3.54 ug/L) reported by author
94 EC10 calculated via logistic dose-response function using EC20 (2.93 ug/L) and EC50 (3.02 ug/L) reported by author

95 EC10 calculated via logistic dose-response function using EC20 (2.54 ug/L) and EC50 (2.79 ug/L) reported by author

96 EC10 calculated via logistic dose-response function using EC20 (2.27 ug/L) and EC50 (2.87 ug/L) reported by author

97 Effect due to high hardness, not taken up in aggregated data table

Acute toxicity of silver (Ag+) to marine organisms

- Validity according to Klimisch (1997); only records with a validity of 1 or 2 (green) can be used for ERL derivation.
- Bold records are selected for ERL derivation. These records are (1) valid; (2) based on measured dissolved concentrations of Ag+; (3) performed in water with DOC < 2 mg/L or labwater or filtered natural water or well water; (4) with a pH of 6-9; (5) EC50s/LC50s for acute and NOECs/EC10s for chronic studies.
- When for a certain species, data for different endpoints are available (e.g., growth, reproduction) the data for the most sensitive endpoint are selected. If there are more data for the same enpdoint, the geometric mean is used.

Species	Species properties	Analyzed	Test compound	Purity	Test type	Test water	filtered y/n	pH	Temperatu [°C]	Salinity [‰]	DOC mg/L	Exp time	Criterion	Test endpoint	Value total [µg Ag+/L]	Value dissolved [µg Ag+/L]	Value unknonw/ nominal [µg Ag+/L]	Validity	Notes	Reference
Bacteria																				
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	5		20 h	EC50	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	10		20 h	EC50	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	20		20 h	EC50	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	30		20 h	EC50	growth			< 5394	3	1	Gupta et al. 1998
Vibrio fischeri	microtox assay	N	AgNO3		S	am		6.5-7.5				22 h	EC50	bioluminescence			7,92	3		Hsieh et al. 2004
Algae																				
Thalassiosira weissflogii	**exp. Growth**	**Y**	**oxidative dissolution of nano particles**	**99,7**	**S**	**am**		**8,2**	**20**	**35**	**0**	**48 h**	**EC50**	**growth rate**		**20,5**		**2**	**2**	**Miao et al 2009**
Thalassiosira weissflogii	exp. Growth	Y	oxidative dissolution of nano particles	99,7	S	am		8,2	20	35	0	48 h	EC50	chlorophyll-a		83,1		2	2	Miao et al 2009
Thalassiosira weissflogii	exp. Growth	Y	oxidative dissolution of nano particles	99,7	S	am		8,2	20	35	0	48 h	EC50	photosystem II yield		1294		2	2	Miao et al 2009
Protozoa																				
Lingulodinium polyedra					S	am			19	32		96 h	IC50	luminescence			13	3	3,4	Lapota et al., 2007
Mollusca																				
Argopecten irradians	juveniles; 20-30 mm	N	AgNO3		S	nw	y		20	25		96h	LC50	mortality			33	2	11	Nelson et al., 1976
Argopecten irradians	juveniles; 20-30 mm	N	AgNO3		S	nw	y		20	25		96h	LC5	mortality			14	2	11	Nelson et al., 1976
Argopecten irradians	juveniles; 20-30 mm	N	AgNO3		S	nw	y		20	25		96h	LC25	mortality			22	2	11	Nelson et al., 1976
Crassostrea gigas													LC50	mortality			11,91	4		Coglianese and Martin, 1981 in Wood et al., 2002
Crassostrea gigas													LC50	mortality			15,1	4		Coglianese and Martin, 1981 in Wood et al., 2002
Crassostrea gigas													LC50	mortality			19	4		Dinnel et al., 1983 in Wood et al., 2002
Crassostrea gigas													LC50	mortality			11,94	4	26	Coglianese 1982 in Wood et al. 2002
Crassostrea virginica													LC50	mortality			24,2	4		MacInnes and Calabrese, 1978 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			35,3	4		MacInnes and Calabrese, 1978 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			32,2	4		MacInnes and Calabrese, 1978 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			13	4		Zaroogian, 1981 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			7	4		Zaroogian, 1981 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			3	4		Zaroogian, 1981 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			37	4		Zaroogian, 1981 in Wood et al., 2002
Crassostrea virginica													LC50	mortality			5,8	4	26	Calabrese et al. 1978 in Wood et al 2002

Loligo opalescens	post hatch larvae	Y	AgNO3		S	nw	y	8,1	8,6	30		96 h	LC50	mortality	> 100, < 200			2	9	Dinnel et al. 1989
Mercenaria mercenaria													LC50	mortality			21	4	26	Calabrese and Nelson 1974 in Wood et al 2002
Mytilus edulis	15.8 mm	N	AgNO3		R	nw	y	6.9-7.5	20	25		96 h	LC50	mortality			159	2	27	Nelson et al., 1988
Perna viridis	75 mm; 35 g	N	AgCl	99	R	nw		7,9	28	30		96 h	LC50	mortality			3830	3	11,12,13	Vijayavel, 2009
Perna viridis	85 g; field collected	N	AgCl	99	R	nw		7	28	31,3		96 h	LC50	mortality			4000	3	11,12,14	Vijayavel et al. 2007 (TEC)
Perna viridis	6 cm; field collected	N	AgCl2		R	nw		8,2	28	31,3		96 h	LC50	mortality			3830	3	11,12	Vijayavel et al. 2007 (Chemosphere)
Perna viridis	6 cm; field collected	N	AgCl2		R	nw		8,2	28	31,3		96 h	LOEC	oxygen consumption			2000	3	11,12	Vijayavel et al. 2007 (Chemosphere)
Perna viridis	6 cm; field collected	N	AgCl2		R	nw		8,2	28	31,3		96 h	NOEC	filtration rate			1000	3	11,12,15	Vijayavel et al. 2007 (Chemosphere)
Perna viridis													LC50	mortality			30	4		Mathew and Menon, 1983 in Wood et al., 2002
Annelida																				
Neanthes arenaceodentata													LC50	mortality			151	4		Pesch and Hoffman, 1983 in Wood et al., 2002
Neanthes arenaceodentata													LC50	mortality			145	4		Pesch and Hoffman, 1983 in Wood et al., 2002
Neanthes arenaceodentata													LC50	mortality			260	4		Pesch and Hoffman, 1983 in Wood et al., 2002
Crustacea																				
Acartia sp.					S	nw		7	15			48 h	LC50	mortality			43	3	10	Hook and Fisher 2001
Acartia clausi													LC50	mortality			13,3	4		Lussier and Cardin, 1985 in Wood et al., 2002
Acartia tonsa													LC50	mortality			37,8	4		Lussier and Cardin, 1985 in Wood et al., 2002
Acartia tonsa													LC50	mortality			30,9	4		Schimmel 1981 in Wood et al., 2002
Acartia tonsa													LC50	mortality			66	4		Schimmel 1981 in Wood et al., 2002
Acartia tonsa													LC50	mortality			35,8	4		Schimmel 1981 in Wood et al., 2002
Acartia tonsa													LC50	mortality			23,5	4		Schimmel 1981 in Wood et al., 2002
Acartia tonsa													LC50	mortality			36,4	4		Schimmel 1981 in Wood et al., 2002
Acartia tonsa													LC50	mortality			36,3	4		Lussier and Cardin, 1985 in Wood et al., 2002
Acartia tonsa	**adults**	**Y**	**AgNO3**	**ag**	**R**	**nw/dtw**	**y**	**6,98**	**20**	**5**	**0,6**	**48 h**	**LC50**	**mortality**	**11,6**	**7,1**		**2**	**27**	**Pedroso et al., 2007**
Acartia tonsa	adults	Y	AgNO3	ag	R	nw/dtw	y	6,98	20	5	0,6	48 h	LC50	mortality	62,1	48,4		3	28	Pedroso et al., 2007
Acartia tonsa	**adults**	**Y**	**AgNO3**	**ag**	**R**	**nw/dtw**	**y**	**7,38**	**20**	**15**	**2**	**48 h**	**LC50**	**mortality**	**87,2**	**79,2**		**2**	**27**	**Pedroso et al., 2007**
Acartia tonsa	adults	Y	AgNO3	ag	R	nw/dtw	y	7,3	20	15	2,4	48 h	LC50	mortality	98,5	52,3		3	28	Pedroso et al., 2007
Acartia tonsa	adults	Y	AgNO3	ag	R	nw/dtw	y	7,46	20	30	5,1	48 h	LC50	mortality	163,2	154,6		2	27	Pedroso et al., 2007
Acartia tonsa	adults	Y	AgNO3	ag	R	nw/dtw	y	7,51	20	30	5,4	48 h	LC50	mortality	238,4	190,9		3	28	Pedroso et al., 2007
Americamysis bahia	**7 days old**	**Y**	**AgNO3**	**99**	**F**	**nw**	**y**	**7.7-8.2**	**26-28**	**20**		**96 h**	**LC50**	**mortality**		**260**		**2**	**5,6**	**Ward and Kramer 2002**
Americamysis bahia	**< 24 h**	**Y**	**AgNO3**	**99**	**F**	**nw**	**y**	**7.7-8.2**	**26-28**	**20**		**96 h**	**LC50**	**mortality**		**280**		**2**	**5,6**	**Ward and Kramer 2002**
Americamysis bahia		**Y**	**AgNO3**	**99**	**F**	**nw**	**y**	**7.7-8.2**	**26-28**	**20**		**96 h**	**LC50**	**mortality**		**260**		**2**	**5,7**	**Ward and Kramer 2002**
Americamysis bahia	24 h	Y	Ag		F	nw	y		22	30		96 h	LC50	mortality	249			2		Lussier et al 1985
Americamysis bahia													LC50	mortality			256	4		Schimmel 1981 in Wood et al., 2002
Americamysis bahia													LC50	mortality			300	4		Schimmel 1981 in Wood et al., 2002
Americamysis bahia													LC50	mortality			86	4		Schimmel 1981 in Wood et al., 2002
Americamysis bahia													LC50	mortality			313	4		Schimmel 1981 in Wood et al., 2002
Americamysis bahia													LC50	mortality			65	4		Schimmel 1981 in Wood et al., 2002
Americamysis bahia													LC50	mortality			132	4		Schimmel 1981 in Wood et al., 2002
Ampelisca abdita		Y	AgNO3		R	nw	y		19	31		10 d	LC50	mortality	20			2	8,9	Berry et al 1999
Cancer magister	zoea	Y	AgNO3		S	nw	y	8,1	8,5	30		96 h	LC50	mortality	33			2	9	Dinnel et al. 1989
Cancer magister	zoeae 48 h	N	AgNO3	ag	S	nw		8,1	15	33,8		96 h	LC50	mortality			55	3	3	Martin et al. 1981
Crangon spp.	adult, 63 mm	Y	AgNO3		F	nw	y	7,9	13,9	30,1		96 h	LC50	mortality	> 838			2	9	Dinnel et al. 1989
Titriopus brevicornis													LC50	mortality			36,37	4		Menasria and Pavillon, 1994 in Wood et al., 2002

