TABLE 1
Table 1A. Chronic Population-Level Effects of NPE, NPEC, and NP to Aquatic Organisms.
All units in μg/L unless otherwise specified.

Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
	Fish and Amphibians				
NPE-18	Sheepshead minnow (M) *Cyprinodon variegatus*	70-d FT, partial life cycle, sub-adults (F0) allowed to mature then bred, breeding trials and hatching trials were conducted in clean water, 40 fish per each of two replicates, spawning groups of 2 males and 5 females per replicates, 50 eggs used for hatching trials from each replicate, 50 fry from each replicate monitored for 7 days for survivability, mean measured concentrations were 72 to 103% of nominal for Ex 1 and 75 to 86% of nominal for Ex 2, Ex 1: 0, 900, 1870, 3890, 8700, 20500 μg/L, Ex 2: 0, <50, <50, 750, 4200, 8600 μg/L	Ex 1: F0 adult survival: 1870 (3890) F0 growth: 3890 (8700) F0 egg production: (900), F1 hatch: 900 (1870) F1 survival: 3890 (8700) Ex 2: F0 adult survival: 4200 (8600) F0 growth: 4200 (8600) F0 egg production: 8600 F1 hatch: 750 (4200) F1 survival: 8600	Ex 1: 1,2,3,4,5,6 valid Ex 2: 1,2,3,4,5,6 valid	Johnson et al. (2001)
NPE-9	Fathead minnow (F) *Pimephales promelas*	7-d, R, unspecified concentrations, USEPA methods, specific test conditions given, 1-d old fish used, non-GLP	Mortality: 1800 (2000) growth: 1000 (2000)	2,3,4,5, valid with restrictions, uncertainties in methods	Dorn et al. (1993)
NPE-9	Fathead minnow (F) *P. promelas*	42-d, FT, 0, 0.21, 0.65, 2.1, 7.9 μg/L NPE-9, breeding trials with 3 males and females in each of 3 replicates per test concentration	Mortality: 7.9 fecundity: 7.9	1,2,3,4,5,6 valid	Nichols et al. (2001)

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NPE-2 NPEC-1 NP	Rainbow trout (F) *O. mykiss*	Ex 1: 108-d FT (22-d exposure), female juvenile fish, 0, 1, 10, 50 μg/L, concentrations unmeasured Ex 2: 466-d FT (31-d exposure), female juvenile fish, 0, 1, 10, 30 μg/L, concentrations unmeasured	Stability of test concentrations unknown, inconsistent in direction and small (<10%) variations in weight and length observed, use of a serial sampling scheme questioned by authors	1,3 not valid	Ashfield et al. (1998)
NP	Rainbow trout (F) *O. mykiss*	18-week, FT, female 2-y old fish, mean measured concentrations of 0.7, 8.3, 85.6 μg/L	Survival: 85.6	1,2,3,5,6 valid	Harris et al. (2001)
NP	Rainbow trout (F) *O. mykiss*	90-d, FT, ELS test, fertilized eggs allowed to hatch (~day 34) grow out until day 90, two replicates for each concentration, measured test concentrations of 0, 6.0, 10.3, 23.1, 53.0, 114 μg/L, ASTM and USEPA methods	Mortality: 10.3 (23.1) hatch success: 114 growth: 6.0 (10.3)	1,2,3,4,5,6 valid	Brooke (1993a)
NP	Rainbow trout (F) *O. mykiss*	1 year exposure during embryonic, larval, and juvenile stages, FT, mean measured concentrations of 0, 1.05, 10.17 μg/L, endpoints were survival, hatch rate, weight, sex ratio	No effects at either concentration for any endpoint	1,2,3,5,6 valid	Ackermann et al. (2002)
NP	Rainbow trout (F) *O. mykiss*	5-d, FT, juveniles ave. 14 cm length, 40 and 80 μg/L, then behavior assessment (swimming speed, shoal cohesion, aggression, foraging success, reaction to simulated predator attack)	No replicates, no analytical	1,3,5,6 not valid	Ward et al. (2006)
NP	Rainbow trout *O. mykiss*	10-d per month intermittent exposure of 1,	F1 eyed-egg stage mortality (>10%): 1 (10)	1,2,3,5,6 valid	Schwaiger et al. (2002)

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		10 μg/L for 4 months; eggs and sperm collected, eggs fertilized and grown out to maturity in clean water (3 y); F1 mortality (>10%) of eyed-egg stage larvae, F1 mortality between eyed-egg state and hatching, hatching success, F1 sex ratio	F1 mortality (>10%) between eyed-egg stage and hatch: 10 F1 Hatching success: 1 (10) F1 Sex ratio: 10		
NP	Fathead minnow (F) *P. promelas*	42-d paired-breeding assay, 21-d clean water exposure, then 21-d exposure to NP at 0, 100 μg/L nominal (Ex 1) or 0, 1, 10, 100 μg/L nominal, replicate tanks, methanol cosolvent, concentrations measured at days 0 and 21, 48 to 99% nominal achieved, critical issue: authors state this may be insufficient for confidence in accuracy, study otherwise study well reported	Ex 1: mortality 71 growth: 71 fecundity: (71) Ex 2: mortality: 57.7 growth: 57.7 fecundity #eggs spawned: 8.1 (57.7) #spawnings: 0.65 (8.1) egg batch size: 8.1 (57.7)	1,3,4,5 valid with restrictions	Harries et al. (2000)
NP	Fathead minnow (F) *P. promelas*	33-d, FT, ELS test (growth measured at day 28), measured test concentrations, ASTM and USEPA methods	Mortality: 7.4 (14) length: 23	1,2,3,4,5,6 valid	Ward and Boeri (1991b)
NP	Fathead minnow (F) *P. promelas*	28-d, FT, ELS test, 20 4-week old fry per each of two replicates, measured test concentrations of 0, 9.3, 19.2, 38.1, 77.5, 193 μg/L, ASTM and USEPA methods	Survival: 77.5 (193) wet weights: 38.1 (77.5)	1,2,3,4,5,6 valid	Brooke (1993b)
NP	Fathead minnow (F) *P. promelas*	42-d, FT, measured test concentrations, adults exposed for 7-d, then breeding tiles added for 14 days (Ex 1=21 days), breeding tiles removed for 7 days, tiles added for 14	Ex 1: mortality: 3.4 inhibition of egg production per female:	Ex 1: 1,2,3,4,5 valid	Giesy et al. (2000)

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		days (Ex 2=2nd breeding period), Ex 1: 0, 0.05, 0.16, 0.40, 1.6, 3.4 μg/ L, Ex 2: 0, 0.09, 0.10, 0.33, 0.93, 2.4 μg/L	1.6 (3.4) solvent control egg production ceased at day 11 of breeding Ex II: complete inhibition of reproduction in solvent control makes it impossible to show effects due to NP	Ex 2: 1,2,3,4 not valid	
NP	Bluegill sunfish (F) *Lepomis macrochirus*	28-d, FT, 4-week old juveniles, mean measured concentrations of 0, 5.6, 12.4, 27.6, 59.5, 126 μg/L, ASTM and USEPA methods	Mortality: 59.5 (126) wet weight: 126	1,2,3,4,5,6 valid	Brooke (1993b)
NPE-9 NPE-4 NPE-1 NPEC1 NP	Japanese medaka (F) *Oryzias latipes*	100-d, R, NPE-9: 30 to 1000 μg/L, NPE-4: 10 to 1000 μg/L, NPE-1: 10 to 300 μg/L, NPEC1: 100 to 3000 μg/L, NP 1 to 100 μg/L, endpoints: survival, length, weight, sex ratio	For all endpoints: NPE-9: 1000 NPE-4: 1000 NPE-1: 300 NPEC1: 3000 NP: 100	1,2,3,5,6 valid	Balch and Metcalfe (2003)
NP	Japanese medaka *O. latipes*	30-d, FT, 5to 8 days post hatch fish exposed for 30 days followed by a 30 day grow out period, 0, 0.54, 0.77, 1.93 μg/L	Mortality: 1.93 growth: 1.93 sex differentiation: 1.93 egg production: 1.93 egg viability: 1.93 hatching success: 1.93	1,2,3,4,5,6 valid	Nimrod and Benson (1998)
NP	Japanese medaka *O. latipes*	90-d, R, 1-2 day post hatch fish, selected but only indirect analysis of test	40% control mortality invalidates this study	1,3,4,5 not valid	Gray and Metcalfe

