CHEMICAL UPDATE WORKSHEET

Chemical Name:	**Magnesium**
CAS #:	**7439-95-4**
Revised By:	RRD Toxicology Unit
Revision Date:	September 21, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	24.305	24.304	CRC	EXP
Physical State at ambient temp	Inorganic	Inorganic	MDEQ	
Melting Point (˚C)	---	650.00	CRC	EXP
Boiling Point (˚C)	1110	1090.00	CRC	EXP
Solubility (ug/L)	NA	NA	NA	NA
Vapor Pressure (mmHg at 25˚C)	NA	NR	NA	NA
HLC (atm-m^3/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; cm^2/s)	NR	NR	NA	NA
Diffusivity in Water (Dw; cm^2/s)	NR	NR	NA	NA
Soil Water Partition Coefficient (Kd; inorganics)	NA	NA	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (˚C)	NA	500	PC	EXP
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)	1.1E+1	1.1E+1	MDEQ 1994; NAS 1977	
RfD details	Per RRD: Laxative effects (critical effect) in humans at 400 ppm in drinking water (Drinking Water & Health, 1977). RD calculation date: 10/17/94. No IRIS record available. No PPRTV document.	**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ value based on National Academy of Sciences (NAS) (1977) determination. The derivation of the ECHA (REACH) value was not available. See details below. **Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time **PPRTV:** No PPRTV record available at this time. **MRL:** No MRL record available at this time. **Tier 3 Sources:** **MDEQ:** RfD = 11 mg/kg/day: laxative effects in humans at 400 ppm in drinking water (Drinking Water & health, 1977). **Critical Studies:** 1) National Academy of Sciences Washington, D.C. 1977. Drinking Water and Health. Safe Drinking Water Committee, National Research Council. 2) McKee, J.E., and H.W. Wolf. (eds.) 1963. Water Quality Criteria, 2nd ed. The Resource Agency of California State Water Resources Control Board Publication no. 3-A. Sacramento. 3) Kehoe, R.A. 1953. Report on the physiological effects of some common inorganic salts in water on man and domestic animals. The Kettering Laboratory, University of Cincinnati. **Methods**: not available **Critical effect**: Magnesium salts at levels over 700 mg/liter (especially magnesium sulfate) have a laxative effect, particularly on new users, although the human body can adapt to the effects of magnesium with time (McKee and Wolf, 1963). The most sensitive people are affected by MgSO4 at about 400 mg/liter and the average person at about 1,000 mg/liter (Kehoe, 1953). **End point or Point of Departure (POD):** Laxative effect.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		Uncertainty Factors: not available **Source and date:** DEQ-CCD/RRD (1/17/1994) and National Academy of Sciences, 1977. **ECHA (REACH):** DNEL (Derived No Effect Level) derivation (i.e. surrogate key study) was not specified. Study result type: read-across from supporting substance (structural analogue or surrogate) Supporting oral toxicity studies presented are: 1) Takizawa, T. et al. 2000. A 90-day repeated dose oral toxicity study of magnesium chloride in F344 rats. Bull. Natl. Inst. Health Sci. 118, 63-70 Magnesium chloride administered to rats as an admixture to solid food over a period of 90 days caused transient soft stool in male and female animals of the 2.5% group and suppression of body weight gain in males. Thus, the dose of 0.5% (i.e. 308 mg/kg bw/d for males and 299 mg/kg bw/d for females) was considered as the no-observed-adverse-effect-level (NOAEL). 2) Sondergaard, D.; et al. 1990. Magnesium stearate given perorally to rats. A short term study. Toxicology 17, 51-55. Wistar rats (20/sex/dose) were exposed to 0, 5%, 10%, and 20% magnesium stearate in diet for 90 days. The NOEL was established at 5% magnesium stearate in diet (2500 mg/kg bw/day) based on effects on relative liver weights in males fed 10% and increased amounts of iron in the livers of animals fed 20%. 3) Tanaka, H.; et al. 1993. Thirteen-week oral toxicity study of magnesium chloride in B6C3F1 mice. Toxicol. Let. 73, 25-32. B6C3F1 mice (10/sex/dose) were exposed to 0.3, 0.6, 2.5 and 5% magnesium chloride in diet for 13 weeks. The NOEL was 1.25% which corresponds to 2.69 g/kg bw/d in males and 3.26 g/kg bw/d in females 4) Kurata, Y.; et al. 1989. Lack of carcinogenicity of magnesium chloride in a long-term feeding study in B6C3F1 mice. Fd. Chem. Toxic. 27, 559-563 B6C3F1 mice (0/sex/dose) were exposed to 0.5 or 2% magnesium chloride in diet for 96 weeks. NOEL was 0.5%, which refers to 730 mg/kg bw/day, based on		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		decreased body weights in females. **Other Tier 3:** No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of California, Massachusetts, Minnesota, New Jersey, New York, and Texas, Canada, The Netherlands (RIVM), WHO (IARC), WHO (IPCS/INCHEM) and OECD HPV.		
Oral Cancer Slope Factor (CSF) (mg/kg-day)$^{-1}$)	--	NA	MDEQ, 2015	
CSF details	No RRD entry in CCD and no IRIS file available.	**Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time. **MRL:** NA; MRLs are for noncancer only. **PPRTV:** No PPRTV record available at this time. **Tier 3 Source:** **MDEQ:** Per DEQ-CCD, no value at this time.		Complete