Pisces																	
Apeltes quadracus														546,6	4		Cardin, 1986 in Wood et al., 2002
Anguilla anguilla			AgNO3	S						24 h	LC50	mortality		750	4	16,21	Grosell et al. 1998 in Ratte 1999
Atherinops affinis											LC50	mortality		183	4		Shaw et al., 1998 in Wood et al., 2002
Cymatogaster aggregata	adult, 101mm	Y	AgNO3	F	nw	y	29,3	13,1	29,3	96 h	LC50	mortality	356		2	9,17	Dinnel et al. 1989
Cymatogaster aggregata	adult								30	96 h	LC50	mortality		356	4*	18,19	Dinnel et al. 1983 in Hogstrand and Wood 1998
Cyprinodon variegatus	juvenile								28	96 h	LC50	mortality		1170	4	19	US EPA 1993 in Hogstrand and Wood 1998
Cyprinodon variegatus											LC50	mortality		1170	4*	20	US-EPA 1980 in Ratte 1999
Cyprinodon variegatus		Y		S							LC50	mortality		1400	4	19	US-EPA 1980
Cyprinodon variegatus											LC50	mortality		441	4		Schimmel, 1981 in Wood et al., 2002
Cyprinodon variegatus											LC50	mortality		898	4		Schimmel, 1981 in Wood et al., 2002
Cyprinodon variegatus											LC50	mortality		1356	4		Schimmel, 1981 in Wood et al., 2002
Cyprinodon variegatus											LC50	mortality		1510	4		Schimmel, 1981 in Wood et al., 2002
Cyprinodon variegatus											LC50	mortality		1876	4		Schimmel, 1981 in Wood et al., 2002
Cyprinodon variegatus											LC50	mortality		1065	4		Shaw et al., 1998 in Wood et al., 2002
Fundulus heteroclitus	adult								24	96 h	LC50	mortality		2700	4	19	Dorfmann 1977 in Hogstrand and Wood 1998
Menidia beryllina											LC50	mortality		260	4		Shaw et al., 1998 in Wood et al., 2002
Menidia menidia											LC50	mortality		110,1	4		Cardin, 1986 in Wood et al., 2002
Oligocottus maculosus	juvenile, 1.33 g	Y	AgNO3	R	nw	n	7,8	10	32	96 h	LC50	mortality	664		2	9	Shaw et al. 1998
Oligocottus maculosus	juvenile, 1.33 g	Y	AgNO3	R	nw	n	7,8	10	32	168 h	LC50	mortality	472		2	9	Shaw et al. 1998
Oligocottus maculosus	juvenile, 1.33 g	Y	AgNO3	R	rw	n	7,8	10	25	96 h	LC50	mortality	331		2	9	Shaw et al. 1998
Oligocottus maculosus	juvenile, 1.33 g	Y	AgNO3	R	rw	n	7,8	10	25	168 h	LC50	mortality	119		2	9	Shaw et al. 1998
Oligocottus maculosus			AgNO3							96 h	LC50	mortality		664	4*		Shaw et al. 1998 in Ratte 1999
Oligocottus maculosus			AgNO3							168 h	LC50	mortality		472	4*		Shaw et al. 1998 in Ratte 1999
Oligocottus maculosus			AgNO3							96 h	LC50	mortality		331	4*		Shaw et al. 1998 in Ratte 1999
Oligocottus maculosus			AgNO3							168 h	LC50	mortality		119	4*		Shaw et al. 1998 in Ratte 1999
Oligocottus maculosus			AgNO3							96 h	LC50	mortality		1078600	4	16	Shaw et al. 1998 in Ratte 1999
Oligocottus maculosus	juvenile								32	96 h	LC50	mortality		657	4	22	Shaw et al. 1998 in Hogstrand and Wood 1998
Oligocottus maculosus	juvenile								32	168 h	LC50	mortality		472	4*		Shaw et al. 1998 in Hogstrand and Wood 1998
Oligocottus maculosus	juvenile								25	96 h	LC50	mortality		330	4	22	Shaw et al. 1998 in Hogstrand and Wood 1998
Oligocottus maculosus	juvenile								25	168 h	LC50	mortality		119	4*		Shaw et al. 1998 in Hogstrand and Wood 1998
Oncorhynchus kisutch	smolt, 131 mm	Y	AgNO3	F	nw	y	7,8	11,5	28,6	96 h	LC50	mortality	488		2	9	Dinnel et al. 1989
Oncorhynchus mykiss	smolt								30	96 h	LC50	mortality		487	4	19,23	Dinnel et al. 1983 in Hogstrand and Wood 1998
Oncorhynchus mykiss	25 g	N	AgNO3	S	am		8.1-8.2	14	25	96 h	LC50	mortality		401,5	3	24	Ferguson and Hogstrand 1998
Oncorhynchus mykiss	1-4 g		AgNO3	R	dtw		7.9-8.2	15	2,9	168 h	LC50	mortality	>1000000		2	9,25	Hogstrand et al. 1996
Paralichtys dentatus	larva	N									LC50	mortality		4,7	4		EPA 1980
Paralichtys dentatus	embryo, larvae		Ag+								LOEC			4,7	4*		EPA 1980 in Ratte, 1999
Paralichtys dentatus											LC50	mortality		47,7	4		Cardin, 1986 in Wood et al., 2002
Paralichtys dentatus											LC50	mortality		8	4		Cardin, 1986 in Wood et al., 2002
Paralichtys dentatus											LC50	mortality		15,5	4		Cardin, 1986 in Wood et al., 2002
Paralichtys dentatus											LC50	mortality		565,0	4		Shaw et al.., 1998 in Wood et al., 2002
Parophrys vetulus	adult								30	96 h	LC50	mortality		800	4	19	Dinnel et al. 1983 in Hogstrand and Wood 1998
Parophrys vetulus											LC50	mortality		800	4		Dinnel et al., 1983 in Wood et al.., 2002
Pseudopleuronectes americanus											LC50	mortality		196,3	4		Cardin, 1986 in Wood et al., 2002
Scorpaenichthys marmoratus	post hatch larvae	Y	AgNO3	S	nw	y	7,9	8,3	27	96 h	LC50	mortality	> 800		2	9	Dinnel et al. 1989
Tautogolabrus adspersus	141-177 mm	N	AgNO3	S			7.3-7.6	20	24	96 h	EC50	respiration		> 500	3	3	Thurberg and Collier 1977

Notes with acute marine toxicity table

1 Growth perfromed in Luria-Bertani broth

2 Ag+ from oxidative dissolution of nano-particles, which were filtrated out of the water. Results given as total dissolved Ag+; free Ag+ can be calculated by dividing result by 185366.

3 Test concentration not measured

4 Exposure in plastic

5 Mean measured concentrations within 20% of nominal

6 Value obtained in 7-days experiment

7 Value obtained in 28-days experiment

8 Mean measured concentrations >80% of nominal

9 Endpoint based on measured concentrations

10 Test performed with Acartia tonsa and Acartia hudsonica together

11 Endpoint based on nominal concentrations

12 Water not filtered

13 35 g biomass/L

14 85 g biomass/L

15 NOEC = LOEC/2 (20% effect)

16 Value could not be reproduced from original paper

17 Most likely same study as cited from Dinnel et al., 1983

18 Probably same study as described in Dinnel et al., 1989

19 Original reference not available

20

Species of the test compound unknown, it is presumed that the envalue given is for Ag+

21 Cited value refers to soft freshwater

22 Value differs slightly from endpoint in original paper

23 Refers probably to same study as reported in Dinnel et al., 1989, both Coho salmon

24 Initial water concentration was measured, result not reported

25 Test medium prepared as 50 mM NaCl solution

26 Original reference evaluated and results taken up in chronic data table

27 Organisms were not fed during the test

28 Organisms were fed during the test

Chronic toxicity of silver (7440-22-4) to marine organisms

- Validity according to Klimisch (1997); only records with a validity of 1 or 2 (green) can be used for ERL derivation.
- Bold records are selected for ERL derivation. These records are (1) valid; (2) based on measured dissolved concentrations of Ag+; (3) performed in water with DOC < 2 mg/L or labwater or filtered natural water or well water; (4) with a pH of 6-9; (5) EC50s/LC50s for acute and NOECs/EC10s for chronic studies.
- When for a certain species, data for different endpoints are available (e.g., growth, reproduction) the data for the most sensitive endpoint are selected. If there are more data for the same endpoint, the geometric mean is used.