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		concentrations, nominal 0, 10, 50, 100 μg/L			(1997)
NP	Japanese medaka *O. latipes*	14-d, R, males exposed then bred with unexposed females in clean water for 7-d, nominal concentrations only, acetone cosolvent, 0, 0.03, 0.10, 0.30 μM/L nominal or 0, 6.6, 20, 66 μg/L (NP mwt~220 g/mol)	Egg production: 66 hatching success: 66	1,3,5 valid with restrictions, no analytical	Shioda (2000)
NP	Japanese medaka *O. latipes*	1.5-generation, FT, <24-h embryos continuously exposed, raised to adults, bred, eggs hatched, raised for 60-d to sexual maturity, mean measured concentrations 0, 4.2, 8.2, 17.7, 51.5, 183 μg/L, several parameters (GSI, fecundity, fertility, F1 generation test) were only examined at lower concentrations due to the few number of surviving adults	F0 hatching: 51.5 (183) F0 time to hatch: 183 F0 swim-up success: 51.5 (183) F0 day 60 mortality: 8.2 (17.7) F0 sex ratio: 17.7 (51.5) F0 somatic growth: 51.5 (183) F0 egg production: 17.7 F0 fertility: 17.7 F1 hatchability: 17.7 F1 mortality: 17.7 F1 somatic growth: 17.7 F1 sex ratio: 8.2 (17.7)	1,2,3,4,5,6 valid	Yokota (2001)
NP	Japanese medaka (F) *O. latipes*	Fertilized eggs exposed until 60-dph, NP: 3.13 to 50 μg/L (measured); sex differentiation, mortality, growth (L, W); Measured concentrations	NP: Mortality: 44.7 Weight: 11.6 (23.5); Length: 23.5 (44.7); Sex ratio: 6.08 (11.6)	1,2,3,4,5,6 valid	Seki et al. (2003)
NP	Swordtail (F) *Xiphophorus helleri*	60-d, S, 20 juvenile fish per treatment, nominal concentrations only, 0, 0.2, 2.0, 20 μg/L; total body length and sword lengths	No confidence in concentrations as use of a 60-d static system	1,3 not valid	Kwak et al. (2001)

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		measured in males	invalidates this test		
NP	Zebrafish (F) *Danio rerio*	58-d R; 10, 100 μg/L (nominal); 2 dph until 60 dph; remaining fish held for 6 months, then breeding trials (3 reps of 15 trials); egg production, hatch, viability, swim up; GSI	<u>60-dph results</u>: Sex ratio: 10 (100) Mortality: 100 Length, weight: 100 CF: 10 (100) <u>240 dph reproduction</u> #successful trials, egg production, egg viability, hatch success: 100 Swim-up: 10 (100) Effects were reversible	1,3,5,6 valid with restrictions (no analytical)	Lin and Janz (2006)
NP	Zebrafish (F) *Danio rerio*	21-d, R, DMSO, adults exposed to 0.1 to 500 μg/L; GSI, afterwards males and females exposed to 0 and 50 μg/L NP crossbred for 7-d; eggshell thickness, fecundity, hatching rate, malformation of offspring	<u>After cross-breeding:</u> No effects on fecundity, or hatching in previously exposed males and females; embryo malformations increased	1,3,5,6 Valid with restrictions (no analytical)	Yang et al. (2006)
NP	Guppies (F) *Poecilia reticulata*	90-d, R, 100 μg/L only (nominal), 5-d post-birth fish; sex ratio, GSI, HSI; cross-breeding over next 5 months measuring sexual behavior and reproduction	<u>After 90-d:</u> No effect on mortality; sex ratio biased to female <u>After cross-breeding:</u> Male, but not female exposed fish paired with control fish had altered reproduction, but data not given	1,3,5 valid with restrictions no analytical, reproduction data not given	Cardinali et al. (2004)
NP	Atlantic cod (M) *Gadus morhua*	21-d, FT, 30 μg/L only; length, weight, HSI, CF, measured	<u>Cod:</u> No effects on growth	1,3,5,6 valid with	Martin-Skilton et

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
	Turbot (M) *Scophthalmus maximus*		<u>Turbot</u>: Length: no effect; Weight, CF: increased over controls	restrictions, single conc., no analytical	al. (2006)
NP	Marbled sole (M) *Pleuronectes yokohamae*	96-h acutes, SR, measured	NP was detected in controls	1,3,5,6 not valid	Kume et al. (2006)
NP	Sea bass (M) *Dicentrarchus labrax*	24-hour exposure to 871 μg/L (nominal) and DMSO, n = 5; LSI	Single concentration, no analytical, no replicates	1,3,5 not valid	Teles et al. (2004)
NP	Rare minnow (F) *Gobiocypris rarus*	28-d, FT, 3, 10, 30 μg/L; GSI, RSI, HSI, nominal	Mortality, growth	1,3,5,6 Valid with restrictions, unclear replication, no analytical	Zha et al. (2007)
NP	Atlantic salmon (M) *Salmo salar*	96-h, water, SR, 4 g juvenile salmon, n=3 per treatment, measured	96-h LC50 = 900 μg/L	Valid with restrictions, old method	McLeese et al. (1980)
NP	Atlantic salmon (M) *S. salar*	Water, SR and FT, 8 g juvenile salmon, n=3 per treatment, measured	96-h LC50s = 130 to 190 μg/L	Valid with restrictions, old method	McLeese et al. (1981)
NP	Atlantic salmon (M) *Salmo salar*	28-d feeding study, 5 month old juvenile salmon dosed via feed Feeding, 0.2 g fish (feeding) for 4 weeks at 300 and 1500 mg/kg, bw 7.5 g fish, injected 2-4 times over 17 d, total dose 80, 160 mg/kg, bw, no confirmation of	Sex ratio: 1500 mg/kg dw Injection part of study not valid	1,3,5 valid with restrictions, no analytical	Norrgren et al. (1999)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		feed concentrations			
NP	Atlantic salmon (M) *S. salar*		Retrospective look at potential for NP adjuvant use contributing to salmon population declines (1975-85)	Not assignable	Fairchild et al. (1999)
NP	Atlantic salmon (M) *S. salar*		Restating and adding to Fairchild et al. (1999) paper		Brown and Fairchild (2003)
NP	Atlantic salmon (M) *S. salar*	30-d aqueous exposure of ethanol and 5, 10, 15 and 20 μg/L, 12-h R, nominal only, endpoint was survival	Survival: 20 μg/L	3,5,6 valid with restrictions, no analytical	Moore et al. (2003)
NP	Atlantic salmon (M) *S. salar*	I.p. injection, 1 year old 29 g fish, 6 injections of 120 μg/g over 20 days, mortality, CF	Not valid as dosing was via injection, no analytical	1,3,5,6 Not valid	Madsen et al. (2004)
NP	Atlantic salmon (M) *S. salar*	Pulse doses of water-borne NP, drip renewal in fresh water, transferred to SW (Early, Mid, or Late in the month), 75-80 g 14 month old fish, 20 μg/L on days 1 and 5 (for 24 hours) three times in one month period, nominal	Early-exposed fish had Reduced weights Fish from the Mid and Late-exposed fish may have started to reverse the p-s transformation by being held in FW too long in the season	1,3,5,6 valid with restrictions, no analytical	Arsenault et al. (2004)
NP	Atlantic salmon (M) *S. salar*	I.p. injection, 25-50 g fish injected with 0.5 to 150 μg/g on four days, N	Not valid as dosing was via injection, no analytical	1,3,5,6 Not valid	McCormick et al. (2005)
NP	Atlantic salmon (M)	Water, FT, 10 and 100 μg/L, measured,	>50% mortality at 100	1,3,5,6	Lerner et al.

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	S. salar	mortality	μg/L Mean measured NP concentrations were 6.5 and 80 μg/L	valid with restrictions	(2007b)
NP	Chinook salmon (M) *Oncorhynchus tshawytscha*	29-d exposure, R, measured, grow-out period of 103 days post-hatch, egg through adult stages, endpoints: survival, sex ratio, gonad development	Survival: 10 sex ratio: 10	1,2,3,5,6 valid	Afonso et al. (2002)
NP	African clawed frog (F) *Xenopus laevis*	12-week, R, single replicate test systems, duplicate controls, tadpoles at developmental stage 38/40 (2 to 3 days post hatch), exposed until metamorphosis was accomplished in ~90% of all animals, nominal concentrations only, 0, 10^{-8}, 10^{-7} M (0, 2.2, 22 μg/L using a mwt of ~220 g/mol)	Temperature control vital influence on *Xenopus* development but design lacked temperature control; absence of explanation or discussion of temperature and of skewed control sex ratio invalidates study	3,5 not valid	Kloas et al. (1999)
NP	African clawed frog (F) *X. laevis*	Exposure from stage 10.5 (11-h) to stage 37 (49-h), 0.002 to 1000 μg/L, nominal-only, examined body shape, length, interocular distance	Body shape, length, interocular differences: 20 (100)	1,3,5,6 valid with restrictions, no analytical	Bevan et al. (2003)
NP	African clawed frog (F) *X. laevis*	96-h, S, normal cleavage embryos (n=24), 3-h post fertilization used, 200 to 11,000 μg/L; mortality, development, nominal	No replicates, no statistics in some cases, no analytical	1,3,5,6 Not valid, no replicates, no statistics in some cases, no analytical	Sone et al. (2004)

