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SAFETY DATA SHEET: MANGANESE DINITRATE; MANGANESE (2+) DINITRATE
Provided in accordance with Article 18(2) of Regulation (EC) No 1272/2008

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product Identifier:

Substance name: Manganese dinitrate, manganese (2+) dinitrate
Other names: Mn (NO₃)₂
EINECS number: 233-828-8
CAS number: 10377-66-9
REACH Registration number: [If applicable]
Unique formula identifier (UFI): Not applicable for this substance

1.2 Relevant identified uses of the Substance/Mixture and uses advised against:

Formulation of non-fertilizer products:
PC7 Base metals and alloys
PC 9a: Coatings and paints, thinners, paint removals
PC 15 Non-metal surface treatment products
PC 18 Ink and toners
PC 21: Laboratory chemicals
PC 23: Leather treatment products
PC 34: Textile dyes, and impregnating products
PC 36: Water softeners
PC 37: Water treatment chemicals
PC 39: Cosmetics, personal care products
PC 12: Used in fertilizers and fertilizers products.
PC 20: Production of other manganese-based compounds, intermediate
PC14: Use in electronics industry / metal treatment
PC 12: Widespread use of fertilisers by professional workers

Add or delete the above to suit your company's needs.

No known uses advised against



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1.3 Details of the supplier of the safety data sheet:(including address, phone numbers etc: **Complete as required.**

1.4 Emergency Telephone: **Complete as required (For EU add 112) CIAV # of receiving country.**





SECTION 2: HAZARD IDENTIFICATION

2.1 Classification of the substance or mixture:

Classification according to Regulation (EC) No. 1272/2008 [CLP]:

Classified as; Acute Tox. 4; STOT RE 2; Eye Dam.1; Oxid solid 2; Skin Corr. 1C

2.2 Label elements:

Classification	Oxidising solid 2; Acute Tox. 4; STOT RE 2; Skin Corr. 1C; Eye Dam.1;
Pictogram GHS07, GHS08, GHS05, GHS03 respectively	   
Signal word	Danger
Hazard statement	H272: May intensify fire; Oxidiser. H302: Harmful if swallowed. H314: Causes severe skin burns and eye damage. H373: May cause serious damage to the brain through prolonged or repeated exposure via inhalation.
Precautionary statement Prevention	P264, P260, P270, P273, P280, P210, P303, P221
Precautionary statement Response	P301+ P330+P331, P303+P361+P353, P301+P312
Precautionary Statement Disposal	P501
Additional labelling requirements	EUH071: Corrosive to the respiratory tract

2.3 Other Hazards:

The substance is an inorganic metallic salt. Based on available information, the substance does not meet the criteria for classification as persistent, bioaccumulative and toxic or very persistent and very bioaccumulative.

Endocrine disrupting properties have not been identified from existing acute or chronic data. Data lacking.

Include **other hazards if known.**

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substance(s) **[Amend as appropriate]**

Manganese dinitrate is an inorganic mono-constituent. Its impurities are negligible and do not influence the overall classification.

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Chemical name	EC No.	CAS number	Nominal % w/w	REACH Registration
Manganese dinitrate	233-828-8	10377-66-9	>95 - 100% (Amend as appropriate)	xx-xxxxxx-xx
Water	231-797-2	7732-18-15	<5%	

3.2 Mixtures: The substance is not a mixture.

SECTION 4: FIRST AID MEASURES

4.1 Description of first aid measures:

4.1.1 General Information

Avoid contact with eyes and skin as the substance can cause severe skin burns and serious eye damage. In case of accident or unwellness, seek medical advice immediately.

4.1.2 Following Inhalation: Do not inhale. Wear an appropriate mask. The substance is corrosive, hence will irritate the lungs. Upon prolong exposure may cause subtle neurological effects. **Include other relevant information based on your company's procedures as well as the specific mask type used.**

4.1.3 Following Skin Contact: Wear appropriate protective equipment and avoid skin contact. Skin protection is a must. The substance causes severe skin burns. **Include information based on your company's procedures.**

4.1.4 Following Eye Contact: Eye protection is a must. The substance causes serious eye damage. **Include information based on your company's procedures as well as the recommended specific goggle type.**

4.1.5 Following Ingestion: Do not ingest. **Include other relevant information based on your company's procedures.**

4.1.6 Self-protection of the first aider: Full PPE is recommended – Mask, goggles and appropriate overalls. **Include other information based on your company's procedures.**

4.2 Most important symptoms and effects, both acute and delayed: The substance causes burns therefore, avoid skin and eye contact. Avoid breathing. Effects are immediate and acute.