Species	Species properties	Analyzed	Test compou	Purity [%]	Test type	Test water	filtered y/n	pH	Temperatu [°C]	Salinity [‰]	DOC mg/L	Exp time	Criterion	Test endpoint	Value total [µg Ag+/L]	Value dissolved [µg Ag+/L]	Value unknown/nominal [µg Ag+/L]	Validity	Notes	Reference
Bacteria																				
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	5		20 h	NOEC	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	10		20 h	NOEC	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	20		20 h	NOEC	growth			< 5394	3	1	Gupta et al. 1998
Escherichia coli	strain J 53; log phase cells	N	AgNO3		S	am			37	30		20 h	NOEC	growth			< 5394	3	1	Gupta et al. 1998
Vibrio fischeri	microtox assay	N	AgNO3		S	am			15	20		2 h	NOEC	bioluminescence			108	3		Deheyn et al. 2004
Vibrio fischeri	wild type	N	AgNO3		S	am			22	20		9 h	NOEC	bioluminescence			10,8	3		Deheyn et al. 2004
Vibrio fischeri	microtox assay	N	AgNO3		S	am		6.5-7.5				22 h	NOEC	bioluminescence			5,61	3		Hsieh et al. 2004
Algae																				
Champia parvula	fronds	Y	AgNO3		R	nw			20-22	30		14 d	NOEC	production of cystocarps	1,2			4?	23	Steele and Thursby 1983 in REACH dossier
Champia parvula	fronds	Y	AgNO3		R	nw			20-22	30		14 d	NOEC	growth rate	1,9			4?	23	Steele and Thursby 1983 in REACH dossier
Gymnodium sp.			Ag+									48 h	NOEC				2-10	4	2	Wilson and Freeberg 1980 in Ratte 1999
Thalassiosira weissflogii	**exp. Growth**	**Y**	**oxidative dissolution of nano particles**	**99,7**	**S**	**am**		**8,2**	**20**	**35**	**0**	**48 h**	**NOEC**	**growth rate**		**4,9**		**2**	**3**	**Miao et al 2009**
Thalassiosira weissflogii	**exp. Growth**	**Y**	**oxidative dissolution of nano particles**	**99,7**	**S**	**am**		**8,2**	**20**	**35**	**0**	**48 h**	**NOEC**	**chlorophyll-a**		**4,9**		**2**	**3**	**Miao et al 2009**
Mollusca																				
Crassostrea gigas	10 months	N	AgNO3		R	nw		-		35		28 d	NOEC	mortality			20	3	4	Metayer et al., 1990
Crassostrea gigas	10 months	N	AgNO3		R	nw		-		35		28 d	NOEC	mortality			20	3*		Metayer et al., 1990 in Van der Plassche et al 1999
Crassostrea gigas	embryo, larvae	N	Ag+										LOEC				14	4	2	Dinnel et al 1983 in Ratte, 1999
Crassostrea gigas	embryo	Y	AgNO3		S	nw		8,2	20	16,5		48 h	NOEC	embryonic development			5,6	3	5,6	Coglianese 1982
Crassostrea gigas	embryo	Y	AgNO3		S	nw		8,2	20	22,7		48 h	NOEC	embryonic development			10	3	5,6	Coglianese 1982
Crassostrea gigas	embryo	Y	AgNO3		S	nw		8,2	20	33		48 h	NOEC	embryonic development			≥ 18	3	5,6	Coglianese 1982
Crassostrea gigas	embryo	N	AgNO3	ag	S	nw		8,1	20	33,8		48 h	EC50	embryonic development			22	3	4	Martin et al. 1981
Crassostrea gigas	embryo	N	AgNO3	rg	S	nw	y	8,2	20	33		48 h	EC50	embryonic development			13,3	3	4,6, 24	Coglianese and Martin, 1981

Crassostrea gigas	embryo	N	AgNO3	rg	S	nw	y	8,2	20	33		48 h	EC10	embryonic development		10,4	3	4,6, 24	Coglianese and Martin, 1981
Crassostrea gigas	embryo	N	AgNO3	rg	S	nw	y	8,2	20	33		48 h	EC50	embryonic development		15,7	3	4,6, 24	Coglianese and Martin, 1981
Crassostrea gigas	embryo	N	AgNO3	rg	S	nw	y	8,2	20	33		48 h	EC10	embryonic development		13,3	3	4,6, 24	Coglianese and Martin, 1981
Crassostrea rhizophora	1 h old embryos	N	AgNO3	rg	S	nw		7.0-8.5	27	28		24 h	NOEC	embryonic development		0,927	4	7	Da Cruz et al, 2007
Crassostrea virginica	larvae	N	AgNO3		R	nw		7.0-8.5	25	24		12 d	LC50	mortality		25	3	4	Calabrese et al. 1977
Crassostrea virginica	larvae	N	AgNO3		R	nw		7.0-8.5	25	24		12 d	LC5	mortality		14,2	3	4	Calabrese et al. 1977
Crassostrea virginica	embryo	N	AgNO3		S	am	n.a.	7.0-8.5	26	25		42-48 h	LC50	mortality		5,8	3	4	Calabrese et al. 1973
Crassostrea virginica	embryo		AgNO3										LC50	mortality		5,8	3*		Calabrese et al. 1973 in Calabrese et al. 1977
Crassostrea virginica	larvae		AgNO3										LC50			25	4*		Calabrese et al. 1977 in Ratte 1999
Crassostrea virginica	embryo		Ag+									48 h	LC50			6	4*		Calabrese et al. 1977 in Ratte 1999
Crepidula fornicata	24 mo		Ag+										LOEC	larvae release		10	4	2	Nelson et al 1983 in Ratte, 1999
Crepidula fornicata	mated pairs	Y			F	nw			4.5-25	25		2 years	NOEC	reproduction	5		4*	22	Nelson et al., 1983 in REACH dossier (aangevraagd)
Crepidula fornicata	mated pairs	Y	AgNO3		F	nw	y		4.5-25	25		2 years	NOEC	reproduction (abortions)	1,34		2	22,25	Nelson et al., 1983
Ilyanassa obsoleta	embryo	N	AgNO3			nw		8	12-18			2.5 h	NOEC	embryonic development		0,0001	3		Conrad 1988
Ilyanassa obsoleta	embryo		Ag+										LOEC	embryonic development		< 1	4	8	Conrad 1988 in Ratte, 1999
Mercenaria mercenaria	larvae	N	AgNO3		R	nw		7.0-8.5	25	24		8-10 d	LC50	mortality		32,4	3	4	Calabrese et al. 1977
Mercenaria mercenaria	larvae	N	AgNO3		R	nw		7.0-8.5	25	24		8-10 d	LC5	mortality		18,6	3	4	Calabrese et al. 1977
Mercenaria mercenaria	larvae		AgNO3										LC50			32	4*		Calabrese et al. 1977 in Ratte 1999
Mercenaria mercenaria	embryo		AgNO3		S	am		7.0-8.5	26	25		42-48 h	LC50	mortality		21	3	4	Calabrese and Nelson 1974
Mercenaria mercenaria	embryo		AgNO3										LC50	mortality		21	3*		Calabrese and Nelson 1974 in Calabrese et al. 1977
Mytilus edulis	2.5 months, 4.5 mm	Y	AgNO3		F	nw			2.6-24.0	25		21 m	NOEC	growth		≥ 10	4	5,6	Calabrese et al. 1984
Mytilus edulis	field collected juvenile	Y	AgNO3		F	nw			2.4-22.8	25		12 m	NOEC	growth		25	4	5,6	Calabrese et al. 1984
Mytilus edulis	juvenile	Y	AgNO3		F	nw		-		25		6 m	NOEC	growth		25	4*		Calabrese et al., 1984 in Van der Plassche et al 1999
Mytilus edulis	embryo		Ag+									72 h	LOEC			< 4	4	2	Dinnel et al 1983 in Ratte, 1999
Mytilus edulis	embryo	N	AgNO3	ag	S	nw		8,1	17	33,8		48 h	EC50	embryonic development		14	3	4	Martin et al. 1981
Mytilus galloprovincialis	3 year	N	AgNO3		R	nw		-		35		28 d	NOEC	mortality		20	3	4	Metayer et al., 1990
Mytilus galloprovincialis	3 year	N	AgNO3		R	nw		-		35		28 d	NOEC	mortality		20	3*		Metayer et al., 1990 in Van der Plassche et al 1999
Spisula solidissima	embryo, 4 h	Y	AgNO3	ag	S	nw	y	7,6	20	32,5		1 h	NOEC	development	< 8		2	6,9	Zoto and Robinson 1985
Spisula solidissima	embryo, 4 h	Y	AgNO3	ag	S	nw	y	7,6	20	32,5		1 h	EC50	development	18		2	6,9	Zoto and Robinson 1985
Spisula solidissima	embryo, 1 h	Y	AgNO3	ag	S	nw	y	7,6	20	32,5		48 h	NOEC	development	< 4		2		Zoto and Robinson 1985
Spisula solidissima	embryo, 1 h	Y	AgNO3	ag	S	nw	y	7,6	20	32,5		48 h	EC50	development	14		2		Zoto and Robinson 1985
Spisula solidissima	embryo		Ag+									1 h	EC50			14	4*		Zoto and Robinson 1985 in Ratte 1999
Spisula solidissima	gametes											45 min	EC50			6	4	10	Zoto and Robinson 1985 in Ratte 1999
Spisula solidissima	eggs	N	AgNO3		F	nw		8	20	30		45 min	NOEC	larval development		9,5	3	4	Eyster and Morse 1984
Spisula solidissima	sperm	N	AgNO3		F	nw		8	20	30		45 min	NOEC	larval development		9,5	3	4	Eyster and Morse 1984
Spisula solidissima	eggs and sperm	N	AgNO3		F	nw		8	20	30		45 min	NOEC	larval development		0,6	3	4	Eyster and Morse 1984
Spisula solidissima	embryo, 24 h	N	AgNO3		F	nw		8	20	30		47 h	NOEC	larval development		9,5	3	4	Eyster and Morse 1984
Spisula solidissima	fertilized eggs	N	AgNO3		F	nw		8	20	30		48 h	NOEC	larval development		<9.5	3	4	Eyster and Morse 1984