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NP	Bullfrog (F) *Rana catesbeiana*	7-d, SR, premetamorphic tadpoles, 3 replicates, 4 tadpoles per replicate; 234, 468, 936 μg/L (nominal); tail length, width, limb development, cranial transformation	Tail length: 468 (936) All other endpoints: 936	1,3,5,6 valid with restrictions, no analytical	Christensen et al. (2005)
NP	Black spotted pond frog (F) *Rana nigromaculata*	60-d, SR, DMSO, 2, 20, 200 μg/L (nominal), n=30 tadpoles per treatment; duplicates per treatment; malformations	Malformations: 20 (200)	1,3,5,6 valid with restrictions, varying number of frogs during test, no analytical	Yang et al. (2005)
	<u>**Invertebrates**</u>				
NPE-9	Water flea (F) *Daphnia magna*	R, 7-d, unspecified concentrations, USEPA methods, specific test conditions given, <24-h old neonates used, non-GLP	Mortality: 10,000 (20,000) growth: 10,000	2,3,4,5, valid with restrictions	Dorn et al. (1993)
NPE	Water flea (F) *D. magna*	2 generation (21-d F0 and 14-d F1), R, ASTM method, <24-h neonates used, nominal only, 0, 310, 620, 1200, 2500, 3000 μg/L (1st generation), 0, 1200, 2500 μg/L (2nd generation)	Absence of information as to the specific test chemical used and it's source/purity invalidate this test.	3,4,5,6 not valid	Baldwin et al. (1998)
NPE-10 NPE-6 NPE-1,2 NP	Water flea (F) *D. magna* Water flea (F) *Ceriodaphnia dubia*	24-h, S (Daphnia), 48-h, S (Ceriodaphnia), 7-d, SR, chronic (Ceriodaphnia); ISO acute and chronic methods used, bioassays done 3 times, 24-h Daphnia data not shown, nominal	48-h C.dubia EC50s: NPE-10: 10,000 NPE-6: 2540 NPE-1,2: 210 7-d C. dubia EC50s: NPE-10: 200 NPE-6: 180 NPE-1,2: 70	1,3,4,5,6 valid with restrictions, no analytical, linear NP used so data not reported	Isidori et al. (2006)

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NPE-1.5	Cladoceran (F) *Ceriodaphnia dubia*	7-d, R, USEPA methods, <24-h old instar, mean measured concentrations were 0, 8.35, 25.7, 84.4, 285, 886, 2600 μg/L, GLP	Mortality: 285 (886) time to first brood: 285 (886) young per female per day: 285 (886)	1,2,3,4,5,6 valid	England (1995a)
NPE-1.5	Mysid shrimp (M) *Mysidopsis bahia*	28-d, FT, life-cycle test, US TSCA and EPA methods, mean measured concentrations of 0, 2.2, 4.0, 7.7, 16, 32 μg/L, <24-h juveniles, GLP	Mortality: 32 growth: 16 (32) reproductive success: 7.7 (16)	1,2,3,4,5,6 valid	Sousa (1999)
NPEC-1	Cladoceran (F) *C. dubia*	7-d, R, USEPA methods, <24-h old instar, mean measured concentrations were 0, 520, 1100, 2200, 4700, 8400, 17,000 μg/L, GLP	Mortality: 8400 (17,000) time to first brood: 2200 (4700) young per female per day: 2200 (4700)	1,2,3,4,5,6 valid	England and Buckrath (1997)
NP	Cladoceran (F) *C. dubia*	7-d, R, USEPA methods, <24-h old instar, mean measured concentrations were 0, 2.89, 10.4, 25.9, 88.7, 202, 377 μg/L, GLP	Mortality: 202 (377) time to first brood: 88.7 (202) young per female per day: 88.7 (202)	1,2,3,4,5,6 valid	England (1995b)
NP	Water flea (F) *D. magna*	21-d, R, OECD method, <24-h instar, mean measured concentrations of 0, 14, 24, 39, 71, 130, 250 μg/L, GLP	Mortality: 24 (39) growth: 39 (71) reproduction: 24 (39)	1,2,3,4,5,6 valid	Comber et al. (1993)
NP	Water flea (F) *D. magna*	21-d, R, ASTM method, mean measured concentrations of 0, 44.3, 63.1, 116, 215, 500 μg/L, GLP	Mortality: 215 (500) growth: 116 (215) young per surviving adult: 215 (500) young per starting adult: 116 (215)	1,2,3,4,5,6 valid	Brooke (1993a)

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NP	Water flea (F) *D. magna*	2 generation (21-d F0 and 21-d F1), R, ASTM method, <24-h neonates used, nominal only, 0, 6.2, 12, 25, 50, 100 μg/L (1st generation), 0, 6.2, 25 μg/L (2nd generation)	1st generation: mortality: 100 reproduction: 50 (100) 2nd generation: mortality: 25 reproduction: 25	1,3,4,5 valid with restrictions, no analytical	Baldwin et al. (1997)
NP	Water flea (F) *D. magna*	21-d, R, atypical light regime of 8 h light: 16 h dark used to stimulate production of males, daphnids fed ample (Ex 1) or inadequate (Ex 2) amount of food, nominal concentration of 0, 25 μg/L. Controls in Ex 2 had higher % males and reduced total number offspring compared to Ex 1. Effects more pronounced with exposure to NP	Ex 1 (high food): fecundity: 25 sex differentiation: 25 Ex 2: fecundity: 25 sex differentiation (increased %males): (25)	1,3,5 valid with restrictions, no analytical	Baer & Owens (1999)
NP	Water flea (F) *D. magna*	21-d, R, OECD method used, <24-h instar, nominal concentrations only 0, 1, 10, 100 μg/L	Absence of data on control, solvent control performance, test concentration stability, concentration-specific reproduction data, or water quality invalidate this study	3,4 not valid	Kopf (1997)
NP	Water flea (F) *D. magna*	21-d, R, nominal concentrations only, varied by experiment, Ex I: typical assay examining mortality, reproduction and abnormal offspring, a second part with 20 test concentrations 90% of the next, Ex II: direct embryo-larval exposure measuring developmental effects, timing uncertain,	Absence of full test concentration data (nominal or measured), control performance, timing of all testing invalidates this study	3 not valid	LeBlanc et al. (2000)

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		concentrations unstated, assume nominal only, Ex III: embryo toxicity after maternal exposure			
NP	Water flea (F) *D. magna*	14-d S, nominal concentration only (100 µg/L), females exposed to 16h light/8h dark or 8h light/16h dark, female endpoints were survival, #molts, #live neonates, #deformed neonates, males exposed to 16h light/8h dark, male endpoints were survival and #molts	Females, 16h light: no effect on survival, #deformed neonates increased females 8h light: no differences males: no effects on survival, or body length	1,3,5,6 valid with restrictions, no analytical	Gibble and Baer (2003)
NP	Water flea (F) *D. magna*	Acute test followed ISO method Chronic test followed ISO method, carried out for two generations Nominal	48-h EC50 mobility: 130 <u>21-d, 1st generation</u>: Cumulative offspring/female: 60 (80) <u>21-d, 2nd generation</u>: Mortality: 20 (40) Cumulative offspring/female: 20 (40)	1,3,4,5,6 valid with restrictions, no analytical	Brennan et al. (2006)
NP	Water flea (F) *D. magna*	48-h, S, acute tests with (8 µL/L) and w/o EtOH as carrier solvent; nominal 21-d, S, chronic tests with and w/o EtOH conducted under short light (8:16h) conditions, 12.5, 25, 50 µg/L; adult survival, #molts, fecundity, #aborted eggs, sex ratio; nominal	Since EtOH has a confounding effect as used, only data w/o EtOH are valid. 48-h EC50 (n=3) 234 to 337 21-d mortality, fecundity, sex ratio: 50 Deformities: 25 (50)	1,2,3 valid with restrictions, no analytical Data with EtOH are not valid	Zhang et al. (2003)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
NP	Water flea (F) *D. galeata*	2-generation, SR, nominal-only, 0, 3 to 100 μg/L, endpoints: survival and #neonates, used to calculated the EC50 for reduction by 50% of the intrinsic rate of increase (r) of the population	Gen. 1: Survival: 70 (100) #neonates: 50 (70) EC50 (for r) = 65.2 Gen 2: Survival: 50 (70) #neonates: 70 (>70) EC50 (for r) = 81.5	1,3,5,6 valid with restrictions, no analytical	Tanaka and Nakanishi (2002)
NP	Euryhaline cladoceran (M) *Diaphanosoma celebensis*	21-d, SR, 0.01, 0.1, 1.0, 10, 50 μg/L (P generation), then F1-F3 generations in clean water, fecundity endpoints; nominal	Age at 1st reproduction, reproductive period: 50 increased offspring/female at 1, but not higher concentrations lifespan: 10 (50) Effects not seen in F1-3 generations	1,3,5,6 valid with restrictions, no analytical	Marcial and Hagiwara (2007)
NP	Midge larvae (F) *Chironomus tentans*	For all three experiments, 2nd instar larvae were used and procedures were based on ASTM and EPA methods, mortality and growth of midge larvae measured using different exposure routes. Ex 1: 14-d, FT, aqueous exposure with minimal sand substrate, mean measured water column concentrations of 0, 23, 44, 76, 150, 320 μg/L, Ex 2: 14-d, FT, aqueous exposure with natural sediment substrate, some surface adsorption onto sediment occurred but were not at equilibrium, mean measured water	Ex 1: mortality: 76 (150) growth: 76 (150) Ex 2: - mortality (water column exposure): 38.7 (81.1) - growth (water column exposure): 20.5 (38.7) Ex 3: - mortality (sediment exposure): 20.1 (34.2 mg/kg dry)	1,2,3,4,5,6 valid	England and Bussard (1993)

Table 1A. Chronic Population-Level Effects of NPE, NPEC, and NP to Aquatic Organisms. All units in μg/L unless otherwise specified.

Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		column concentrations of 0, 7.19, 20.5, 38.7, 81.1, 146 μg/L, estimated pore water concentrations of 0, <0.823, 1.94, 1.95, 2.56, 3.67 μg/L, mean measured non-equilibrium sediment concentrations were 0, 0.0649, 0.0916, 0.193, 0.326, 0.475 mg/kg dry. Ex 3: 14-d, FT of clean water, sediment dosed with chemical, mean measured interstitial concentrations of 0, 15.3, 35.4, 78.3, 143, 252 μg/L, mean measured sediment concentrations of 0, 2.34, 4.79, 9.51, 20.1, 34.2 mg/kg	- growth (sediment exposure): 20.1 (34.2 mg/kg dry) - mortality (pore water exposure): 143 (252) - growth (pore water exposure): 143 (252)		
NP	Midge (F) *C. tentans*	Life-cycle test from hatch to emergence (53 days), concentrations of 0, 12.5, 25, 50, 100, 200 μg/L, mean measured concentrations ~one half nominal, endpoints: survival, growth, reproduction, emergence, viability of F1	Larval mortality: 42 (91) growth: 91 emergence: 91 reproduction: 91 viability of F1: 91	1,2,3,4,5,6 valid	Kahl et al. (1997)
NP	Benthic crustacean (M) *Leptocheirus plumulosus*	28-d life-cycle test using dosed sediment, mean measured concentrations of 2.1 to 61.5 μg/g dw, endpoints were survival and #young/female	Survival: 61.5 μg/g dw #young/female: 61.5 μg/g, dw	1,2,3,5,6 valid	Zulkosky et al. (2002)
NP	Copepod (M) *Tisbe buttagliai*	Ex 1: 53-d, R, nauplii <1 day old, mean measured concentrations of 0, 20, 40.5, 74, 300 μg/L, F0 eggs hatch, become adults, lay eggs (F1), grow out to be sexed Ex 2: 39-d, R, nauplii <1day old, mean measured concentrations of 0, 20, 40.5	Ex 1: mortality: 20.0 (40.5) fecundity: 20.0 (40.5) sex ratio (F0 and F1): 20.0 (40.5) Ex 2:	1,2,3,5,6 valid	Bechmann (1999)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		μg/L, F0 eggs hatch, become adults, lay eggs (F1), grow out to be sexed	mortality: 20.0 (40.5) fecundity: 20.0 (40.5) sex ratio (F0 and F1): 20.0 (40.5)		
NP	Copepod (M) *Eurytemora affinis*	96-h, S, ISO method, DMSO 10-d, SR, DMSO, mortality, maturation, sex ratio; nominal	96-h LC50: 38 10-d mortality (nauplius): 7 (15) Growth/development: (7) Sex ratio: not affected	1,3,5,6 valid with restrictions, test conc. not given, no analytical	Forget-Leray et al. (2005)
NP	Mysid shrimp (M) *M. bahia*	28-d, FT, life-cycle test, US TSCA and EPA methods, mean measured concentrations of 0, 3.9, 6.7, 9.1 μg/L, <24-h juveniles, GLP	mortality: 6.7 (9.1) growth: 3.9 (6.7) reproduction: 6.7 (9.1)	1,2,3,4,5,6 valid	Ward and Boeri (1991a)
NP	Mussel (M) *Mytilus edulis*	Ex 1: 35-d, R, adults, 17 deg. C Ex 2: 30-d, R, adults, 17 deg. C Ex 3: 30-d, FT, adults, 10 deg. C Ex 4: 72-h, R, eggs from one adult and sperm from one adult, 17 deg C	Ex 1: 15-d LC50 = 500 35-d LC50 = 140 Ex 4: fertilization success: 200 early development: 200	1,3,5 valid with restrictions	Granmo et al. (1989)
NP	Zebra mussel (F) *Dreissena polymorphya*	15-, 35-, 50-d LC50s, 100 to 10,000 μg/L (Ex.1), 5 and 500 μg/L (Ex.2), mortality, attachment, filtration, nominal	15-d LC50 : 3680 30-d LC50 : 2190 50-d LC50 : 1620 50-d, mortality	1,3,5,6 valid with restrictions, no analytical	Quinn et al. (2006)
NP	Pacific oyster (M) *Crassostrea gigas*	72-h, S, 3 replicates, MeOH in graded concentrations of 0.01 to 1000 μg/L; NP: 0.1, 1.0, 10, 100, 1000, 10000 μg/L; time to D-shape, developmental deformities, nominal	72-h pf Development to D-shape and deformities: 10 (100) Delay in development occurred but was not	1,3,5,6 valid with restrictions, no analytical,	Nice et al. (2000)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
			different from controls by 48-h	rapid loss of NP	
NP	Pacific oyster (M) *C. gigas*	7-8 dpf exposure of larvae to 1 and 100 μg/L NP and MeOH; few details given- book chapter, refers to other paper, examined survival (larval density), growth (development delay), settlement, measured	All endpoints affected by both treatments (1), apparently not by MeOH, difficult to interpret as very rapid loss of NP was observed (91% in 6-h)	2,5,6 valid with restrictions, rapid loss of NP, N apparently very small	Nice et al. (2001)
NP	Pacific oyster (M) *C. gigas*	7-8 dpf exposure of larvae to 1 and 100 μg/L NP and MeOH (100 μg/L); grow out for 10 months to maturity, cross breeding treated and control oysters; measured length, sex ratio, #hermaphrodites, transgenerational gamete survival	Length: 100 Sex ratio: 100 # hermaphrodites: (1) difficult to interpret as very rapid loss of NP was observed (91% in 6-h) and N seems very small	1,2,3,5,6 valid with restrictions, rapid loss of NP, N apparently very small N	Nice et al. (2003)
NPE-10 NP	Sea urchin (M) *Paracentrotus lividus*	72-h, S, followed USEPA procedure for sea urchin sperm toxicity test, nominal	72-h EC50: NPE-10: 1940 NP: 270 μg/L	1,3,4,5,6 valid with restrictions, no analytical	Ghirardini et al. (2001)
NP	Sea urchin (M) *Arbacia lixula*	72-h pf, S, sperm fertilization success (Ex.1) and fertilized eggs (Ex. 2) up to 72-h pluteus larval stage, 6 replicates, DMSO, n=300 eggs per replicate, 100 examined at end, 0.937 to 18.74 μg/L; (Ex. 1): sperm fertilization success, mitotic activity, larval malformations, developmental arrest, mortality, nominal	Embryotoxicity - For NP, all treatments (0.937 to 18.74 μg/L, respectively) caused significant reductions in normal embryos and increases in the number of malformed embryos.	1,3,5,6 valid with restrictions, no analytical, possible DMSO effect,	Arslan and Parlak (2007)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
				treatments were compared to clean controls	
NP	Sea urchin (M) *P. lividus*	72-h pf, S, all nominal - Spermiotoxicity: Sea urchin sperm were exposed to NP (seven treatments ranging from 0.937 to 18.74 μg/L) and OP (six treatments ranging from 5 to 160 μg/L) for 30 minutes, then mixed with viable eggs. Fertilization success was measured as percentage of fertilized eggs. In addition, the embryos were qualitatively scored in terms of development stages. Six replicates each were used for clean controls, solvent controls (DMSO) and treatments. Test concentrations were not measured - Embryotoxicity: A nearly identical design was used except that sperm and eggs were added to the treatments together and exposed throughout development (72 hours). The same test concentrations, replication, and endpoints were used as above	- Spermiotoxicity - For NP, apparently a statistically significant reduction in fertilization success occurred at 18.74 μg/L with a NOEC of 9.37 μg/L. In addition, all treatments with both NP showed increased developmental defects (mainly skeletal malformations and some blocked gastrula or blastula) - Embryotoxicity - For NP, all treatments caused significant increases in the number of malformed embryos	1,3,5,6 valid with restrictions, no analytical, possible DMSO effect, treatments were compared to clean controls	Arslan et al. (2007)
NP	Rotifer (F) *Brachionus calyciflorus*	72-h static, life cycle test, newly hatched mimetic females, 25 deg. C, acetone cosolvent, nominal concentrations only, 0,	72-h EC50 = 2.63 μM/L (0-21 95% CI), or, 72-h EC50 = 565 μg/L	1,3,5 valid with restrictions	Radix et al. (2002)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		0.21, 0.35, 0.59, 0.98, 1.63, 2.72, 4.54 μM/L (0, 46, 77, 130, 216, 359, 598, 1000 μg/L using a NP mwt of 220 g/mol), only determinable endpoint was the ratio of ovigerous to non-ovigerous females			
NP	Cnidarian (F) *H. attenuate*	A "saturated" solution of NP was prepared by stirring glass microspheres impregnated with NP in hydra medium. Test concentrations were made by diluting the "saturated" solution by 0.1 to 10%. No other description of test concentrations was made, nominal.	Lack of information on treatments, no analytical, results cannot be meaningfully interpreted	3 not valid	Pachura-Bouchet et al. (2006)
NP	Pond snail (F) *Lymnae stagnalis*	49-d and 84-d, SR, 1, 10, 100 μg/L, EtOH, nominal, only top concentration grown out to day 84, mortality, shell growth, fecundity	49&84-d mortality, shell growth: 100 49-d fecundity: 100 84-d fecundity: (100) F1 Hatching success: 100 F1 fecundity: 100	1,3,5,6 valid with restrictions, no analytical, did not carry 1,10 μg/L to day 84, only 100 μg/L	Czech et al. (2001)
NP	Pond snail (F) *L. stagnalis*	Life cycle test (apparently), 105 μg/L, #fertilized eggs/capsule, egg deformation, development stages, mortality, measured	Embryo mortality, delay in embryogenesis, reduced hatchability: (105)	1,2,3,5,6 valid	Lalah et al. (2007)
NP	Pond snail (F) *L. stagnalis*	10-d, S, Ex.1: 10-500 μg/L, 5 adults per treatment; Ex.2: indoor microcosms, water, sediment, plants, fish, 100, 500 μg/L, fecundity, hatch, development, clutch size	10-d growth: 100 (500) 10-d fecundity: 500 Microcosm: Fecundity, hatch, clutch	1,3,5,6 valid with restrictions, no analytical	Coutellec et al. (2008)

Table 1A. Chronic Population-Level Effects of NPE, NPEC, and NP to Aquatic Organisms. All units in μg/L unless otherwise specified.

Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
			size, development: 500		
NP	Nematode (F) *Caenorhabditis elegans*	3-d lifecycle test, S, measured concentrations 0, 40.2 to 235.2 μg/L, endpoints were body length, #offspring per worm	Length: 40.2 (65.6) #offspring/worm: (40.2)	1,2,3,5,6 valid	Hoss et al. (2002)
NP	Zooplankton (F) community - Cladocera: 8 sp. - Copepoda: 8 sp. - Rotifera: 16 sp. - Ostracoda: species not named	20-d, R, littoral enclosures in a natural pond, mean measured water concentrations of 0, 5, 23, 76, 243 μg/L, followed population abundance and community diversity of pelagic zooplankton	Abundance (cladocera): 23 (76) abundance (copepoda): 5 (23) abundance (rotifera): 23 (76) abundance (ostracoda): 76 (243) community diversity: 23 (76)	1,2,3,5,6 valid	O'Halloran et al. (1999)
NP	Benthic macroinvertebrates (F) - Chironomids: 2 sp. - Oligochaetes: 2 sp. - Mollusca: 2 sp.	20-d, R, littoral enclosures in a natural pond, mean measured water concentrations of 0, 5, 23, 76, 243 μg/L, followed population abundance of benthos	Abundance Tanytarsini: 76 (243) abundance Chironomini: 243 abundance Naididae: 23 (76) abundance Tubificidae: 243 abundance Bivalvia: 23 (76) abundance Gastropoda: 76 (243)	1,2,3,5,6 valid	Schmude et al. (1999)
NP	Zooplankton assemblages (F)	Outdoor microcosms, 4 week pretreatment, 6 weeks treatment (7 conc., 9-120 μg/L), 6	NOEC community: 30 Species richness, but not	1,2,3,5,6 valid with	Severin et al. (2003)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		weeks post treatment; NP dosed using SPMD devices for slow release, conc. measured, zooplankton assemblages examined, 9 control microcosms, single replicates for treatments, measured	diversity affected. Populations recovered at 96 μg/L and higher	restrictions, lack of replication of treatments	
	<u>Algae</u>				
NPE-30 NPE-9 NPE-6	Green algae (F) *Selenastrum capricornutum*	21-d, S, nominal concentrations only of 0, 100000, 200000, 300000, 400000, 500000 μg/L	Absence of test concentration measurements in a 21-d static test and because populations would not be in log growth phase for 21 days invalidates tests	not valid	Nyberg (1988)
NPE-10	Natural algal (F) assemblages	13-d, S, exposure to algae collected from sewage-impacted and non-impacted streams, endpoints: rate of algal biomass accumulation, total algal biovolume, algal community structure, Ex. 1: 200 μg/L, Ex. 2: 5, 50, 500 μg/L, nominal-only	Ex. 1: rate of accumulation: 200 total biovolume: (200) community structure: (200) Ex. 2: total biovolume: (5) community structure: (5)	3,5,6 valid with restrictions	Wilson et al. (2003)
NPE-9	Green algae (F) *S. capricornutum*	96-h, S, unspecified concentrations, USEPA methods, specific test conditions given, non-GLP	Growth (cell counts): 8000 (16,000)	2,3,4,5 valid with restrictions	Dorn et al. (1993)
NP	Green algae (F) *S. capricornutum*	96-h, S, ASTM and EPA methods, mean measured concentrations of 0, 26.6, 66.7, 136, 329, 694, 1480, 2720 μg/L	Growth (biomass): 694 (1480)	1,2,3,4,5,6 valid	Brooke (1993a)
NP	Green algae (F) *S. capricornutum*	72-h, S, growth (biomass) test, US TSCA and EPA methods, mean measured	Growth (biomass): 92	1,2,3,4,5,6 valid	Ward and Boeri

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		concentrations, GLP			(1990b)
NP	Green algae (F) *Scenedesmus subspicatus*	72-static, DIN-EN28692	Only summary data presented, no data on replicates given, no control data given, no measurements of concentrations given	not valid	Kopf (1997)
NP	Green algae (M) *Skeletonema costatum*	96-h. S, ASTM and EPA methods, mean measured test concentrations of 0, 10, 20, 38, 110, 160 μg/L, GLP	Growth (cell number): EC10 = 12	1,2,3,4,5,6 valid	Ward and Boeri (1990a)
NP	Phytoplankton and periphyton assemblages (F)	Outdoor microcosms, 4 week pretreatment, 6 weeks treatment (7 conc., 9-120 μg/L), 6 weeks post treatment; NP dosed using SPMD devices for slow release, conc. measured; phytoplankton cell density and biomass, phytoplankton and periphyton diversity, assemblage composition examined; 9 control microcosms, single replicates for treatments, measured	The results of any changes in phytoplankton communities cannot be separated from the changes in zooplankton (see Severin et al., 2003)	1,3,5,6 Not valid due to inability to assign effects to changes in zooplankton or treatments	Hense et al. (2003)
NP	Diatom (F) *Melosira varians*	10-d, S, 12.5 deg. C, cell density; 3 tests: 0, 2, 20, 200 μg/L, 0, 4, 40, 400 μg/L, 0, 8, 80, 800 μg/L; nominal	Cell density: 20-80 (200-800) Overall: 20(40)	1,3,5,6 valid with restrictions, no analytical	Julius et al. (2007)
NP	Duckweed (F) *Lemna minor*	96-h, FT, ASTM and EPA methods, mean measured concentrations of 0, <88.0, 109, 375, 901, 2080 μg/L	Frond production: 901 (2080)	1,2,3,4,5,6 valid	Brooke (1993a)
NP	Duckweed (F) *L. minor*	Ex 1: 6-d, S, nominal concentrations only of 0, 500, 2500, 5000 μg/L, NOECs and LOECs determined qualitatively	Ex 1: growth (frond number): 2500 (5000) Ex 2: frond	1,3,6 use with care	Prasad (1989)

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Material	Species	Test Conditions	Reported effects NOEC (LOEC)	Acceptance Scoring & Study Validity	Reference
		Ex 2: 4-d, R, nominal concentrations only of 0, 125, 250, 500, 1250, 2500 μg/L, NOECs and LOECs determined qualitatively	multiplication: 250 (500)		
NP	Macrophyte (F) *Salvina molesta*	9-d, S, nominal concentrations only of 0, 2500, 10000, 25000 μg/L, NOECs and LOECs determined qualitatively	Growth (frond number: (2500)	1,3,6 use with care	Prasad (1989)

Abbreviations: S = static test system, SR and R = renewal test system, FT = flow-through test system, NOEC = no observed effect concentration, LOEC = lowest observed effect concentration, ECx = effect concentration causing x percent effect, LCx = lethal concentration causing x percent lethality, ELS = early life stage test, NPE = nonylphenol ethoxylates, NPEC = nonylphenol ether carboxylates, NP = nonylphenol, GSI = gonadosomatic index (ratio of gonad wieght to body weight), HSI and LSI = hepatic and liver somatic indices, TSI = testis-somatic index, OSI = ovasomatic index, ASTM = American Society for Testing and Materials, USEPA = U.S. Environmental Protection Agency, OECD = Organization for Economic Cooperation and Development, GLP = Good Laboratory Practices, mwt = molecular weight (g/mol).

Note: NOEC are always shown without parentheses. LOEC are always shown with parentheses. If a NOEC is not accompanied by a LOEC, then no effects were reported at the highest concentration tested. If a LOEC is not accompanied by a NOEC, then effects were reported at all concentrations tested.