4.3 Indication of any immediate medical attention and special treatment needed: Upon skin or eye contact or accidental inhalation -seek medical attention immediately. **Include information based on your company's procedures.**

SECTION 5: FIRE-FIGHTING MEASURES:

5.1 Extinguishing media:

CO₂, dry chemical, dry sand, alcohol-resistant foam. **Include information on an appropriate extinguishing medium and any unsuitable extinguishing media based on your company's procedures.**



5.2 Special hazards arising from substance or mixture:

The substance does not decompose naturally. However, upon combustion produces fumes of metallic oxides and nitrogen oxides (NOx). **Include any other relevant information.**

5.3 Advice for fire-fighters:

Avoid contact with skin and eyes. Flames could produce toxic gases, therefore wear appropriate respiratory protection equipment. Include information based on your company's procedures.

SECTION 6: ACCIDENTAL RELEASE MEASURES:

6.1 Personal precautions, protective equipment and emergency procedures:

6.1.1 For non-emergency personnel:

- Dusk mask, goggles and overalls are a must-see section 8 for more details.
- Sufficient ventilation is essential. Avoid all ignition sources.
- In the event of any accidental release, evacuate the area and consult trained personnel's – **Amend as per your company procedures.**

6.1.2 For emergency responders: Remove persons to safety. Isolate hazard area and deny entry. Ventilate closed spaces before entering. Use personal protective equipment, **specify which to use/which not to use**, see section 8 – **Amend as per your company procedures.**

6.2 Environmental precautions:

Substance is not considered an environmental hazard based on available studies. However, it is advisable to keep away from drains/waterways as it could change their pH profile. Collect and reuse or dispose of according to the national laws. **Include other information based on your company's procedures.**

6.3 Methods and material for containment and cleaning up:

In the event of a spill, collect contaminated material and put in appropriate containers for disposal. Dispose of as special waste in compliance with local and national regulations.

6.3.2 For containment: Collect in closed and suitable containers for disposal or reuse **Include other information based on your company's procedures.**

6.3.3 For cleaning up: Clean contaminated objects and areas thoroughly observing environmental regulations – **Amend as per company procedures-Include cleaning and vacuuming techniques.**

6.3.4 Other information: **Include information based on your company's procedure such as clean-up techniques/materials never to be used.**

6.4 Reference to other sections: For Personal protective equipment and appropriate disposal: see section 8 and 13.

Section 7: HANDLING AND STORAGE:

7.1 Precautions for safe handling:

7.1.1 Recommendations:

- Use only in well ventilated areas. Avoid generating dust as dust can easily enter the eyes or touch the skin. Wear personal protective clothing (see Section 8). **Include other information based on your company's procedures.**



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- b) Avoid handling with incompatible substances/mixtures: Avoid contact with acids (**List incompatible substances if known**)
- c) Avoid dust generating operations or must be carried out in properly ventilated areas while wearing appropriate PPE.
- d) Capture dust if possible and if generated, vacuum and compress into pellets to minimize environmental exposure- **Amend as per company procedures.**

7.1.2 Advice on general occupational hygiene:

- a) Do not eat, drink or smoke in work areas.
- b) Wash hands before and after use and keep them dry.
- c) Remove contaminated clothing and personal protective equipment before entering eating areas - Include other information based on your company's procedures.

