



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Nickel
CAS #:	7440-02-0
Revised By:	RRD Toxicology Unit
Revision Date:	September 24, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	58.7	58.69	EPI	EXP
Physical State at ambient temp	Inorganic	Inorganic	MDEQ	
Melting Point (°C)	---	1455.00	CRC	EXP
Boiling Point (°C)	2730	2913.00	CRC	EXP
Solubility (ug/L)	NA	NA	NA	NA
Vapor Pressure (mmHg at 25°C)	NA	NR	NA	NA
HLC (atm-m³/mol at 25°C)	NR	NR	NA	NA
Log Kow (log P; octanol-water)	NR	NR	NA	NA
Koc (organic carbon; L/Kg)	NR	NR	NA	NA
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	NR	NR	NA	NA
Diffusivity in Water (Dw; cm²/s)	NR	NR	NA	NA
Soil Water Partition Coefficient (Kd; inorganics)	65	6.5E+01	SSG	EST

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	NA	NA	NA	NA
Lower Explosivity Level (LEL; unitless)	NA	NA	NA	NA
Critical Temperature (K)		NR	NA	NA
Enthalpy of Vaporization (cal/mol)		NR	NA	NA
Density (g/mL, g/cm ³)		NR	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	NR	EMSOFT	NA

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	7.6E-2	6.0E-3	MDEQ, 2007	
RfD details	<p>MDNR converted NOAEL = 7.6 mg/kg; UF = 100; IRIS reported RfD of 2E-2 based on 0.05 conversion factor and UF = 300. Additional 3 used to account for inadequacy of repro studies which MDNR does not believe to be appropriate chronic feeding study (Ambrose et al., 1976). Used MDNR conversion factor of 0.076 for females and males. NOAEL = 100 ppm. Critical effects = decrease in body and organ weights. RD calculation date: 7/16/87.</p>	<p>Tier 3 Source: MDEQ: Basis: MDEQ, CAL EPA, Health Canada, and Minnesota Pollution Control Agency all use the more recent toxicity data (Springborn 2000 sponsored by the Nickel Producers Environmental Research Association (NiPERA). The POD selected by all three agencies is the same; however, MDEQ adjusted the dose to represent the percentage of nickel in the administered dose of nickel sulfate hexahydrate. The MDEQ value is selected for that reason as the adjustment results in the actual dose of Ni administered rather than the Ni salt. All other Tier 3 sources report RfDs that do not represent the most recent scientific data. See details below.</p> <p>Tier 1 Source: IRIS 12/01/1996: RfD = 2E-2 mg/kg/day Critical Study: Ambrose, A.M., D.S. Larson, J.R. Borzelleca and G.R. Hennigar, Jr. 1976. Long-term toxicological assessment of nickel in rats and dogs. J. Food Sci. Technol. 13: 181-187. Methods: A 2-year feeding study using rats given 0, 100, 1000 or 2500 ppm nickel (estimated as 0, 5, 50 and 125 mg Ni/kg bw) in the diet. A conversion factor – 1 ppm = 0.05 mg/kg-day – was used; assumed rat consumption. Critical effect: Decreased body and organ weights. End point or Point of Departure (POD): NOAEL = 100 ppm in diet (5 mg/kg-day); LOAEL = 1000 ppm in diet (50 mg/kg-day); Uncertainty Factors: UF = 300; 10 for interspecies extrapolation and 10 to protect sensitive populations. An additional UF of 3 is used to account for inadequacies in the reproductive studies (RTI, 1987; Ambrose et al., 1976; Smith et al., 1990).</p> <p>Tier 2 Sources:</p>	Complete	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>PPRTV: No PPRTV record available at this time. MRL: Per ATSDR (August 2005), no oral value at this time.</p> <p>Tier 3 Sources: MDEQ-RRD 2007: A toxicity assessment for nickel was drafted in 2007; the RfD is 0.006 mg/kg-day. It includes information from two studies that are not included in the IRIS review: Springborn 2000b and Obone et al., 1999 – see draft assessment. Springborn 2000b is a rat reproductive toxicity study and Obone et al., 1999 is a subchronic oral toxicity rat study. The Draft assessment needs to be updated and finalized. In addition, recommendations from the TSG CEH subcommittee should be considered in generating the RfD and the criteria. Critical Study: Springborn Laboratory (2000b) An oral (gavage) two-generation reproduction toxicity study in Sprague-Dawley rats with nickel sulfate hexahydrate. Springborn Laboratories Study No. 3472.4 for NiPERA, Inc. Methods: A two generation reproductive study: F₀, F₁ and F₂ generation Sprague-Dawley rats (28 per sex per treatment group) were administered 0, 1.0, 2.5, 5.0 or 10 mg/kg-day nickel sulfate hexahydrate via once-daily oral gavage. F₀ animal dosing began ten weeks prior to mating and F₁ animal dosing was initiated on postpartum day 22. Critical Effects: Decreased relative liver weights in the male rats of the F₀ and F₁ generations. End point or Point of Departure (POD): A LOAEL of 5.0 mg/kg-d (equivalent to 1.1 mg/Ni/kg-d) and NOAEL = 2.5 mg/kg/d (equivalent to 0.6 mg/kg/day) were identified for the significantly decreased relative liver weight toxicity endpoint in male F₁ rats. UF: 100 (10 for interspecies and intraspecies extrapolation each). Source and Date: MDEQ RRD Toxicology assessment for soluble nickel salts, October 2007.