Crustacea																				
Americamysis bahia		Y	AgNO3	rg	F	nw	y			31		28 d	NOEC	reproduction	33			2	11	Breteler et al 1982
Americamysis bahia		Y	AgNO3	rg	F	nw	y			31		28 d	NOEC	survival	70			2	11	Breteler et al 1982
Americamysis bahia	24 h	Y	Ag		F	nw	y		22	30		38 d	NOEC	reproduction	11			2	11	Lussier et al 1985
Americamysis bahia			AgNO3									38 d	NOEC	reproduction			11	4*		Lussier et al., 1985 in INERIS, 2006 en Stoffdatenblatt, 2009
Americamysis bahia			AgNO3							15-30			NOEC				9	4	2	McKenney 1982 in Ward and
Americamysis bahia			AgNO3							20			NOEC				11	4	2	McKenney 1982 in Ward and Kramer 2003
Americamysis bahia			AgNO3							15-30			NOEC				14	4	2	McKenney 1982 in Ward and Kramer 2004
Americamysis bahia			AgNO3							15-30			NOEC				30	4	2	McKenney 1982 in Ward and Kramer 2005
Americamysis bahia			AgNO3							15-30			NOEC				70	4	2	McKenney 1982 in Ward and Kramer 2006
Americamysis bahia	< 24 h	Y	AgNO3		F							28 d	NOEC	reproduction			5,715	3	5,6	Raimondo and McKenney, 2006
Americamysis bahia	< 24 h	Y	AgNO3		F							28 d	NOEC	mortality			40	3	5,6	Raimondo and McKenney, 2006
Americamysis bahia	7 days old	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	NOEC	development; growth		65		2	12	Ward and Kramer 2002
Americamysis bahia	7 days old	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	EC10	development		75,9		2	12,26	Ward and Kramer 2002
Americamysis bahia	**7 days old**	**Y**	**AgNO3**	**99**	**F**	**nw**	**y**	**7.7-8.2**	**26-28**	**20**		**7 d**	**EC10**	**reproduction**		**78,9**		**2**	**12,26**	**Ward and Kramer 2002**
Americamysis bahia	< 24 h	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	NOEC	growth		38		2	12	Ward and Kramer 2002
Americamysis bahia	< 24 h	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	EC10	mortality		140		2	12,26	Ward and Kramer 2002
Americamysis bahia	< 24 h	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	EC10	development		68,7		2	12,26	Ward and Kramer 2002
Americamysis bahia	< 24 h	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		7 d	EC10	growth		55,6		2	12,26	Ward and Kramer 2002
Americamysis bahia		Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		28 d	NOEC	mortality; growth		34		2	12	Ward and Kramer 2002
Americamysis bahia		Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		28 d	EC10	mortality		45,4		2	12,26	Ward and Kramer 2002
Americamysis bahia	males	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		28 d	EC10	growth (length)		17,6		2	12,26	Ward and Kramer 2002
Americamysis bahia	females	Y	AgNO3	99	F	nw	y	7.7-8.2	26-28	20		28 d	EC10	growth (weight)		41,3		2	12,26	Ward and Kramer 2002
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	10	0.28-0.43	28 d	NOEC	mortality		6		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	10	0.28-0.43	28 d	NOEC	reproduction		6		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	10	0.28-0.43	28 d	NOEC	growth		13		1	11,13	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	10	0.28-0.43	28 d	EC10	mortality		4,2		1	11,26	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	**7 d**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**26-28**	**10**	**0.28-0.43**	**28 d**	**EC10**	**reproduction**		**3**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	20	0.57-0.86	28 d	NOEC	mortality		34		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	**7 d**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**26-28**	**20**	**0.57-0.86**	**28 d**	**NOEC**	**reproduction**		**60**		**1**	**11,13**	**Ward et al 2006 (ETC 25: 1809)**
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	20	0.57-0.86	28 d	NOEC	growth		34		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	20	0.57-0.86	28 d	EC10	mortality		51,2		1	11,26	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d, males	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	20	0.57-0.86	28 d	EC10	growth		18,4		1	11,26	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	30	0.86-1.29	28 d	NOEC	mortality		19		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	30	0.86-1.29	28 d	NOEC	reproduction		37		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	30	0.86-1.29	28 d	NOEC	growth		72		1	11,13	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	7 d	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	30	0.86-1.29	28 d	EC10	mortality		21,3		1	11,26	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	**7 d**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**26-28**	**30**	**0.86-1.29**	**28 d**	**EC10**	**reproduction**		**27,8**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Americamysis bahia	<24h	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	10	0.28-0.43	7 d	NOEC	growth		5,3		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	<24h	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	20	0.57-0.86	7 d	NOEC	growth		38		1	11	Ward et al 2006 (ETC 25: 1809)
Americamysis bahia	<24h	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	26-28	30	0.86-1.29	7 d	NOEC	growth		64		1	11	Ward et al 2006 (ETC 25: 1809)
Scylla serrata	sperm	N				am		9	22				EC50	acrosome reaction			1,96	3	4	Zhang et al 2010

Scylla serrata	sperm	N				am		9	22				NOEC	acrosome reaction			< 0.56	3	4	Zhang et al 2010
Echinodermata																				
Arbacia lixula	embryo		Ag+										LOEC				0,5	4	2	Soyer 1963 in Ratte, 1999
Arbacia punctulata	sperm and eggs	Y	AgNO3	>99.9	S	nw	y	6.9-8.1	19.4-21.9	29	0.86-1.29	1 h	NOEC	fertilization		9,3		1	11,12,14	Ward et al 2006 (ETC 25: 1568)
Arbacia punctulata	sperm and eggs	Y	AgNO3	>99.9	S	nw	y	6.9-8.1	19.4-21.9	29	0.86-1.29	1 h	EC10	fertilization		8,9		1	11,12,26	Ward et al 2006 (ETC 25: 1568)
Arbacia punctulata	< 4 h eggs	Y	AgNO3	>99.9	S	nw	y	6.9-8.1	19.4-21.9	29	0.86-1.29	48 h	NOEC	development		9,3		1	11,12,14	Ward et al 2006 (ETC 25: 1568)
Arbacia punctulata	< 4 h eggs	Y	AgNO3	>99.9	S	nw	y	6.9-8.1	19.4-21.9	29	0.86-1.29	48 h	EC10	development		20,1		1	11,12,26	Ward et al 2006 (ETC 25: 1568)
Arbacia punctulata	adults	Y	AgNO3	>99.9	F	nw	y	6.9-8.1	13.9-16.5	29	0.86-1.29	30 d	NOEC	mortality		19		1	11,12,14	Ward et al 2006 (ETC 25: 1568)
Arbacia punctulata	**adults**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**6.9-8.1**	**13.9-16.5**	**29**	**0.86-1.29**	**30 d**	**NOEC**	**loss of spines; spine tugor; inability to ahdhere to surfaces**		**8,6**		**1**	**11,12,15**	**Ward et al 2006 (ETC 25: 1568)**
Arbacia punctulata	adults	Y	AgNO3	>99.9	F	nw	y	6.9-8.1	13.9-16.5	29	0.86-1.29	30 d	NOEC	growth		19		1	11,12,14	Ward et al 2006 (ETC 25: 1568)
Dendraster excentricus	sperm/eggs	Y	AgNO3			nw	y	7.8-8.1		30		80 min	EC50	fertilization	54			2	11	Dinnel et al 1989
Dendraster excentricus	sperm												EC50				54	4*		Dinnel et al 1989 in Zhang et al 2010
Dendraster excentricus	freshly fertilized eggs	Y	AgNO3		S	nw	y	8.0-8.1	12.5-13.0	30		120 h	EC50	mortality	33			2	11	Dinnel et al 1989
Strongylocentrotus droebachiensis	freshly fertilized eggs	Y	AgNO3		S	nw	y	7.8-8.1	8.2-8.4	30		120 h	EC50	mortality	24			2	11	Dinnel et al 1989
Strongylocentrotus purpuratus	freshly fertilized eggs	Y	AgNO3		S	nw	y	7-8-8.1	8.2-8.4	30		120 h	EC50	mortality	15			2	11	Dinnel et al 1989
Strongylocentrotus droebachiensis	sperm/eggs	Y	AgNO3			nw	y	7.8-8.1		30		80 min	EC50	fertilization	86			2	11	Dinnel et al 1989
Strongylocentrotus franciscanus	sperm/eggs	Y	AgNO3			nw	y	7.8-8.1		30		80 min	EC50	fertilization	112			2	11	Dinnel et al 1989
Strongylocentrotus purpuratus	sperm/eggs	Y	AgNO3			nw	y	7.8-8.1		30		80 min	EC50	fertilization	115			2	11	Dinnel et al 1989
Strongylocentrotus droebachiensis	sperm												EC50				86	4*		Dinnel et al 1989 in Zhang et al 2010
Strongylocentrotus franciscanus	sperm												EC50				112	4*		Dinnel et al 1989 in Zhang et al 2010
Strongylocentrotus purpuratus	sperm												EC50				115	4*		Dinnel et al 1989 in Zhang et al 2010
Paracentrotus lividus	sperm	N	AgNO3		S	nw			19	38		30 min	NOEC	fertilization			108	3	4	Warnau et al. 1996
Paracentrotus lividus	sperm	N	AgNO3		S	nw			19	38		75 min	NOEC	fertilization			10,8	3	4	Warnau et al. 1996
Paracentrotus lividus	embryo	N	AgNO3		S	nw			19	38		72 h	NOEC	mortality			81	3	4	Warnau et al. 1996
Paracentrotus lividus	embryo	N	AgNO3		S	nw			19	38		72 h	NOEC	development			11	3	4	Warnau et al. 1996
Paracentrotus lividus			AgNO3									72 h	NOEC	growth			16,9	4	16	Warnau et al., 1996 in INERIS, 2006