7.2 Conditions for safe storage, including any incompatibilities:

7.2.1 Specific storage requirements:

a) Risk management associated to physical and chemical properties

i) Explosive atmosphere: The substance is not explosive, however, store away from explosive materials

ii) **Corrosive conditions:** The substance does not corrode metal, hence no adverse corrosive effects are expected

iii) **Flammability hazard:** The substance is not flammable, however, keep away from flammable materials as the substance may intensify fire (it is an oxidizer)

iv) **Incompatible substances or mixtures:** Acids (**List any if known**) **Include information based on company's procedures**

v) **Evaporative conditions:** The substance does not evaporate. Avoid storage around organic evaporative materials/substances.

vi) **Potential ignition sources:** Keep away from ignition sources as the substance may intensify fire.

b) **How to control effects from environmental conditions:** (i) Weather conditions, (ii) ambient pressure, (iii) varying temperatures, (v) humidity and (vi) vibration do not affect the integrity of the substance. However, store in a cool dry environment and protected from (iv) sunlight – the substance is an oxidizer. – **Amend as per your company's procedures.**

c) **How to maintain the integrity of the substance:** The substance is very stable under normal conditions of use. It does not decompose or disintegrate. Stabilisers and antioxidants are not required, however, store protected from sunlight.

d) Other advise

i) **Ventilation requirements:** Ensure adequate ventilation and store in a cool dry place.

ii) **Specific designs for storage:** Keep/store only in original container/packaging. **Include other information based on your company's procedures.**

iii) **Quantity limits under storage conditions:** Keep in original containers and packaging. **Include information based on your national laws.**



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iv) **Packaging compatibility:** Store in original/similar packaging. Protect container/packaging against damage – **Amend as per company's procedures.**

7.3 Specific end uses(s):

Recommendations: Observe instructions for use and see exposure scenarios – Annex 1

SECTION 8: EXPOSURE CONTROLS/ PERSONAL PROTECTION:

8.1 Control Parameters:

8.1.1 Occupational exposure limits: The EU SCOEL OEL values for Manganese and its inorganic compounds are 0.2mg/m³ – inhalable and 0.05mg/m³ respirable.

8.1.1.1 National limits: **Include other relevant country specific workplace limits**

8.1.1.2 Union limits: 0.2mg/m³ inhalable and 0.05mg/m³ respirable

8.1.1.3 Any other national exposure limit values: **Include if available.**

8.1.1.4 Union Biological limit values: No union biological limit values exist for Inorganic manganese and its compounds.

8.1.1.5 Any other national biological limit values: **Include if available.**

8.1.2 Monitoring Procedures: Dust monitoring is recommended, **provide methodology as per national laws/company procedures.**

8.1.3 Formation of air contaminates: The substance does not produce air contaminants under normal conditions of use. OEL/BLV are not provided **Amend as per your company's use.**

8.1.4 Derived No Effects Limits (DNELs)/Predicted No Effects Concentrations (PNECs):

Hazard Assessment conclusion for Workers: DNELS

Route	Type of effect	Hazard conclusion	Most sensitive endpoint
Inhalation	Systemic effects - Long-term	DNEL (Derived No Effect Level) 0.2mg/m ³	neurotoxicity
Inhalation	Systemic effects - Acute	no-threshold effect and/or no dose-response information available	
Inhalation	Local effects - Long-term	no-threshold effect and/or no dose-response information available	
Inhalation	Local effects - Acute	no-threshold effect and/or no dose-response information available	
Dermal	Systemic effects - Long-term	DNEL (Derived No Effect Level) 0.004mg/kg bw/day	
Dermal	Systemic effects - Acute	no-threshold effect and/or no dose-response information available	

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Dermal	Local effects - Long-term	no-threshold effect and/or no dose-response information available	
Dermal	Local effects - Acute	no-threshold effect and/or no dose-response information available	
Eyes	Local effects	high hazard (no threshold derived)	