</p> <p>CALEPA OEHA, Nickel Reference Exposure Levels (2012) (page 114). REL =</p>		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>1.1E-2 mg/kg-day (same as RfD). OEHHA (2000) identified the oral dose of 1.12 mg/kg-day from the lower dose range of (NiPERA, 2000b) as the appropriate NOAEL value. This NOAEL is lower than the doses at which early pup mortality was observed (LOAEL of 2.23 mg/kg-d) in the preliminary study (NiPERA, 2000a) and the LOAEL of 1.3 mg Ni/kg-d reported by Smith et al. (1993). The oral REL derivation summarized above used UF of 10 each for interspecies and interspecies extrapolations.</p> <p>Massachusetts Drinking Water Guideline for Ni is based on an RfD of 2E-2 mg/kg-d (2015). The RfD is based on a 2 year feeding study in rats exposed to Ni at 0, 100, 1000 or 2500 ppm (0, 5, 50, and 125 Ni/kg bw), body weights in the HD male and female rats were significantly decreased compared with controls. BW reduction also noted at 50 mg/kg/day. This reduction was significant for females at week 6 and from weeks 26 through 104, and for males starting at 52 weeks. In addition, groups of females had significantly higher liver-to-body weight ratios at the 50 and 125 mg/kg/day dose levels. A NOAEL of 5 mg/kg/day was identified based on a lack of these effects at this dose level. UF = 300 (10 each for inter- and interspecies and 3 for inadequacies in reproductive studies).</p> <p>Minnesota RfD = 1.1E-2 (Draft, 2015). Used to develop the Soil Remediation Value for Ni. CA EPA (2012) is cited as the reference.</p> <p>New Jersey DEP Toxicity Factor for Ni Soluble Salts (2008) = 2E-2 mg/kg-day. No details provided.</p> <p>New York State Brownfield Cleanup Program: RfD = 2E-2 mg/kg-day. POD = NOEL = 5 mg/kg/day. UF = 300. Based on decreased body and organ weights observed in male and female rats in a two year feeding study. Study LOEL = 50 mg/kg/day. IRIS Also used by: IRIS (2004); EPA Region 3 (2004); EPA ODW, (2004); HEAST (1997); NYS DEC (1997).</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Texas TCEQ RfD = 2.0E-2 based on IRIS. Used within the Texas Risk Reduction Program (TRRP) Rule, 2014.</p> <p>Health Canada Tox Reference Value for Ni = 1.1E-2 mg/kg-d. Soluble Nickel (nickel chloride and nickel sulphate). (TDI) 1.1E-2 mg/kg-d is an oral tolerable daily intake (TDI). Two-generation reproductive toxicity study with rats via drinking water. 0, 0.22, 0.55, 1.1 and 2.2 mg/kg-day. FO: prior to and during mating (males and females) and throughout gestation lactation; F1: from weaning through reproduction until weaning of F2 pups. UF = 100 (10 each for intra- and intraspecies variability). Critical effect: post-implantation perinatal lethality. POD = NOAEL = 1.1 mg/kg-d. Source: WHO, 2005 (based on SLI, 2000).</p> <p>ECHA REACH Dossier on Ni: 2E-2 mg/kg-day based on developmental/teratogenicity endpoint. NOAEL = 1.1 mg/kg bw/day. Overall assessment factor = 50.</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, , WHO (IARC), WHO (IPCS/INCHEM), The Netherlands (RIVM) and OECD HPV.</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	NA	NA	MDEQ, 2015	
CSF details	--	<p>Per IRIS 12/1/1996 for nickel soluble salts: The USEPA has not evaluated soluble salts of nickel, as a class of compounds, for potential human carcinogenicity. However, nickel refinery dust and specific nickel compounds, nickel carbonyl and nickel subsulfide, have been evaluated. Summaries of these evaluations are on IRIS.</p> <p>Tier 1 and 2 Sources: IRIS (12/1/1996): No value is available. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		Tier 3 Source: MDEQ: No MDEQ record available at this time.		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)	NA	9E-2	ATSDR, 2005	
RfC/ITSL details	--	Tier 2 Source: ATSDR: Basis: ATSDR is a Tier 2 Source, no Tier 1 available. The Inhalation chronic MRL = $9\text{E}-5 \text{ mg}/\text{m}^3$ and the Inhalation intermediate MRL = $0.0002 \text{ mg}/\text{m}^3$ Critical Study: NTP 1996c. Toxicology and carcinogenesis of nickel sulfate hexahydrate (CAS No. 1010197-0) in F344/N rats and B6C3F1 mice (inhalation studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Toxicology Program. Methods: Groups of male and female F344 rats were exposed to 0.12, 0.25, or $0.5 \text{ mg}/\text{m}^3$ nickel sulfate hexahydrate (0, 0.03, 0.06, or $0.11 \text{ mg Ni}/\text{m}^3$ as calculated by study authors) 6 hours/day, 5 days/week for 2 years. Critical effect: Lung lesions consisted of chronic active inflammation, hyperplasia of alveolar macrophages, alveolar proteinosis, and fibrosis at 0.06 and $0.11 \text{ mg Ni}/\text{m}^3$. The combined incidences of chronic active inflammation in the male and female rats were 28/106, 24/106, 91/106, and 98/107 in the 0, 0.03, 0.06, and $0.11 \text{ mg Ni}/\text{m}^3$ groups, respectively. The chronic inflammation consisted of multifocal, minimal to mild accumulation of macrophages, neutrophils, and cellular debris within the alveolar spaces. No significant alterations in the malignant tumors were observed in the lungs. Significant increases in the incidence of lymphoid hyperplasia of the bronchial lymph nodes and atrophy of the olfactory epithelium were observed at $1.1\text{E}+2$		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>$\mu\text{g Ni/m}^3$.