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
	In Vitro Tests				
NPE40 NPE9 NPE2 NP	VTG induction in male rainbow trout hepatocytes	Relative potency as compared to 17-*B* estradiol (which equals 1)	NPE40: no activity NPE9: 2E-7 NPE2: 6 E-6 NP: 9E-6	Valid	Jobling and Sumpter (1993)
NP	YES assay	Relative potency as compared to 17-*B* estradiol (which equals 1)	NP: 7.2 E-7	Valid	Folmar et al. (2002)
NPE2 NP	VTG induction in cultured male rainbow trout hepatocytes Competitive binding to the estradiol receptor in rainbow trout	Dose response assessment of VTG production Dose response assessment of competitive displacement of E2 from estrogen receptor	No statistics used, however, substantial increase in VTG induction at 1E-5 M concentrations of NPE2 and NP compared to 1E-6 and 1E-7 M No displacement by NPE2, displacement initiated at ~5E-7 M NP	Valid with restrictions No analytical	White et al. (1994)
NP	Yeast expressing the human estrogen receptor (hER) Yeast expressing the human androgen receptor (hAR)	Color changes indicative of binding to the estrogen receptor, also to demonstrate anti-estrogenic activity Color changes indicative of binding to the androgen receptor, also to demonstrate anti-androgenic activity	On a scale of 1 to 4, NP demonstrates moderate (2) estrogenic activity, but no anti-estrogenic activity On a scale of 1 to 4, NP demonstrates low (1) androgenic activity, but no anti-androgenic activity	Valid	Sohoni and Sumpter (1998)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NPE1,2 NP	Metabolic responses measured by calorespirometry	Metabolic rates of ciliated gill tissue from the freshwater bivalve mollusk *Elliptio complanata*	No analytical confirmation of exposure, no statistics applied, 50 min exposures, NPE-1,2: apparent reduction in metabolism at 10-4 to 10-3 M and apparent stimulation at 10-6 to 10-5 M NP: apparent reduction of metabolism at 10-3 M and apparent stimulation at 10-6 to 10-4 M	Valid with restrictions No analytical, no statistics	Levine and Cheney (2000)
	<u>In Vivo Tests</u>				
NPE2 NP	Rainbow trout *Oncorhynnchus mykiss*	Exposed male adult rainbow trout (*O. mykiss*) for 3 weeks VTG induction in blood plasma from exposure to nominal 30μg/L Spermatogenesis, relative proportion of cell types, from exposure to nominal 30 μg/L Dose response assessment of VTG induction, GSI measured in same fish	100- to 1000-fold increase in serum VTG concentration for both NPE2 and NP, as compared to controls For both NPE and NP, spermatogenesis was slightly delayed as indicted by higher proportion of spermatogonia than spermatocytes, as compared to controls VTG induced at 20.3, but not 5.02 μg/L NP GSI reduced at 54.3, but not 20.3 μg/L NP	Valid	Jobling et al. (1996)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Rainbow trout *O. mykiss*	Exposed female adult rainbow trout (*O. mykiss*) for 18 weeks Dose response assessment of VTG induction, plasma levels of follicle stimulating hormone (LSH) and gene expression of LSH in the pituitary, plasma and pituitary levels of luteinizing hormone (LH) and gene expression in pituitary, plasma E2 levels, GSI measured in same fish	VTG induction at 8.3 μg/L and higher, plasma E2 reduced at 85.6 μg/L, plasma FSH and pituitary gene expression reduced at all concentrations, pituitary LH reduced at 85.6 μg/L, LH gene expression reduced at 8.3 μg/L, transitory slight increase in plasma LH, GSI reduced at 85.6, but not 8.3 μg/L	Valid	Harris et al. (2001)
NP	Rainbow trout *O. mykiss*	Periodic exposure, changes in fish skin observed	No significant changes to skin cell structures or mucous cells. Significant alteration of granulation pattern at periodic exposure to 1 or 10 μg/L NP	Valid	Burkhardt-Holm et al. (2000)
NP	Rainbow trout *O. mykiss*	9-d flow-through, induction of plasma VTG	Significant induction of VTG at 76 μg/L	Valid	Pederson et al. (1999)
NP	Rainbow trout *O. mykiss*	1 year flow-through, induction of VTG, ZRP expression in liver	VTG induction: (1.05) μg/L ZRP expression: 1.05 (10.17) μg/L	Valid	Ackermann et al. (2002)
NP	Rainbow trout *O. mykiss*	10-d per month intermittent exposure of 1, 10 μg/L for 4 months; eggs and sperm collected, eggs fertilized and grown out to maturity in clean water (3 y); VTG, estrogen (E2), testosterone (T)	VTG F0 adults: 10 VTG F1 males: 10 VTG F1 females: (10) E2 in F1 males: (10) E2 in F1 females: 10 T in F1 males: 10 T in F1 females: (10)	Valid	Schwaiger et al. (2002)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Guppies *Poecilia reticulata*	90-d, R, 100 μg/L only (nominal), 5-d post-birth fish; VTG; cross-breeding over next 5 months	<u>After 90-d:</u> VTG induced in females, not males	Valid with restrictions no analytical, reproduction data not given	Cardinali et al. (2004)
NPE-9	Fathead minnow *Pimephales promelas*	42-d flow-through , plasma VTG, 17β-estradiol (E2), testosterone (T)	No induction of VTG at any concentration tested (highest 7.9 μg/l), No differences between treatments and control for plasma E2 or T	Valid	Nichols et al. (2001)
NP	Fathead minnow *P. promelas*	Ex 1: 14-d exposure of 3 adult males per treatment, 1, 10, 50 μg/L, measured Ex 2: 14-d feeding study of 3 males per treatment, 100, 500, 1000 μg/day Measured VTG mRNA (liver) and plasma VTG	Ex 1: hepatic mRNA VTG = 10 (50), plasma VTG = 100 (500) μg/day Ex 2: hepatic mRNA VTG = 1 (10), plasma VTG = 100 (500) μg/day	Valid	Pickford et al. (2003)
NP	Fathead minnow *P. promelas*	Flow-through, paired-breeding assay with secondary sex characteristics, serum VTG	Reduction in number of tubercles but not the size of the fat pad noted at 8.1 to 57.7 μg/L. Serum VTG induced at 8.1 to 57.7 μg/L	Valid with restrictions, analytical difficulties noted	Harries et al. (2000)
NP	Fathead minnow *P. promelas*	42-d flow-through, plasma VTG, 17β-estradiol (E2)	Dose related decrease in plasma VTG in females. No dose related change in plasma VTG in males. ~Equal elevation of plasma E2 at all doses except the highest (3.4 μg/L) in females and males	Valid with restrictions Solvent effects in second experiment	Giesy et al. (2000)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NPE-9 NP	Fathead minnow *P. promelas*	42-d flow-through, observations of secondary sex characteristics and gonadal histology.	NPE-9 - No effects on tubercle or fat pad size, on survival, or on testicular or ovarian histology at highest level (5.5 μg/L). Ex I: NP - No effects on tubercle or fat pad size, or survival at highest level (3.4 μg/L). Increase in severity score of male gonads at 1.6 but not 0.4 μg/L. Ex II: NP - data not usable as solvent control completely inhibited egg production (see companion paper, Giesy et al. 2001)	Valid with restrictions, second test not valid due to solvent control effects	Miles-Richardson et al. (1999)
NPE-9 NPE-4 NPE-1 NPEC1 NP	Medaka fish *Oryzias latipes*	100-d, R, endpoints: secondary sex characteristics, male papillary processes, testis-ova	NPE-9 and NPE-4: all endpoints NOEC 1000 μg/L, highest concentration tested NPE-1: secondary characteristics NOEC (LOEC) 100 (300) μg/L, all other endpoints NOEC 300 μg/L NPEC1: all endpoints NOEC 3000 μg/L, highest concentration tested NP: secondary characteristics NOEC (LOEC) 10 (30) μg/L, male processes NOEC 100 μg/L, testis-ova 30 (100)	Valid	Balch and Metcalfe (2003)
NP	Medaka fish *O. latipes*	Fertilized eggs exposed until 60-dph, NP: 3.13 to 50 μg/L; hepatic VTG, secondary sex	Secondary sex char.: 11.6 (23.5); Testis/ova:	Valid	Seki et al. (2003)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
		characteristics, testis-ova, measured	6.08 (11.6); VTG (males and females): 6.08 (11.6) Secondary sex characters were reversible		
NP	Medaka fish *O. latipes*	Histology of male and female gonad tissue in medaka fish Presence of ovarian tissue in male gonads	40% control mortality	Not valid	Gray and Metcalfe (1997)
NP	Medaka fish *O. latipes*	Life-cycle flow-through, secondary sex characteristics, gonadal histology of males and females	F0: Secondary male sex characteristics were eliminated at 51.5 but not 17.7 μg/L. Testis-ova significantly higher in males at 17.7 but not 8.2 μg/L. F0 TSI: 17.7 F0 OSI: 4.2 (8.2) F1: Secondary male sex characteristics were eliminated at 17.7 but not 8.2 μg/L. Testis-ova significantly higher in males at 17.7 but not 8.2 μg/L	Valid	Yokota et al. (2001)
NP	Medaka fish *O. latipes*	5 week exposure of adult males, induction of female specific proteins in males	FSP induction occurred in after 4 weeks at all nominal concentrations of 0.1, 10, 100 μg/L	Valid with restrictions Control performance data not presented.	Kashiwada et al. (2002)
NP	Japanese medaka *O. latipes*	30-d, FT, 5to 8 days post hatch fish exposed for 30 days followed by a 30 day grow out period, 0, 0.54, 0.77, 1.93 μg/L	OSI: 1.93 TSI: 1.93	1,2,3,4,5,6 valid	Nimrod and Benson (1998)
NP	Common carp	28 to 31-d exposure, serum sex	As compared to controls, no	Valid	Villeneuve et al.