Pisces																				
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**10**	**0.28-0.43**	**28 d**	**NOEC**	**mortality**		**26**		**1**	**11,17**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	10	0.28-0.43	28 d	NOEC	growth		26		1	11,17	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**10**	**0.28-0.43**	**28 d**	**EC10**	**mortality at hatch**		**25**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**10**	**0.28-0.43**	**28 d**	**EC10**	**mortality after 28 days**		**27,5**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**20**	**0.57-0.86**	**28 d**	**NOEC**	**mortality**		**49**		**1**	**11,18**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	20	0.57-0.86	28 d	NOEC	growth		49		1	11,18	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**20**	**0.57-0.86**	**28 d**	**EC10**	**mortality after 28 days**		**71**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	20	0.57-0.86	28 d	EC10	growth (wet weight)		14,2		1	11,26	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	20	0.57-0.86	28 d	EC10	growth (dry weight)		17,4		1	11,26	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	30	0.86-1.29	28 d	NOEC	mortality		130		1	11,19	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	embryos	Y	AgNO3	>99.9	F	nw	y	7.6-8.2	23.1-27.0	30	0.86-1.29	28 d	NOEC	growth		130		1	11,19	Ward et al 2006 (ETC 25: 1809)
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**30**	**0.86-1.29**	**28 d**	**EC10**	**mortality after 28 days**		**144**		**1**	**11,26**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**10**	**0.28-0.43**	**7 d**	**NOEC**	**mortality or growth**		**19**		**1**	**11**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**20**	**0.57-0.86**	**7 d**	**NOEC**	**mortality or growth**		**100**		**1**	**11**	**Ward et al 2006 (ETC 25: 1809)**
Menidia beryllina	**embryos**	**Y**	**AgNO3**	**>99.9**	**F**	**nw**	**y**	**7.6-8.2**	**23.1-27.0**	**30**	**0.86-1.29**	**7 d**	**NOEC**	**mortality or growth**		**460**		**1**	**11**	**Ward et al 2006 (ETC 25: 1809)**
Paralichtys dentatus	embryo, larvae		Ag+										LOEC				5-8	4	2,20	Luoma et al 1995
Paralichtys dentatus	embryo, larvae		Ag+										LOEC				5-8	4*		Luoma et al 1995 in Ratte, 1999
Pseudopleuronectes americanus	embryos	Y	AgNO3		F	nw	y		7	30		18 d	NOEC	time to hatch	54			2		Klein-MacPhee et al. 1984
Pseudopleuronectes americanus	embryos	Y	AgNO3		F	nw	y		7	30		18 d	NOEC	viability	54			2		Klein-MacPhee et al. 1984
Pseudopleuronectes americanus																	54	4*	21	Hogstrand and Wood, 1998 in Van der Plassche et al 1999
Pseudopleuronectes americanus	larvae												NOEC	hatching			54	4*		Klein-MacPhee et al. 1984 in Hogstrand and Wood 1998
Pseudopleuronectes americanus	embryos	Y	AgNO3		S	nw + dw	y		8,7	10			NOEC	hatching	>174			2	11	Voyer et al. 1982
Pseudopleuronectes americanus	embryos	Y	AgNO3		S	nw + dw	y		8,7	21			NOEC	hatching	> 167			2	11	Voyer et al. 1982
Pseudopleuronectes americanus	embryos	Y	AgNO3		S	nw	y		8,7	32			NOEC	hatching	> 166			2	11	Voyer et al. 1982

Notes with chronic marine toxicity table

1 Growth perfromed in Luria-Bertani broth
2 Original reference not available
3 Ag+ from oxidative dissolution of nano-particles, which were filtrated out of the water. Results given as total dissolved Ag+; free Ag+ can be calculated by dividing result by 185366
4 Test concentration not measured
5 Results of analysis not reported
6 Endpoints based on nominal concentrations
7 Embryonic development test; results do not seem to be correct since the LOEC is a factor of 100 below the lowest test concentration
8 Unit probably wrong
9 Measured concentration within 25% of nominal concentration
10 Value probably refers to citation
11 Endpoints based on measured concentrations
12 Measured concentration within 20% of nominal concentration
13 No proper fit for calculation of EC10 from data in table
14 Corresponding calculated free ionic silver 0.0004 µg/L
15 Corresponding calculated free ionic silver 0.00031 µg/L
16 Probably expressed as AgNO3
17 corresponding free ionic silver 0.0083 µg/L
18 corresponding free ionic silver 0.0036 µg/L
19 corresponding free ionic silver 0.0032 µg/L
20 Cited values from unpublished data
21 Value originates from Klein-MacPhee et al., 1984 and is cited by Hogstrand and Wood, 1998
22 2-generation study
23 Key study in REACH dossier
24 EC10 and EC50 calculated from data in article using Graphpad
25 Organisms were fed during the study
26 EC10 calculated form data in table

Toxicity of silver to birds/mammals.

Species	Species properties (age, sex)	Test compound	Purity [%]	Application route	Exp. time	Criterion	Test endpoint	Value mg Ag/kg diet	Ri	Notes	Reference
Birds											
No data											
Mamalia											
Dog		AgS2O3		diet	90 d	LOEC	pigment deposit	455	2	9	Ctgb 2004
Guinea pig		AgNO3		dermal	8 w	NOEC	mortality	2743	4	5,12	Wahlberg 1965 in Ratte et al. 1999
Guinea pig		AgNO3		dermal	8 w	NOEC	weight	2743	4	5,12	Wahlberg 1965 in Ratte et al. 1999
Mouse	10-12 weeks	AgNO3		drinking water	14 d	NOEC	health	≥ 0.06	2	3,14,16	Pelkonen et al 2003
Mouse		AgNO3/AgCl		oral	37 w	NOEC	behaviour	150	4	8,12	Rungby and Danscher 1984 in Ratte et al. 1999
Mouse		AgNO3		drinking water	125 d	NOEC	reduced activity	< 286	2	5,14,16	Rungby and Danscher 1984
Rabbit		AgNO3		diet	30 d	NOEC		≥ 4-5	2	1,14	Jones and Bailey 1974
Rabbit		AgI		diet	30 d	NOEC		≥ 10	2	1,14	Jones and Bailey 1974
Rabbit	8-10 months	AgNO3		oral	30 d	NOEC	mortality	162	3	6	Tamimi et al. 1998
Rabbit	8-10 months	AgNO3		oral	30 d	NOEC	diarrhea	< 10	3	6	Tamimi et al. 1998
Rat	10-12 months	AgNO3		oral	30 d	NOEC	mortality	≥ 975	3	6	Tamimi et al. 1998
Rat	10-12 months	AgNO3		oral	30 d	NOEC	diarrhea	16,2	3	6	Tamimi et al. 1998
Rat		AgNO3		oral	14 d	NOEC	mortality	3624	4	5,10,12	Walker 1971 in Ratte et al. 1999
Rat				oral	4 d	NOEC	mortality	33600	4	5,12	Dequidt et al 1974 in Ratte et al. 1999
Rat		AgNO3		oral	37 w	NOEC	weight	4444	4	5,10,12	Matuk et al 1981 in Ratte et al. 1999
Rat		AgS2O3		gavage	90 d	NOEC	pigment deposit	130	2	5	Ctgb 2004
Rat		AgS2O3		gavage	2 gen	NOEC	maternal body weight	130	2	5	Ctgb 2004

Rat		AgS2O3	gavage	day 6-20 of gestation	NOEC	foetal development	130	2	5	Ctgb 2004
Rat		AgNO3	drinkingwater	37 w	NOEC	body weight/mortality	< 3810	2	5,11,14,15	Matuk et al 1981
Rat	8 weeks	AgNO3	drinkingwater	81 w	NOEC	clinical condition	< 3112	2	5,13,14,15	Walker 1971
Rat	8 weeks	AgNO3	drinkingwater	12 w	NOEC	clinical condition	1556	2	5,13,15	Walker 1971
Rat		colloidal	oral	4 d	NOEC	mortality	< 33600	2	5,14	Dequidt et al 1974

Notes birds and mammals

1 Study examined the effect of silver on the cecal flora, no population relevant effects are reported

2 Studies with nanosilver have been added to the table for the purpose of comparison because of the limited available studeis with "ionic" silver

3 Conversion from waterconcentration to food concentration based on waterconsumption equal to foodconsumption

4 The AgNO3 was supplied in a mouthwash, controls with placebo mouthwash were performed

5 Recalculated from mg/kg bw/d using an conversionfactor of 20

6 Recalculated from mg/kg bw/d using an conversionfactor of 33.3

7 Exposure consisted fo swabbing the oral cavity, consumption is not excluded and the actual intake is unknown. In the study is stated that the effects could also be subscribed to the nitrate