</p> <p>End point or Point of Departure (POD): NOAEL of $3.0\text{E}+1 \mu\text{g/m}^3$ for chronic active inflammation and lung fibrosis in rats is the basis of the chronic inhalation MRL for nickel.</p> <p>Uncertainty Factors: UF = 30; 10 for human variability and 3 for extrapolation to humans.</p> <p>Source and date: ATSDR 8/2005</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (12/01/1996) no inhalation value at this time. PPRTV: No PPRTV record available at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD no value at this time.</p>		
Inhalation Unit Risk Factor (IURF) ($(\mu\text{g/m}^3)^{-1}$)	2.4E-4	2.4E-4	IRIS, 1991	
IURF details	<p>Potency is the range midpoint of risks from nickel containing refinery dust as described in EPA's 1986 Health Assessment Document. MDEQ/AQD calculation date: 5/9/91.</p>	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. IRIS: For nickel soluble salts, IRIS has no value at this time. IRIS has not evaluated soluble salts of nickel, as a class of compounds, for potential human carcinogenicity. The IRIS file (1/1/1991) for nickel refinery dust presents an IURF of $2.4\text{E}-4$ per $(\mu\text{g/m}^3)$. Data sets from nickel refineries in Huntington, WV (Enterline and Marsh, 1982), Copper Cliff, Ontario (Chovil et al., 1981), Clydach, Wales (Peto et al., 1984), and Kristiansand, Norway (Magnus et al., 1982) provide information available for choice of model or for separation of risk by the type of nickel exposure. The unit risk estimates ranged from $1.1\text{E}-5$ to $4.6\text{E}-4$ per $(\mu\text{g/cu.m})$. As the best estimate, the midpoint of the range, $2.4\text{E}-4$ per $(\mu\text{g/cu.m})$, is taken as the incremental unit risk due to a lifetime exposure to nickel matte refinery dust.</p> <p>IRIS Weight of Evidence Characterization (1/1/1991): Classification – A; human carcinogen. Basis — Human data in which exposure to nickel refinery</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>dust caused lung and nasal tumors in sulfide nickel matte refinery workers in several epidemiologic studies in different countries, and on animal data in which carcinomas were produced in rats by inhalation and injection Source: IRIS ,12/01/1996</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ-AQD: Per DEQ-CCD-AQD May 9, 1991 IUR = 2.4E-4 µg/m³ with annual averaging time. Potency is the range midpoint of risk from nickel-containing refinery dust as described in EPA’s 1986 Health Assessment Document. 05/09/1991. Critical Study: U.S. EPA Health Assessment Document for Nickel and Nickel Compounds. (1986), EPA/600/8-83/012FF. Methods: NA. Carcinogen Weight-of-Evidence (WOE) Class: Per AQD cancer assessment: A. Evidence is positive for some forms. Human evidence is strongest via inhalation in sulfide nickel matte refining industry. 1. Lung and nose tumors high relative risks nasal cancer (dose response by length of exposure). B. Many positive animal studies by the injection route, some positive via inhalation. C. Nickel Acetate and Nickel Carbonyl (B2[I])— cancer at sites distal to injection site. Many caused tumors at the site of injection. D. Nickel oxide has been tested in numerous bioassays that have indicated increased tumor incidence. (See Table I of the AQD justification).</p>		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	No	USEPA, 2015	
MMOA Details	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Developmental or Reproductive Effector? (Y/N)	No	NO	MDEQ, 2015	Literature search update.
Developmental or Reproductive Toxicity Details	NA	The RfD is not based on a developmental effect. Doses were the same in the F0 and F1 males and the response was not greater in the F1 males (relative liver weight in % of control was -9.3% for F0 males and -7.9% for F1 males).--		
State Drinking Water Standard (SDWS) (µg/L)	--	NO	SDWA, 1976	
SDWS details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (µg/L)	--	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
Is there an Aesthetic Value? (Y/N)	NO	Not evaluated.	NA	
Aesthetic value details	NA	NA		
Is there a Phytotoxicity Value? (Y/N)	NO	Not evaluated.	NA	
Phytotoxicity details	NA	NA		
Others:				