Hazard Assessment conclusion for the Environment: PNECs

Compartment	Hazard conclusion	Remarks/Justification
Freshwater	PNEC aqua (freshwater): 0.036mg/L Intermittent releases: 0.104mg/L	Assessment factor: 50 Extrapolation method: assessment factor PNEC aqua (freshwater) The lowest NOEC value from the dataset was obtained in the brook trout study (Davies & Brinkman 1998). This study was conducted on MnSO ₄ and the NOEC was 0.55 mg Mn/L. This is equivalent to 1.790 mg/L of Mn(NO ₃) ₂ when a molecular weight correction is made. PNEC intermittent release hazard assessment conclusion: PNEC aqua (intermittent releases) PNEC intermittent release assessment factor: 100.0 PNEC intermittent release extrapolation method: assessment factor PNEC intermittent release justification: The lowest acute L(E)C ₅₀ value from the dataset was obtained in the rainbow trout (Davies & Brinkman 1998). This study was conducted on MnSO ₄ and the LC ₅₀ was 3.2 mg Mn/L. This is equivalent to 10.41 mg/L of Mn(NO ₃) ₂ when a molecular weight correction is made.
Marine water	PNEC aqua (marine water): 0mg/L Intermittent releases:	Assessment factor: 50 Extrapolation method: assessment factor PNEC aqua (marine water) Based on the long-term NOEC from a study on the marine species; Pacific oyster (NOEC of 0.02 mg Mn/L).
Sediments (freshwater)	PNEC sediment (freshwater):	Assessment factor: 50 Extrapolation method: assessment factor PNEC sediment (freshwater)

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	0.011mg/kg sediment dw	Based on the lowest endpoint (NOEC of 0.57 mg Mn/kg sediment dwt) from studies on two sediment dwelling organisms
Sediments (marine water)	PNEC sediment (marine water): 0.001mg/kg sediment dw	Assessment factor: 500 Extrapolation method: equilibrium partitioning method PNEC sediment (marine water) Based on the freshwater endpoints with an increased AF factor.
Sewage treatment plant	PNEC STP: 56mg/L	Assessment factor: 10 Extrapolation method: assessment factor PNEC STP Activated sludge respiration/inhibition test; NOEC = 560 mg MnSO ₄ /L
Soil	PNEC soil: 25.1mg/kg soil dw	Assessment factor: 10 Extrapolation method: assessment factor PNEC soil Based on the lowest NOEC (251 mg Mn/kg soil d.w.) from a range of long-term studies.
Air	no hazard identified:	
Secondary poisoning	no potential for bioaccumulation:	Bioaccumulation of Mn is not expected to occur. Hence no secondary poisoning risk exists.

8.1.5 Control banding: A control banding approach is not used to decrease risk management measure during the use of this substance for the uses specified in section 1.2.

8.2 Exposure controls: See Exposure scenarios on, Annex 1

8.2.1 Appropriate engineering controls: Dust is trapped and recycled where possible. Wastewater is collected for treatment and recycled. **Amend as per your company's procedures.**

8.2.2 Individual protective measures: Overalls, goggles and masks are mandatory during use.

8.2.2.1 Other non-personal protection: Good industrial hygiene is a must. Keep and use in well ventilated areas. See section 5 for more information. **Amend as per your company's procedures.**

8.2.2.2 CEN stand requirement for protective equipment: **(Please state the quality/standard/thickness of the personal protective equipment used by your organisation)**



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- a) Eye/face protection: Eye protection is a must. **Complete as per your company procedures e.g type of goggles and mask**
- b) Skin protection: Overalls, gloves and boots are mandatory and good industrial hygiene is a must. **(Please specify type of overall, gloves, boots including the thickness of material).**
- c) Respiratory protection: N95 Mask (Amend as per your company procedures)
- d) Thermal hazards: Not applicable

8.2.3 Environmental exposure controls: The substance is not harmful to the environment. See Annex I, Exposure scenarios **(Please include environmental controls employed by your company)**

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES: **[the information below is based on available literature and studies]**

9.1 General information	
State	Solid
Colour	Pink
Odour	Odourless
Melting point (Mpt) / Freezing point	308 +/-1K, Regulation (EC) No. 440/2008, Annex, A1
Boiling point or initial boiling point/boiling range	Decomposed from 396K at 101.87kPa, Regulation (EC) No. 440/2008
Flammability of solids	Not flammable, Regulation (EC) No. 440/2008, Method A10
Lower and upper explosion limit	Not applicable to solids
Flash Point	Study scientifically unjustified
Auto-ignition temperature	Not applicable to solids
Decomposition temperature	Not applicable to inorganic solids
pH	Include if known (where the substance is a solid, the pH of an aqueous solution at a given concentration shall be indicated)
Kinematic viscosity	Not applicable to solids
Water content	27.1 %w/w: Solubility – Very soluble: Regulation (EC) No. 440/2008, Annex A6
Partition Coefficient	Study scientifically unjustified
Vapour pressure	2.7 x 10 ⁻² Pa at 25°C, Method B4
Density/Relative density	2.11 at 20.8°C, Regulation (EC) No. 440/2008, Annex, A3
Relative Vapour density	Not applicable to solids
Particle characteristics	study technically not feasible
9.2 Other information	No additional information relevant to the safe use of the substance
9.2.1 Physical hazard classes	
Explosives properties	Not explosive
Flammable gases	Not applicable as the substance is a solid