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
	Cyprinus carpio	steroids, VTG induction, gonadal histology, mean measured concentrations up to 5.36 µg/L	effects on somatic growth or liver or gonad weights, no differences in plasma E2 or testosterone, no differences in plasma VTG, no histopathological changes observed in testes, hepatopancreas, brain or gills		(2002)
NP	Common carp *C. carpio*	70-d flow-through, hematological alterations, histopathology of the liver, kidney and spleen, 1 to 15 µg/L NP	Significant decrease in red blood cells at 10, but not 5 µg/L. Mean corpuscular volume and hemoglobin elevated at 15 but not 10 µg/L. Packed cell volume, hemoglobin content, and mean corpuscular hemoglobin concentration were not affected at any concentration. No histologic effects on kidney, liver or spleen at any concentration	Valid	Schwaiger et al. (2000)
NP	Swordtail fish *Xiphophorus helleri*	3-d renewal, Induction of VTG nRNA in liver, scoring of male gonadal cells for necrosis/apoptosis	VTG induced at 4 to 100 µg/L. Increases in numbers of necrotic/apoptotic male gonad cells at 4 to 100 µg/L	Valid	Kwak et al. (2001)
NP	Zebrafish *Danio rerio*	58-d R; 10, 100 µg/L (nominal); 2 dph until 60 dph; VTG, HSP;	<u>60-dph results</u>: VTG, HSP: 100	Valid with restrictions No analytical	Lin and Janz (2006)
NP	Zebrafish *D. rerio*	21-d, R, DMSO, mature males and females exposed to 0.1 to 500 µg/L (nominal); GSI, VTG; afterwards males and	<u>After 21 days:</u> VTG: 10 (50) GSI: 10 (50) <u>After cross-breeding:</u>	Valid with restrictions No analytical	Yang et al. (2006)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
		females were exposed to 0 and 50 μg/L NP crossbred for 7-d; embryo CAT D activity, eggshell thickness, fecundity, hatching rate, malformation of offspring	eggshell thickness decreased, CAT D: effects in F, not M		
NP	Zebrafish *D. rerio*	90-hour R, 6 hour ph embryos; exposure unknown; numerous neurotoxic and teratogenic cellular endpoints were examined	No analytical, exposure system unclear	Not valid	Ton et al. (2006)
NPE-9	Three-spined stickleback *Gasterosteus aculeatus*	21-d, SR, 10 adult M&F fish; 50, 100, 500, 1000 μg/L; Biomarkers EROD, GST, GPx, GSH, TBARS, and VTG	EROD, GSTY, GPx, GSH, TBARS: (50) VTG: 1000	1,5 not valid, poor methods section, no analytical	Sanchez et al. (2006)
NP	Chinese sturgeon *Acipenser sinensis* Gray	Injection, VTG nRNA gene expression	Injection study	Not valid	Zhang et al. (2005)
NP	Channel catfish *Ictalurus punctatus*	Injection, ER binding	Injection study	Not valid	Nimrond and Benson (1997)
NP	Flounder *Platichthys flesuss* (M)	Exposed male adult flounder (*P. flesus*) for 3 weeks, VTG induction, gonad histopathology, GSI and HSI measured in same fish	No induction of VTG at highest mean measured concentration of 24.5 μg/L, no effects on gonad histology reduced testis weight: 24.5 reduced liver weight: 7.2 (24.5)	Valid	Allen et al. (1999)
NP	Guppies (F) *Poecilia reticulata*	90-d, R, 100 μg/L only (nominal), 5-d post-birth fish; sex ratio, GSI, HSI; cross-breeding over next 5 months	<u>After 90-d:</u> female GSI & HSI and male HSI increased from control, female HSI decreased;	1,3,5 valid with restrictions no	Cardinali et al. (2004)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
		measuring sexual behavior and reproduction	VTG induced in females, not males After cross-breeding: Male sexual behavior affected, not female	analytical, reproduction data not given	
NP	Atlantic salmon (M) *S. salar*	I.p. injection, 1 year old fish, 23 g, 130 µg/g fish endpoints taken at 10, 20, 30 d before and after SW challenge Plasma ion balance, HIS, muscle water, NaKATPase. First look at endpoints related to paar-smolt transformation	Injection, no analytical	Not valid	Madsen et al. (1997)
NP	Atlantic salmon (M) *Salmo salar*	28-d feeding study, 5 month old juvenile salmon dosed via feed, 0.2 g fish (feeding) for 4 weeks at 300 and 1500 mg/kg, bw Injection: 7.5 g fish, injected 2-4 times over 17 d, total dose 80, 160 mg/kg, bw No confirmation of test concentrations	No VTG induction (E2 did) LSI: (300 mg/kg, dw)	Valid with restrictions, no analytical (feeding study) Not valid (injection study)	Norrgren et al. (1999)
NP	Atlantic salmon (M) *S. salar*	I.p. inhections, 226g fish, n=6 per treatment, single injection at 25 mg/kg, bw; VTG and ZRP stimulation, EROD activity	Injection, no analytical	Not valid	Arukwe et al. (2000a)
NP	Atlantic salmon (M) *S. salar*	I.p. injection Ex.1: 400 to 600 g fish, single injection at 125 mg/kg, bw, hold for 3 days	Injection, no analytical	Not valid	Yadetie and Male (2002)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
		Ex. 2: 200-300 g fish, 3 injections with 10, 50 or 125 mg/kg, bw Several pituitary hormones related to growth			
NP	Atlantic salmon (M) *S. salar*	I.p. injection, 1 year old 29 g fish, 6 injections of 120 µg/g over 20 days. After treatment and before and after release into a stream to test migration, measured mortality, muscle water content, NaKATPase activity, condition factor	Injection study, no analytical	Not valid	Madsen et al. (2004)
NP	Atlantic salmon (M) *S. salar*	Pulse doses of water-borne NP, drip renewal in fresh water, transferred to SW (Early, Mid, or Late in the month), 75-80 g 14 month old fish, 20 µg/L on days 1 and 5 (for 24 hours) three times in one month period, N	Early-exposed fish had Reduced weights and plasma growth factors (IGF-I) that are related to P-s transformation, and plasma growth factors (IGF-I) that are related to P-s transformation Fish from the Mid and Late-exposed fish may have started to reverse the p-s transformation by being held in FW too long in the season	Valid with restrictions, pulse dosing limits use in hazard assessment	Arsenault et al. (2004)
NP	Atlantic salmon (M) *S. salar*	I.p. injection, 25-50 g fish injected with 0.5 to 150 µg/g on four days. Following SW challenges, measured plasma Na, Ca, VTG, IGF-I, T4, T3.	Injection, no analytical	Not valid	McCormick et al. (2005)
NP	Atlantic salmon (M)	Water, FT, 21-d exposure to 10	After SW challenge, Plasma	Valid	Lerner et al.