(C) Chemical-specific Absorption Factors

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABS _{gi})	---	1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABS _{gi} details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AE _d)	---	0.01	MDEQ, 2015	
AE _d details				
Ingestion Absorption Efficiency (AE _i)		0.5	MDEQ, 2015	
AE _i Details				
Relative Source Contribution for Water (RSC _w)		0.2	MDEQ, 2015	
Relative Source Contribution for Soil (RSC _s)		1.0	MDEQ, 2015	
Relative Source Contribution for Air (RSC _A)		1.0	MDEQ, 2015	
Others				

(D) Rule 57 Water Quality Values and GSI Criteria

Current GSI value (µg/L)	(G)
Updated GSI value (µg/L)	(G)
Rule 57 Drinking Water Value (µg/L)	2,600

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	2,600	6/1997
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	210,000	6/1997
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	NA	NA
Human Cancer values for non-drinking water source (HCV-Non-drink)	NA	NA
Final Chronic Value (FCV)	$(EXP(0.846*(LnH)+0.0584))*0.997^D$ D = value is expressed as dissolved	7/1997
Aquatic maximum value (AMV)	$(EXP(0.846*(LnH)+2.255))*0.998^D$ D = value is expressed as dissolved	7/1997
Final Acute Value (FAV)	$(EXP(0.846*(LnH)+2.255))*0.998*2^D$ D = value is expressed as dissolved	7/1997

Sources:

1. MDEQ Surface Water Assessment Section Rule 57 [website](#)
2. MDEQ Rule 57 [table](#)

(E) Target Detection Limits (TDL)

	Value	Source
Target Detection Limit – Soil ($\mu\text{g}/\text{kg}$)	1,000	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	20	MDEQ, 2015
Target Detection Limit – Air (ppbv)	NA	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	NA	MDEQ, 2015

CHEMICAL UPDATE WORKSHEET ABBREVIATIONS:

CAS # - Chemical Abstract Service Number.