8 Recalculated from mg/kg bw/d using an conversionfactor of 8.3

9 Recalculated from mg/kg bw/d using an conversionfactor of 40

10 NOAEL was given for dry weight, this NOEC could not be reproduced from the original paper

11 Recalculated from a water concentration of 0.25% silvernitrate

12 unclear if concentration is expressed as Ag of as the salt

13 Recalculated from a water concentration of 12 mM silvernitrate

14 only one concentration tested

15 An average daily waterconsumption for rats of 120 ml/kgbw/d has been used for recalculation (value is based on Niethammer and Krapp (1978, EFSA guidance on birds and mammals and the website research.uiowa.edu/anima which cite from from Harkness JE, Wagner JE 1989, The Biology and Medicine of Rabbits and Rodents; 3rd Edition, Lea and Febiger, Philadelphia)

16 An average daily waterconsumption for mice of 230 ml/kgbw/d has been used for recalculation (value is based on the EFSA guidance on birds and mammals)

Recalculated from a water concentration of 0.015% silvernitrate

Salinity Seawater
(Joop Bakker, Waterdienst: Grasshoff, 1976)

	mg/L	ratio to salinity	Totale saliniteit 34 promille
Cl-	18800	0,5527	
Na	10770	0,3078	
Ca	412	0,01175	
Mg	1290	0,03697	
SO4	2711	0,07747	
K	380	0,00114	
Br	67	0,00192	

References

Bard CC, Murphy JJ, Stone DL, Terhaar CJ. 1976. Silver in photoprocessing effluents. Journal of the Water Pollution Control Federation. 48: 389-394.
Berry WJ, Cantwell MG, Edwards PA, Serbst JR, Hansen DJ. 1999. Predicting toxicity of sediments spiked with silver. Environmental Toxicology and Chemistry. 18: 40-48.
Bianchini A, Bowles KC, Brauner CJ, Gorsuch JW, Kramer JR, Wood CM. 2002a. Evaluation of the effect of reactive sulfide on the acute toxicity of silver (I) to Daphnia magna. Part 2: Toxicity results. Environmental Toxicology and Chemistry. 21: 1294-1300.
Bianchini A, Grosell M, Gregory SM, Wood CM. 2002b. Acute silver toxicity in aquatic animals is a function of sodium uptake rate. Environmental Science and Technology. 36: 1763-1766.
Bianchini A, Wood CM. 2002. Physiological effects of chronic silver exposure in Daphnia magna. Comparative Biochemistry and Physiology - C Toxicology and Pharmacology. 133: 137-145.
in Daphnia magna? A critical assessment of the acute-to-chronic toxicity ratio for silver. Ecotoxicology and Environmental Safety. 71: 32-40.
Bielmyer GK, Bell RA, Klaine SJ. 2002. Effects of ligand-bound silver on Ceriodaphnia dubia. Environmental Toxicology and Chemistry. 21: 2204-2208.
study of the acute biotic ligand model for silver. Environmental Toxicology and Chemistry. 26: 2241-2246.
Birge WJ, Zuiderveen JA. 1995. The comparative toxicity of silver to aquatic biota. In: Andren AW, Bober TW (Eds.) 3rd Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.
to Hyalella azteca at two levels of water hardness. Environmental Toxicology and Chemistry. 24: 641-652.
Brauner CJ, Wilson J, Kamunde C, Wood CM. 2003. Water chloride provides partial protection during chronic exposure to waterborne silver in rainbow trout (Oncorhynchus mykiss) embryos and larvae. Physiological and Biochemical Zoology. 76: 803-815.
development in rainbow trout (Oncorhynchus mykiss) embryos and larvae, in the presence and absence of added dissolved organic matter. Comparative Biochemistry and Physiology - C Toxicology and Pharmacology. 133: 161-173.
exposure on growth, survival, and sublethal indicators of toxicity in early life stages of rainbow trout (Oncorhynchus mykiss). Journal of Comparative Physiology B: Biochemical, Systemic, and Environmental Physiology. 172: 153-162.
Breteler RJ, Williams JW, Buhl RL. 1982. Measurement of chronic toxicity using the opossum shrimp Mysidopsis bahia. Hydrobiologia. 93: 189-194.
Bringmann G, Kühn R. 1977. Grenzwerte der Schadwirkung wassergefaehrdender Stoffe gegen Bakterien (Pseudomonas putida) und Gruenalgen (Scenedesmus quadricauda) im Zellvermehrungshemmtest. Zeitschrift für Wasser-Abwasser-Forschung. 10: 87-98.
Blaualgen (Microcystis aeruginosa) und Gruenalgen (Scenedesmus quadricauda) im Zellvermehrungshemmtest. Vom Wasser. 50: 45-60.
Bringmann G, Kühn R. 1980a. Bestimmung der biologischen Schadwirkung wassergefährdender Stoffe gegen Protozoen II. Bakterienfressende Ciliaten. Z. Wasser Abwasser Forsch. `1: 26-31.
Bringmann G, Kühn R. 1980b. Comparison of the toxicity thresholds of water pollutants to bacteria, algae, and protozoa in the cell multiplication inhibition test. Water Research. 14: 231-241.
Bronk BV, Li ZZ, Czégé J. 2001. Polarized light scattering as a rapid and sensitive assay for metal toxicity to bacteria. Journal of Applied Toxicology. 21: 107-113.
Effects of laboratory test conditions on the toxicity of silver to aquatic organisms. In: Andren AW, Bober TW (Eds.) 2nd Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.

Brown BT, Rattigan BM. 1979. Toxicity of soluble copper and other metal ions to *Elodea canadensis*. Environmental Pollution. 303-314.
Buikema Jr AL, Cairns J, Sullivan GW. 1974. Evaluation of Philodina Acuticornis (Rotifera) as a Bioassay Organism for Heavy Metals. Water Resources Bulletin. 10: 648-661.
on silver toxicity: Comparison between rainbow trout and fathead minnows. Environmental Toxicology and Chemistry. 18: 56-62.
how water chemistry influences silver toxicity to invertebrates. Comparative Biochemistry and Physiology - C Toxicology and Pharmacology. 133: 259-270.
Calabrese A, Collier RS, Nelson DA, MacInnes JR. 1973. The toxicity of heavy metals to embryos of the American oyster *Crassostrea virginica*. Marine Biology. 18: 162-166.
growth, bioaccumulation and histopathology in the blue mussel Mytilus edulis. Marine Environmental Research. 11: 253-274.
Calabrese A, MacInnes JR, Nelson DA, Miller JE. 1977. Survival and growth of bivalve larvae under heavy metal stress. Marine Biology. 41: 179-184.
Calabrese A, Nelson DA. 1974. Inhibition of embryonic development of the hard clam, *Mercenaria mercenaria*, by heavy metals. Bulletin of Environmental Contamination and Toxicology. 11: 92-97.
Silver toxicity to Chironomus tentans in two freshwater sediments. Environmental Toxicology and Chemistry. 18: 30-39.
Erratum: Toxicity of silver in water and sediment to the freshwater amphipod Hyalella azteca (Environmental Toxiciology and Chemistry (2006) 25 (1802-1808)). Environmental Toxicology and Chemistry. 25: 2551.
Toxicity of silver in water and sediment to the freshwater amphipod Hyalella azteca. Environmental Toxicology and Chemistry. 25: 1802-1808.
Çeçen F, Semerci N, Geyik AG. 2010. Inhibition of respiration and distribution of Cd, Pb, Hg, Ag and Cr species in a nitrifying sludge. Journal of Hazardous Materials. 178: 619-627.
Chae YJ, Pham CH, Lee J, Bae E, Yi J, Gu MB. 2009. Evaluation of the toxic impact of silver nanoparticles on Japanese medaka (Oryzias latipes). Aquatic Toxicology. 94: 320-327.
Chen SY, Lin JG. 2009. Enhancement of metal bioleaching from contaminated sediment using silver ion. Journal of Hazardous Materials. 161: 893-899.
Choi O, Hu Z. 2008. Size dependent and reactive oxygen species related nanosilver toxicity to nitrifying bacteria. Environmental Science and Technology. 42: 4583-4588.
Choi O, Hu Z. 2009. Nitrification inhibition by UVA photocatalytic TiO2 nanoparticles: The role of reactive oxygen species on Nanotoxicity.
Coglianese MP. 1982. The effects of salinity on copper and silver toxicity to embryos of the pacific oyster. Archives of Environmental Contamination and Toxicology. 11: 297-303.
embryonic development of the pacific oyster, *Crassostrea gigas*. I. The toxicity of copper and silver. Marine Environmental Research. 5: 13-27.
Coleman RL, Cearley JE. 1974. Silver toxicity and accumulation in largemouth bass and bluegill. Bulletin of Environmental Contamination and Toxicology. 12: 53-61.
development of the marine gastropod mollusk, (Ilyanassa obsoleta Say). Bulletin of Environmental Contamination and Toxicology. 41: 79-85.
Ctgb. 2004. Toelating zilverthiofosfaat. Wageningen, the Netherlands: Ctgb.
Cunningham JH, Cunningham C, Van Aken B, Lin LS. 2008. Feasibility of disinfection kinetics and minimum inhibitory concentration determination on bacterial cultures using flow cytometry.
da Cruz ACS, Couto BC, Nascimento IA, Pereira SA, Leite MBNL, Bertoletti E, Zagatto P. 2007. Estimation of the critical effect level for pollution prevention based on oyster embryonic development toxicity test: The search for reliability. Environment International. 33: 589-595.
Water Research. 12: 113-117.
assessed by three bioluminescence-based assays using marine organisms. Environmental Toxicology. 19: 161-178.

early life stages of rainbow trout (Oncorhynchus mykiss). Environmental Toxicology and Chemistry. 26: 1717-1725.

derivatives. I. Localization and elimination. Bulletin de la Societe de Pharmacie de Lille. No. 1: 23-35.