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
	S. salar	or 100 μg/L, SW challenge tests, nominal	VTG and ion balances affected in some endpoints at high treatment level		(2007a)
NP	Atlantic salmon (M) *S. salar*	Water, FT, 10 and 100 μg/L, measured	10 μg/L caused effects on various plasma factors	Valid	Lerner et al. (2007b)
NP	Atlantic salmon (M) *S. salar*	gene expression of pituitary hormones	Intraperitonial injection of test material, method of dosing not relevant for aquatic risk assessment	Not valid	Yadetie and Male (2002)
NP	Chinook salmon (M) *Oncorhynchus tshawytscha*	29-d exposure, R, measured, grow-out period of 103 days post-hatch, egg through adult stages, endpoints: survival, sex ratio, gonad development	Female gonad development: 10 male gonad development: 10	1,2,3,5,6 valid	Afonso et al. (2002)
NP	Atlantic cod (M) *Gadus morhua* Turbot (M) *Scophthalmus maximus*	21-d, FT, 30 μg/L only; steroid synthesis, metabolism, nominal	<u>Cod:</u> No effects on any endpoint except glucuronidation of E2; HSI <u>Turbot</u>: Some reductions in steroid synthesis hormones, metabolism, T and 17B, LSI	Valid with restrictions, single test concentratio n	Martin-Skilton et al. (2006)
NP	Sea bass (M) *Dicentrarchus labrax*	24-hour exposure to 871 μg/L and DMSO, n = 5; EROD, GST, ALT, LSI, plasma cortisol, plasma glucose, c-P450, ENA	Single concentrationi, no analytical, no replicates	Not valid	Teles et al. (2004)
NP	Rare minnow (F) *Gobiocypris rarus*	28-d, FT, 3, 10, 30 μg/L; GSI, Renal SI (RSI), HSI, histology,	Histology: 3 (10) VTG in females: 30 VTG in males: 3 (10) , HSI, RSI: 30 GSI in females: 30 GSI in males: 3 (10)	Valid with restrictions, unclear replication, no analytical	Zha et al. (2007)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Grey mullet (M) *Liza aurata*	7-d, 25, 100, 1000 µg/L; two month old juveniles, 0.5-0.7 g, 5 groups, 30 fish/group, no solvent control (EtOH used) Adults males ip injected, females positive control; liver VTG, plasma VTG, CYP1A1, EROD activity	Juvenile aqueous: Plasma, liver VTG: 1000 CYP1A1 & EROD activity: (25) Injection data not valid	Valid with restrictions, replication and dosing unclear, no analytical Injection data not valid	Cionna et al. (2006)
NP	Sheepshead minnow (M) *Cyprinodon variegatus*	Following a 16-d renewal exposure, hepatic VTG nRNA regulation and plasma VTG clearance rates were measured	Hepatic VTG rapidly diminished following cessation of exposure, plasma VTG clearance concentration and time dependent, plasma clearance slower than hepatic clearance	Valid	Hemmer et al. (2002)
NP	Eelpout *Zoarces viviparus*	Injection of fish, VTG induction, testicular structure, cytology	Injection study	Not valid	Christiansen et al. (1998)
NP	African clawed frog *Xenopus laevis*	36-hour, VTG induction using primary cultured hepatocytes	Only qualitative assessment of differences with control	Not valid	Kloas (1999)
NP	African clawed frog *X. laevis*	Exposure from stage 10.5 (11-h) to stage 37 (49-h), 0.002 to 1000 µg/L, nominal-only, examined body shape, length, interocular distance, melanocyte differentiation, apoptosis	Body shape, length, interocular differences: 20 (100) apoptosis, melanocyte differentiation: 2 (20)	Valid with restrictions, no analytical	Bevan et al. (2003)
NPE	Cladoceran *Daphnia magna*	21-d F0 then 14-d F1, renewal Metabolic elimination of testosterone	Specific NPE test material not identified, purity/source not given	Not valid	Baldwin et al. (1998)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Cladoceran *D. magna*	21-d F0 then 21-d F1, renewal Metabolic elimination of testosterone (T)	100 but not 25 µg/L NP reduces the elimination of conjugated metabolites of T	Valid with restrictions Unclear test material	Baldwin et al. (1997)
NP	Zebra mussel *Dreissena polymorphya*	15-, 35-, 50-d LC50s, 100 to 10,000 µg/L (Ex.1), 5 and 500 µg/L (Ex.2), VTG induction, nominal	VTG - M : 5 (500) VTG – F : 500	Valid with restrictions, no analytical	Quinn et al. (2006)
NP	Water flea (F) *D. magna*	14-d S, nominal concentration only (100 µg/L), females exposed to 16h light/8h dark or 8h light/16h dark, female endpoints were survival, #molts, #live neonates, #deformed neonates, males exposed to 16h light/8h dark, male endpoints were survival and #molts	females, 16h light: #molts and abdominal process length stimulated males: #molts, length of first antennae reduced	1,3,5,6 valid with restrictions, no analytical	Gibble and Baer (2003)
NP	Water flea (F) *D. magna*	Acute test followed ISO method Chronic test followed ISO method, carried out for two generations Nominal	48-h EC50 molting frequence: 140 <u>21-d, 1st generation</u>: Cumulative molts/female: 80 (100) <u>21-d, 2nd generation</u>: Cumulative molts/female: 60 (80)	1,3,4,5,6 valid with restrictions, no analytical	Brennan et al. (2006)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Water flea (F) *D. magna*	48-h, S, acute tests with (8 µL/L) and w/o EtOH as carrier solvent; nominal 21-d, S, chronic tests with and w/o EtOH conducted under short light (8:16h) conditions, 12.5, 25, 50 µg/L; adult survival, #molts, fecundity, #aborted eggs, sex ratio; nominal	Molting	1,2,3 valid with restrictions, no analytical Data with EtOH are not valid	Zhang et al. (2003)
NP	Pond snail (F) *Lymnae stagnalis*	49-d and 84-d, SR, 1, 10, 100 µg/L, EtOH, nominal, only top concentration taken out to day 84, histopathology	49-d histopathology: 100 84-d histopathology: (100)	Valid with restrictions No analytical, only carried 100 µg/L to day 84	Czech et al. (2001)
NP	Clam (M) *Tapes philippinarum*	7-d, SR, 25, 50, 100, 200 µg/L, acetone, clearance rate CR, respiration rate RR, scope for growth SFG, survival in air SIA, nominal	Cannot tell if controls were significantly different (they appear to be) or if treatments were compared to clean or pooled controls, no replicates, no analytical	Not valid	Matozzo et al. (2003)
NP	Clam (M) *T. philippinarum*	7-d, SR, 25, 50, 100, 200 µg/L, acetone, antioxidant activity in response to toxicant (SOD and CAT) and reburrowing activity, nominal	Cannot tell if controls were significantly different (they appear to be) or if treatments were compared to clean or pooled controls, no replicates, no analytical	Not valid	Matozzo et al. (2004)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Clam (M) *T. philippinarum*	7-d, SR, 25, 50, 100, 200 μg/L, acetone; Ex.1 – NR uptake (neutral red, an indicator of cell membrane stability), superoxidase activity SOD, lysozyme (bacteriolytic enzyme), Ex.2 – THC (total hematocrit) and hematocyte volume	Controls appear similar, but no statement of how analyzed, THC and hematocrit volume not clearly presented, some "threshold concentrations" given that do not tie to any graph or test concentration, no analytical	Not valid	Matozzo and Marin (2005)
NP	Mussel (M) *Mytilus edulis*	Ex 1: 35-d, R, adults, 17 deg. C Ex 2: 30-d, R, adults, 17 deg. C Ex 3: 30-d, FT, adults, 10 deg. C Ex 4: 72-h, R, eggs from one adult and sperm from one adult, 17 deg C	Ex 2: byssal strength: 18 (56) energy budget (stress indicator): 18 (56) Ex 3: byssal strength: 32 (56) energy budget (stress indicator): 32 (56)	1,3,5 valid with restrictions	Granmo et al. (1989)
NP	Zebra mussel (F) *Dreissena polymorphya*	15-, 35-, 50-d LC50s, 100 to 10,000 μg/L (Ex.1), 5 and 500 μg/L (Ex.2), mortality, attachment, filtration, nominal	50-d: attachment : 1000 (5000) 50-d: filtration: 100 (1000)	1,3,5,6 valid with restrictions, no analytical	Quinn et al. (2006)
NP	Pacific oyster (M) *C. gigas*	7-8 dpf exposure of larvae to 1 and 100 μg/L NP and MeOH (100 μg/L); grow out for 10 months to maturity, cross breeding treated and control oysters; measured length, sex ratio, #hermaphrodites, transgenerational gamete survival	F1 gamete survival: (1) difficult to interpret as very rapid loss of NP was observed (91% in 6-h) and N seems very small	1,2,3,5,6 valid with restrictions, rapid loss of NP, N apparently very small N	Nice et al. (2003)

Table 1B. Secondary and Supplemental Endpoints.

Material	Test System or Species Tested	Endpoint Description	Comments	Validity Check	Reference
NP	Sea urchin (M) *P. lividus*	72-h pf, S, all nominal Genotoxicity - After 5 hours exposure, embryos were harvested and prepared for microscopic analysis looking for mitotic abnormalities using quantitative and morphologic parameters. The exposure regime used is not clear for these particular embryos, but are assumed to be from the embryotoxicity exposure	Genotoxicity - For NP, a decreasing dose response in the number of mitoses per embryo was observed, but there does not appear to have been statistically significant differences between treatments and controls	1,3,5,6 valid with restrictions, no analytical, possible DMSO effect, treatments were compared to clean controls	Arslan et al. (2007)
NP	Cnidarian (F) *Hydra attenuate*	96-h, 3 hydra per vessel, triplicate vessels per treatment, measured, test conc. not specified, survival, morphology, nominal	Morphology: (25) Uncertainly as to statistical significance	1,2,3 Not valid	Pachura et al. (2005)
NP	Phytotoxicity in cell suspension cultures	48-h exposure to cell suspensions of 14 plant species, radiolabeled NP	EC50s ranged from 50 to 1000 μM/L, 3.8 to 38.4% of total radioactivity in bound residue (incorporation into cell walls), those species with largest incorporation were least toxic	Valid	Bokern and Harms (1997)
NP	Diatom (F) *Melosira varians*	10-d, S, 12.5 deg. C, chlorophyll a, total extractable lipid; 3 tests: 0, 2, 20, 200 μg/L, 0, 4, 40, 400 μg/L, 0, 8, 80, 800 μg/L; nominal	Chlorophyll a: 20-80 (200-800) TEL: 200-800 Lipid/chl a ratio: 4(40) Overall: 20(40)	Valid with restrictions, no analytical	Julius et al. (2007)

E2 is 17*B*-estradiol, EE2 is ethinylestradiol, a synthetic estrogen, VTG is vitellogenin, FSP means female-specific proteins, T means testosterone, NOEC means no observed effect concentration, LOEC means lowest observed effect concentration, ECx is an effect concentration caused at x percent level, F0 is the parental generation and F1 is the offspring generation of the F0, NPE are nonylphenol ethoxylates, NP is nonylphenol, NPEC are nonylphenol ether carboxylates, HSP is heat shock protein, TEL is total extractable lipids.

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