Section (A) Chemical-Physical Properties**Reference Source(s):**

CRC	Chemical Rubber Company Handbook of Chemistry and Physics, 95th edition, 2014-2015
EMSOFT	USEPA Exposure Model for Soil-Organic Fate and Transport (EMSOFT) (EPA, 2002)
EPA2001	USEPA (2001) Fact Sheet, Correcting the Henry's Law Constant for Soil Temperature. Office of Solid Waste and Emergency Response, Washington, D.C.
EPA4	USEPA (2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February 22, 2004.
EPI	USEPA's Estimation Programs Interface SUITE 4.1, Copyright 2000-2012
HSDB	Hazardous Substances Data Bank
MDEQ	Michigan Department of Environmental Quality
NPG	National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards
PC	National Center for Biotechnology Information's PubChem database
PP	Syracuse Research Corporation's PhysProp database
SCDM	USEPA's Superfund Chemical Data Matrix
SSG	USEPA's Soil Screening Guidance: Technical Background Document, Second Edition, 1996
USEPA/EPA	United States environmental protection agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

W9 USEPA's User Guide for Water9 Software, Version 2.0.0, 2001

Basis/Comments:

EST	estimated
EXP	experimental
EXT	extrapolated
NA	not available or not applicable
NR	not relevant

Section (B) Toxicity Values/Benchmarks**Sources/References:**

ATSDR	Agency for Toxic Substances and Disease Registry
CALEPA	California Environmental Protection Agency
CAL DTSC	California Department of Toxic Substances Control
CAL OEHHA	CAEPA Office of Environmental Health Hazard Assessment
CCD	MDEQ Chemical Criteria Database
ECHA	European Chemicals Agency (REACH)
OECD HPV	Organization for Economic Cooperation and Development HPV Database
HEAST	USEPA's Health Effects Assessment Summary Tables
IRIS	USEPA's Integrated Risk Information System
MADEP	Massachusetts Department of Environmental Protection
MDEQ/DEQ	Michigan Department of Environmental Quality
DEQ-CCD/AQD	MDEQ Air Quality Division
DEQ-CCD/RRD	MDEQ Remediation and Redevelopment Division
DEQ-CCD/WRD	MDEQ Water Resources Division
MNDOH	Minnesota Department of Health



NJDEP	New Jersey Department of Environmental Protection
NYDEC	New York State Department of Environmental Conservation
OPP/OPPT	USEPA's Office of Pesticide Programs
PPRTV	USEPA's Provisional Peer Reviewed Toxicity Values
RIVM	The Netherlands National Institute of Public Health and the Environment
TCEQ	Texas Commission on Environmental Quality
USEPA	United States Environmental Protection Agency
USEPA OSWER	USEPA Office of Solid Waste and Emergency Response
USEPA MCL	USEPA Maximum Contaminant Level
WHO	World Health Organization
WHO IPCS	International Programme on Chemical Safety (IPCS/INCHEM)
WHO IARC	International Agency for Research on Cancers
NA	Not Available.
NR	Not Relevant.

Toxicity terms:

BMC	Benchmark concentration
BMCL	Lower bound confidence limit on the BMC
BMD	benchmark dose
BMDL	Lower bound confidence limit on the BMD
CSF	Cancer slope Factor
CNS	Central nervous system
IURF or IUR	Inhalation unit risk factor
LOAEL	Lowest observed adverse effect level
LOEL	Lowest observed effect level
MRL	Minimal risk level (ATSDR)
NOAEL	No observed adverse effect level
NOEL	No observed effect level

RfC	Reference concentration
RfD	Reference dose
p-RfD	Provisional RfD
aRfD	Acute RfD
UF	Uncertainty factor
WOE	Weight of evidence

Section (C) Chemical-specific Absorption Factors

MDEQ	Michigan Department of Environmental Quality
USEPA RAGS-E	United States Environmental Protection Agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

Section (D) Rule 57 Water Quality Values and GSI Criteria

GSI	Groundwater-surface water interface
NA	A value is not available or not applicable.
ID	Insufficient data to derive value
NLS	No literature search has been conducted