Diamond JM, Koplish DE, McMahon Iii J, Rost R. 1997. Evaluation of the water-effect ratio procedure for metals in a riverine system. Environmental Toxicology and Chemistry. 16: 509-520.

the New River, Virginia, using representative species. Environmental Toxicology and Chemistry. 9: 1425-1434.

sea urchin sperm bioassays to metals and pesticides. Archives of Environmental Contamination and Toxicology. 18: 748-755.

Elnabawary MT, Welter AN, Robideau RR. 1986. Relative sensitivity of three daphnid species to selected organic and inorganic chemicals. Environmental Toxicology and Chemistry. 5: 393-398.

of laboratory test conditions on the toxicity of silver to aquatic organisms. Environmental Toxicology and Chemistry. 17: 572-578.

Ewell WS, Gorsuch JW, Ritter M, Ruffing CJ. 1993. Ecotoxicological effects of silver compounds. In: Andren AW, Bober TW (Eds.) 1st Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.

exposure of gametes, embryos, and larvae to silver. Archives of Environmental Contamination and Toxicology. 13: 641-646.

growth: Effect of pH, concentration, and organic matter. Environmental Science and Technology. 43: 7285-7290.

Influence of salinity on toxicity and silver speciation. Environmental Toxicology and Chemistry. 17: 589-593.

performed with two organisms (Daphnia magna and Lactuca sativa). Archives of Environmental Contamination and Toxicology. 50: 196-204.

Fulladosa E, Murat JC, Martínez M, Villaescusa I. 2005. Patterns of metals and arsenic poisoning in Vibrio fischeri bacteria. Chemosphere. 60: 43-48.

of commercial nanoparticles against an environmental soil microbe, Pseudomonas putida KT2440. Journal of Biological Engineering. 3.

chronic low level exposure of waterborne silver. Comparative Biochemistry and Physiology - C Pharmacology Toxicology and Endocrinology. 119: 131-137.

modifying the acute toxicity of silver to rainbow trout (Oncorhynchus mykiss). Environmental Toxicology and Chemistry. 16: 2363-2368.

Galvez F, Wood CM. 2002. The mechanisms and costs of physiological and toxicological acclimation to waterborne silver in juvenile rainbow trout (Oncorhynchus mykiss). Journal of Comparative Physiology B: Biochemical, Systemic, and Environmental Physiology. 172: 587-597.

silver toxicity to Daphnia magna: Effect of source and equilibration time. Environmental Toxicology and Chemistry. 24: 2934-2940.

differences in silver toxicity amelioration by natural organic matter to Daphnia magna. Environmental Toxicology and Chemistry. 24: 2941-2947.

species on toxicity of metallic nanomaterials in aquatic organisms. Environmental Toxicology and Chemistry. 27: 1972-1978.

Grosell M, Hogstrand C, Wood CM, Hansen HJM. 2000. A nose-to-nose comparison of the physiological effects of exposure to ionic silver versus silver chloride in the European eel (*Anguilla anguilla*) and the rainbow trout (*Oncorhynchus mykiss*). Aquatic Toxicology. 48: 327-342.

european eel (*Anguilla anguilla*). In: Andren AW, Bober TW (Eds.) 5th Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.

survival, and silver distribution within developing rainbow trout (Oncorhynchus mykiss) embryos. Environmental Toxicology and Chemistry. 20: 553-560.

Gubbins EJ, Batty LC, Lead JR. 2011. Phytotoxicity of silver nanoparticles to *Lemna minor* L. Environmental Pollution. 159: 1551-1559.
Gupta A, Maynes M, Silver S. 1998. Effects of halides on plasmid-mediated silver resistance in Escherichia coli. Applied and Environmental Microbiology. 64: 5042-5045.
Toxicology. 17: 66-73.
Hiriart-Baer VP, Fortin C, Lee D-Y, Campbell PGC. 2006. Toxicity of silver to two freshwater algae, *Chlamydomonas reinhardtii and Pseudokirchneriella subcapitata,* grown under continuous culture conditions: Influence of thiosulphate. Aquatic Toxicology. 78: 136-148.
induction in freshwater rainbow trout during exposure to different silver salts. Environmental Toxicology and Chemistry. 15: 1102-1108.
and toxicity of silver in fish: Implications for water quality criteria. Environmental Toxicology and Chemistry. 17: 547-561.
Holcombe GW, Phipps GL, Fiandt JT. 1983. Toxicity of selected priority pollutants to various aquatic organisms. Ecotoxicology and Environmental Safety. 7: 400-409.
Holcombe GW, Phipps GL, Sulaiman AH, Hoffman AD. 1987. Simultaneous multiple species testing: Acute toxicity of 13 chemicals to 12 diverse freshwater amphibian, fish, and invertebrate families. Archives of Environmental Contamination and Toxicology. 16: 697-710.
pathways and implications for toxicity testing. Environmental Toxicology and Chemistry. 20: 568-574.
Hsieh CY, Tsai MH, Ryan DK, Pancorbo OC. 2004. Toxicity of the 13 priority pollutant metals to Vibrio fisheri in the Microtox® chronic toxicity test. Science of the Total Environment. 320: 37-50.
Hutchinson TC, Czyrska H. 1975. Heavy metal toxicity and synergism to floating aquatic weeds. Verh. Internat. Verein. Limnol. 19: 2102-2111.
Hwang MG, Katayama H, Ohgaki S. 2006. Accumulation of copper and silver onto cell body and its effect on the inactivation of Pseudomonas aeruginosa.
INERIS. 2006. Argent. Verneuil en Halatte: Institut National de l'EnviRonnement industriel et des rISques (INERIS). Report no. draft.
and Soil Pollution. 3: 353-363.
water quality on silver toxicity to rainbow trout (Oncorhynchus mykiss), fathead minnows (Pimephales promelas), and water fleas (Daphnia magna). Environmental Toxicology and Chemistry. 18: 63-70.
Khangarot BS. 1991. Toxicity of metals to a freshwater tubificid worm, Tubifex tubifex (Muller). Bulletin of Environmental Contamination and Toxicology. 46: 906-912.
ostracod, Cypris subglobosa Sowerby, 1840 and correlation to EC50 values of other test models. Journal of Hazardous Materials. 172: 641-649.
Khangarot BS, Ray PK. 1987. Sensitivity of toad tadpoles, Bufo melanostictus (Schneider), to heavy metals. Bulletin of Environmental Contamination and Toxicology. 38: 523-527.
Khangarot BS, Ray PK. 1988a. The acute toxicity of silver to some freshwater fishes. Acta Hydrochimica et Hydrobiologica. 16: 541-545.
Khangarot BS, Ray PK. 1988b. Sensitivity of freshwater pulmonate snails, *Lymnaea luteola* L., to heavy metals. Bulletin of Environmental Contamination and Toxicology. 41: 208-213.
metals and their toxicity to the water flea Daphnia magna Straus. Ecotoxicology and Environmental Safety. 18: 109-120.
(Diptera chironomidae) to heavy metals. Bulletin of Environmental Contamination and Toxicology. 42: 325-330.
Himalayas. Part 5: Acute toxicity of selected heavy metals on the tadpoles of *Rana hexadactyla*. Acta Hydrochimica et Hydrobiologica. 13: 259-263.
sensitivity on the acute toxicity of silver to fathead minnows at various water quality parameters. In: Andren AW, Bober TW (Eds.) 4th Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wisconsin.

Klein-MacPhee G, Cardin JA, Berry WJ. 1984. Effect of silver on eggs and larvae of the winter flounder. Transactions of the American Fisheries Society. 113: 247-251.
Kolts JM, Boese CJ, Meyer JS. 2006. Acute toxicity of copper and silver to Ceriodaphnia dubia in the presence of food. Environmental Toxicology and Chemistry. 25: 1831-1835.
Kolts JM, Boese CJ, Meyer JS. 2009. Effects of dietborne copper and silver on reproduction by Ceriodaphnia dubia. Environmental Toxicology and Chemistry. 28: 71-85.
standard laboratory cladoceran food alters toxicity of waterborne silver to Ceriodaphnia dubia. Environmental Toxicology and Chemistry. 27: 1426-1434.
Laban G, Nies LF, Turco RF, Bickham JW, Sepúlveda MS. 2010. The effects of silver nanoparticles on fathead minnow (Pimephales promelas) embryos. Ecotoxicology. 19: 185-195.
Lapota D, Osorio AR, Liao C, Bjorndal B. 2007. The use of bioluminescent dinoflagellates as an environmental risk assessment tool. Marine Pollution Bulletin. 54: 1857-1867.
LeBlanc GA. 1980. Acute toxicity of priority pollutants to water flea (Daphnia magna). Bulletin of Environmental Contamination and Toxicology. 24: 684-691.
LeBlanc GA. 1984. Interspecies relationships in acute toxicity of chemicals to aquatic organisms. Environmental Toxicology and Chemistry. 3: 47-60.
LeBlanc GA, Mastone JD, Paradice AP. 1984. The influence of speciation on the toxicity of silver to fathead minnow (Pimephales promelas). Environmental Toxicology and Chemistry. 3: 37-46.
two green algae, *Pseudokirchneriella subcapitata* and *Chlamydomonas reinhardtii* . aquatic Toxicology. 75: 127-135.
Lima AR, Curtis C, Hammermeister DE. 1982. Acute toxicity of silver to selected fish and invertebrates. Bulletin of Environmental Contamination and Toxicology. 29: 184-189.
Luoma SN, Ho YB, Bryan GW. 1995. Fate, bioavailability and toxicity of silver in estuarine environments. Marine Pollution Bulletin. 31: 44-54.
Lussier SM, Gentile JH, Walker J. 1985. Acute and chronic effects of heavy metals and cyanide on Mysidopsis bahia (Crustacea:Mysidacea. Aquatic Toxicology. 7: 25-35.
of reactive sulfide on the acute toxicity of silver to rainbow trout (Oncorhynchus mykiss). Environmental Toxicology and Chemistry. 23: 1204-1210.
ionoregulatory effects in American red crayfish (Procambarus clarkii). Environmental Toxicology and Chemistry. 23: 388-395.
Martin M, Osborn KE, Billig P, Glickstein N. 1981. Toxicities of ten metals to Crassostrea gigas and Mytilus edulis embryos and Cancer magister larvae. Marine Pollution Bulletin. 12: 305-308.
Martin TR, Holdich DM. 1986. The acute lethal toxicity of heavy metals to peracrid crustaceans (with particular reference to fresh-water asellids and gammarids). Water Research. 20: 1137-1147.
zeolite and its comparison with that of silver nitrate. Applied and Environmental Microbiology. 69: 4278-4281.
Matuk Y, Ghosh M, McCulloch C. 1981. Distribution of silver in the eyes and plasma proteins of the albino rat. Canadian Journal of Ophthalmology. 16: 146-150.
Metayer C, Amiard-Triquet C, Baud JP. 1990. Species-related variations of silver bioaccumulation and toxicity to three marine bivalves. Water Research. 24: 995-1001.
silver engineered nanoparticles and detoxification by exopolymeric substances. Environmental Pollution. 157: 3034-3041.
Morgan TP, Guadagnolo CM, Grosell M, Wood CM. 2005. Effects of water hardness on toxicological responses to chronic waterborne silver exposure in early life stages of rainbow trout (Oncorhynchus mykiss). Environmental Toxicology and Chemistry. 24: 1642-1647.
toxicity in the freshwater rainbow trout: Support for the acute silver biotic ligand model. Environmental Toxicology and Chemistry. 23: 1261-1267.
Mount DI, Norberg TJ. 1984. A seven-day life-cycle cladoceran toxicity test. Environmental Toxicology and Chemistry. 3: 425-434.