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	1.0E+2	1.0E+2	MDEQ, 1994	
RfC/ITSL details	Per AQD: ITSL based on 1% of TLV for magnesium oxide. Inhalation symptoms of metal fume fever not observed with ingestion, therefore oral data not usable	**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ value based on 1% of the ACGIH TLV for magnesium oxide. ECHA (REACH) did not clearly present how their value was derived. See details below. **Tier 1 and 2 Sources:** No IRIS file available at this time. **PPRTV:** No PPRTV record available at this time. **MRL:** No MRL record available at this time. **Tier 3 Sources:**		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	for ITSL development. FINAL. AQD calculation date: 9/7/94.	**MDEQ-AQD:** ITSL = 100 µg/m^3 (8-hr averaging time): The ITSL is based on 1% of the ACGIH TLV for magnesium oxide set at 10 mg/m^3. The TLV is believed to be protective, with an unknown margin of safety for producing adverse health effects – irritation of eyes and nose, and the symptoms of metal fume fever. Inhalation symptoms of metal fume fever were not observed with ingestion; therefore, the oral data are not relevant for the ITSL. Source: MDEQ-AQD, 9/07/1994 (In AQD ITSL Justification Sheet) **ECHA (REACH):** Derived No Effect Level (DNEL) = 10 mg/m^3 (1.0E+4 µg/m^3): DNEL derivation is not clearly presented. Subs Key Health surveillance Study: Kuschner, W.G.; et al. 1997. Human pulmonary responses to experimental inhalation of high concentration fine and ultrafine magnesium oxide particles. Environ. Health Perspectives, Vol. 105, No. 11, 1234-1237 Methods: Subjects: 6 healthy volunteers, 4 male and 2 female subjects, 3 smokers and 3 non-smokers, aged between 21 and 43. Treatment: Inhalation of fine and ultrafine magnesium oxide particles produced from a furnace system model. Individual exposure concentrations were (duration in parentheses) 5.8 (45 min), 230 (15 min), 210 (20 min), 123 (45 min), 110 (45 min), and 143 (45 min) mg/m^3, given as MgO. By weight, 28 % of the fume particles were ultrafine (<0.1 µm in diameter) and over 98 % of fume particles were fine (<2.5 µm in diameter). Subjects inhaled magnesium oxide fume with medical-grade air through a mouth-breathing face mask. Observations: 18 to 20 hours after inhalation, bronchoalveolar lavage (BAL) cell and cytokine concentrations, pulmonary function and peripheral blood neutrophil concentrations were quantified. Endpoint: acute toxicity Overall assessment factor (AF): 1 **Other Tier 3:** No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		California, Massachusetts, Minnesota, New Jersey, New York, and Texas, Canada, The Netherlands (RIVM), WHO (IARC), WHO (IPCS/INCHEM) and OECD HPV.		
Inhalation Unit Risk Factor (IURF) ((µg/m^3)$^{-1}$)	--	NA	MDEQ, 2015	
IURF details		**Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time. **PPRTV:** No PPRTV record available at this time. **MRL:** NA; MRLs are for noncancer only. **Tier 3 Source:** **MDEQ per CCD:** No value available at this time.		Complete
Mutagenic Mode of Action (MMOA)? (Y/N)	--	No	USEPA, 2015	
MMOA Details	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	--	No	MDEQ, 2015	
Developmental or Reproductive Toxicity Details		No, the RfD or RfC is not based on a reproductive-developmental effect.		
State Drinking Water Standard (SDWS) (µg/L)	No	NO	SDWA, 1976	
SDWS details		MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (µg/L)	No	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details		MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
Is there an Aesthetic Value?	No	Not evaluated.		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
(Y/N)				
Aesthetic value details		The taste threshold for magnesium has been reported by Lockhart et al. (1955) as 100 mg/liter in sensitive persons and about 500 mg/liter for the average person (Kehoe et al. 1953. The effect of water impurities on the flavor of brewed coffee. Food Res. 10:598-605.). This study does not use methods approved by the U.S. EPA as required by Part 201. These values can be used for screening.		
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 (ABSgi)	---	1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABSgi details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AEd)	---	0.01	MDEQ, 2015	
AEd details				
Ingestion Absorption Efficiency (AEi)		0.5	MDEQ, 2015	
AEi Details				
Relative Source Contribution for Water (RSC_W)		1.0	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)	NA
Updated GSI value (µg/L)	(EE)
Rule 57 Drinking Water Value (µg/L)	NA

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)		
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)		
Wildlife Value (WV)		
Human Cancer Values for Drinking Water Source (HCV-drink)		
Human Cancer values for non-drinking water source (HCV-Non-drink)		
Final Chronic Value (FCV)		
Aquatic maximum value (AMV)		
Final Acute Value (FAV)		

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 (μg/kg)	4,000	MDEQ, 2015
Target Detection Limit – Water (μg/L)	1,000	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