Stubblefield WA. 2007. Comparison of short-term chronic and chronic silver toxicity to fathead minnows in unamended and sodium chloride-amended waters. Environmental Toxicology and Chemistry. 26: 1922-1930.
sensitivity of *Lemna paucicostata* to heavy metals. Archives of Environmental Contamination and Toxicology. 10: 159-169.
Naumann B, Eberius M, Appenroth K-J. 2007. Growth rate based dose-response relationships and EC-values of ten heavy metals using the duckweed growth inhibition test (ISO 20079) with *Lemna minor* L. clone St. Journal of Plant Physiology. 164: 1654-1664.
Toxicity of silver nanoparticles to Chlamydomonas reinhardtii. Environmental Science and Technology. 42: 8959-8964.
Nebeker AV. 1982. Evaluation of a Daphnia magna renewal life-cycle test method with silver and endosulfan. Water Research. 16: 739-744.
rainbow trout, fathead minnows and Daphnia magna. Environmental Toxicology and Chemistry. 2: 95-104.
Nelson DA, Calabrese A, Greig RA, Yevich PP, Chang S. 1983. Long-term silver effects on the marine gastropod *Crepidula fornicata*. Marine Ecology - Progress Series. 12: 155-165.
heavy metals on juvenile bay scallops, *Argopecten irradians*, in short-term exposures. Bulletin of Environmental Contamination and Toxicology. 16: 275-282.
blue mussels in acute and long-term exposures. Archives of Environmental Contamination and Toxicology. 17: 595-600.
Norberg-King TJ. 1989. An evaluation of the fathead minnow seven-day subchronic test for estimating chronic toxicity. Environmental Toxicology and Chemistry. 8: 1075-1089.
Oreochromis niloticus following prolonged metal (Ag, Cd, Cr, Cu, Zn) exposures. Environmental Toxicology and Chemistry. 27: 360-366.
and non-enzymatic indicators in the liver of Oreochromis niloticus. Bulletin of Environmental Contamination and Toxicology. 82: 317-321.
Ownby DR, La Point TW, Cobb GP. 2001. Silver size fractionation in aqueous toxicity test solutions. Toxicological and Environmental Chemistry. 81: 29-41.
Acartia tonsa: Influence of salinity and food. Environmental Toxicology and Chemistry. 26: 2158-2165.
Pelkonen KHO, Heinonen-Tanski H, Hänninen OOP. 2003. Accumulation of silver from drinking water into cerebellum and musculus soleus in mice. Toxicology. 186: 151-157.
ionic silver: Discrepancies among model predictions, measured concentrations and mortality. Chemosphere. 46: 1141-1146.
data across two levels of biological organization. Environmental Toxicology and Chemistry. 25: 589-596.
Ratte HT. 1999. Bioaccumulation and toxicity of silver compounds: A review. Environmental Toxicology and Chemistry. 18: 89-108.
Rodgers JH, Deaver E, Rogers P. 1994. Evaluations of the bioavailability and toxicity of silver in sediment. In: Andren AW, Bober TW (Eds.) 2nd Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.
compounds: Laboratory studies with freshwater species. Bulletin of Environmental Contamination and Toxicology. 58: 851-858.
Toxicologica. 55: 398-401.
Schmittschmitt JP, Shaw JR, Birge WJ. 1996. The effects of silver on green algae and prospects for trophic transfer. In: Andren AW, Bober TW (Eds.) 4th Argentum international conference on the transport, fate and effects of silver in the environment. Madison, University of Wiscosin.
(Oligocottus maculosus): Effects of salinity and ammonia. Environmental Toxicology and Chemistry. 17: 594-600.

Stokes PM, Hutchinson TC, Krauter K. 1973. Heavy metal tolerance in algae isolated from contaminated lakes near Sudbury, Ontario. Canadian Journal of Botany. 51: 2155-2168.
antismoking mouthwash 881010 in rats and rabbits. Journal of Toxicology and Environmental Health - Part A. 53: 47-60.
Bulletin. 8: 40-41.
of abscission in fronds of *Lemna minor* L. and the effect of silver ions. Plant Biology (New York). 13: 517-523.
US-EPA. 1980. Ambient water quality criteria for silver. Washington: US- Environmental Protection Agency. Report no. EPA-440/5-80-071.
boron, silver, titanium, tellurium, uranium and organosilicon compounds in the framework of EU Directive 76/464/EEC. Bilthoven, The Netherlands: National Institute of Public Health and the Environment (RIVM). Report no. 601501005.
source on silver toxicity to *Pimephales promelas*. Environmental Toxicology and Chemistry. 22: 2746-2751.
aquatic dipterian larvae with reference to temperature variation. Bulletin of Environmental Contamination and Toxicology. 80: 516-520.
Vijayavel K. 2010. Water chemistry influences the toxicity of silver to the green-lipped mussel Perna viridis. Environmental Monitoring and Assessment. 167: 289-295.
Vijayavel K, Gopalakrishnan S, Balasubramanian MP. 2007a. Sublethal effect of silver and chromium in the green mussel Perna viridis with reference to alterations in oxygen uptake, filtration rate and membrane bound ATPase system as biomarkers. Chemosphere. 69: 979-986.
Vijayavel K, Gopalakrishnan S, Chezhian A, Balasubramanian MP. 2007b. Biochemical constituents and bioaccumulation as biomarkers in the green mussel Perna viridis with reference to silver and chromium toxicity. Toxicological and Environmental Chemistry. 89: 353-361.
Voyer RA, Cardin JA, Heltshe JF, Hoffman GL. 1982. Viability of embryos of the winter flounder Pseudopleuronectes americanus exposed to mixtures of cadmium and silver in combination with selected fixed salinities. Aquatic Toxicology. 2: 223-233.
Walker F. 1971. Experimental argyria: a model for basement membrane studies. British Journal of Experimental Pathology. 52: 589-593.
JW. 2006a. Influence of salinity and organic carbon on the chronic toxicity of silver to mysids (Americamysis bahia) and silversides (Menidia beryllina). Environmental Toxicology and Chemistry. 25: 1809-1816.
Americamysis bahia. Comparative Biochemistry and Physiology - C Toxicology and Pharmacology. 133: 75-86.
Ward TJ, Kramer JR, Boeri RL, Gorsuch JW. 2006b. Chronic toxicity of silver to the sea urchin (Arbacia punctulata). Environmental Toxicology and Chemistry. 25: 1568-1573.
Spermiotoxicity and embryotoxicity of heavy metals in the echinoid Paracentrotus lividus. Environmental Toxicology and Chemistry. 15: 1931-1936.
Williams PL, Dusenbery DB. 1990. Aquatic toxicity testing using the nematode, *Caenorhabditis elegans*. Environmental Toxicology and Chemistry. 9: 1285-1290.
Davies PH, Gorsuch JW, Hogstrand C, Mahony JD, McGeer JC, O'Connor TP. 2002. Biological Effects of Silver. IN Andren AW, Bober TW (Eds.) Silver in the Environment: Transport, Fate and Effects. Pensacola, Florida, USA, SETAC.
Xu QS, Hu JZ, Xie KB, Yang HY, Du KH, Shi GX. 2010. Accumulation and acute toxicity of silver in Potamogeton crispus L. Journal of Hazardous Materials. 173: 186-193.
Yang HC, Pon LA. 2003. Toxicity of metal ions used in dental alloys: A study in the yeast Saccharomyces cerevisiae. Drug and Chemical Toxicology. 26: 75-85.
crab scylla serrata as a sensitive toxicity test for metal exposures. Archives of Environmental Contamination and Toxicology. 58: 96-104.

Zoto GA, Robinson WE. 1985. The toxicity of one-hour silver exposures to early-life stages of the surf clam Spisula solidissima (Dillwyn). Marine Environmental Research. 16: 61-75.