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Aerosols	Not applicable under normal conditions of use
Oxidizing gases	Not applicable as the substance is a solid
Gases under pressure	Not applicable as the substance is a solid
Flammability of liquids/Solids	Not flammable
Self-reactive substances and mixtures	Not self-reactive
Pyrophoric liquids	Not applicable as the substance is a solid
Pyrophoric solids	Does not have pyrophoric properties
Self-heating substances and mixtures	Spontaneous ignition does not occur
Substances and mixtures which emit flammable gases in contact with water	Predicted not to emit flammable gases upon contact with water
Oxidising Liquids/solids	Oxidizer, Method A17
Organic peroxides	Not applicable to inorganic substances
Corrosive to metals	The substance is not corrosive to metals
Desensitised explosives	Not applicable
9.2.2 Other	None

SECTION 10: STABILITY AND REACTIVITY: [Amend information below to conform to your company information]

- 10.1 Reactivity:** No specific test data related to reactivity available for this substance.
- 10.1.1 **Reactivity Hazard of substance:** Not applicable for inorganic substances
- 10.1.2 **Reactivity hazard of mixture:** Not applicable as the substance is not a mixture.
- 10.2 Chemical stability:** The substance is chemically stable under recommended conditions of storage, use and temperature.
- 10.3 Possibility of Hazardous reaction:** No hazardous reaction when handled and stored according to provisions.
- 10.4 Conditions to avoid:** Include your company's information.
- 10.5 Incompatible Materials:** Include your company's information.
- 10.6 Hazardous decomposition products:** Does not decompose when used for intended uses. Include your company's information.

SECTION 11: TOXICOLOGICAL INFORMATION: [The information in this section is from experimental data and other available literature]

11.1 Information on toxicological effects:

a) Acute toxicity:

Acute oral toxicity: Harmful if ingested (LD50: >300 mg/kg bw)

Acute dermal toxicity: Corrosive to the rabbit skin



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Acute inhalation toxicity: For ethical reasons, study cannot be conducted on corrosive substances.

b) Skin corrosion/irritation:

The substance is corrosive to the skin (EPISKIN and Epidermal in-vitro test)

c) Serious eye damage/irritation:

The substance causes severe eye irritation based on skin corrosivity evaluation.

d) Respiratory or skin sensitization:

Not a skin sensitizer in the mouse (One study to OECD guideline 429 and EU method B.42, Local lymph node assay, GLP). There is no information available for respiratory sensitization. However, it is predicted not to be a respiratory sensitizer.

e) Germ cell mutagenicity:

Data lacking for the substance as such due to its corrosivity nature. However, data on MnCl₂ – a very soluble salt considered as a worse-case evaluation concludes – No concerns on mutagenicity based on studies below:

- Ames test with *S. typhimurium* TA 98, TA 100, TA 1535, TA 1537, *E. coli* WP2 uvrA (Met. act.: with and without) (OECD TG 471, EU method B13 and GLP); No toxicity was observed up a concentration of 5000 ug/plate.
- Mammalian cell gene mutation assay with mouse lymphoma L5178Y cells (met. act.: with and without) (OECD 476 and GLP); Negative for mouse lymphoma Cytotoxicity: Yes, induced toxicity was not at the highest dose.
- In-vitro mammalian chromosome aberration test with human lymphocytes (Met. act.: with and without) (OECD guideline 473 and GLP). Negative for lymphocytes. Cytotoxicity: Yes

f) Carcinogenicity:

There are no specific studies on carcinogenicity for this substance. However, carcinogenicity report (NTP, 1993) on analogue substance MnSO₄ and an expert review by Jenkinson, 2009 on genotoxicity as well as peer review article (Assem et al, 2011) concluded – no concerns, carcinogenicity in humans is not expected.

g) Reproductive toxicity:

No reproductive studies exist on this substance, possibly due to its corrosive nature. However, a two generation reprotoxicity study on the male/female rats using MnCl₂ (an analogue substance) via inhalation (OECD guideline 416, GLP) concluded: No treatment related effects at 20 mg/m³ air in F0, F1 and F2 generations (Jardine L, 2013 and McGough & Jardine, 2017) - Not toxic to reproduction

A Prenatal-developmental toxicity study using MnCl₂ via inhalation (OECD 414, GLP) concluded: No fetal abnormalities at not specified at 15 mg/m³ (Dettwiler M, 2016).

h) Specific target organ toxicity (Single exposure):

Based on available data the classification criteria are not met.

i) Specific target organ toxicity (repeated exposure):

Based on published literature inhalation exposure to the substance or its analogues is expected to cause harm upon repeated exposure over long periods of time. The analogue substance MnSO₄ has a harmonized



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classification as STOT RE 2. This classification is therefore read-across to Mn(NO₃)₂.

j) Aspiration hazard:

Data lacking

11.2 Information on other hazards

11.2.1 Endocrine disrupting properties: The substance is not considered an endocrine disruptor based on available literature – Data lacking

SECTION 12: ECOLOGICAL INFORMATION:

12.1 Toxicity:

Acute (short-term):

Aquatic vertebrates:

a) Fish: LC₅₀ (96h): 49.9 mg/L Mn based on mortality (test material-MnSO₄ based on read-across)

b) Fish: LC₅₀ (96h): 27.5 mg/L Mn based on: mortality (150 Hardness. 95 % 23.4 - 31.6 mg/L.) and LL₅₀ (96h): 5.12 mg/L Mn based on: mortality (30 Hardness. 95 % CL 4.6 - 5.7 mg//L.) (test material -MnCl₂ based on read-across)

Aquatic invertebrates:

a) Daphnia magna: LC₅₀ (48h): 9.8 mg/L dissolved (meas. (arithm. mean)) based on: as Mn²⁺ (Without Food) (test material -MnCl₂ based on read-across)

Chronic (long-term) toxicity:

Aquatic vertebrates:

a) Fish early-life stage toxicity: NOEC (4mo): 0.6 mg/L Mn (test material – MnCl₂ based on read-across)

b) Fish early-life stage toxicity: NOEC (4mo): 2.03 mg/L Mn (test material – MnCl₂ based on read-across)

c) Oncorhynchus mykiss (previous name: Salmo gairdneri): Early life: NOEC (4mo): 0.6 mg/L Mn (test material-MnSO₄ based on read-across)

Aquatic invertebrates:

a) Fresh water Ceriodaphnia dubia: LC₅₀ (48h): 5.7 mg Mn/L (Average) test mat. (estimated) based on soft water survival (test material -MnCl₂ based on read-across)

b) Aquatic worm Aeolosoma sp.: LC₅₀ (48h): 39.46 mg/L dissolved (meas. (arithm. mean)) based on mortality (95 % CL); LOEC (48h): 53.67 mg/L dissolved (meas. (arithm. mean)) based on: Survival; NOEC (48h): 27.2 mg/L dissolved (meas. (arithm. mean)) based on: Survival (test material - MnCl₂ based on read-across)

c) ASRI: No effects were seen on microbial activity (OECD Guideline 209, Activated Sludge, Respiration Inhibition- ASRI) at 3 hours exposure: 560 mg/L test material and EC₅₀ (3h) >1000 mg/L test material (nominal) based on: inhibition of total respiration - respiration rate (test material - MnCl₂ based on read-across)

Other Environmental studies

a) Soil macro-organisms at levels up to 157 mg/kg soil dw Mn during 28 days exposure (Kuperman RG, et al DJ 2002)



Based on available studies conducted at different trophic levels, the substance is not harmful to aquatic life.

12.2 Persistence and degradation	No potential for persistence	According to the Guidance on information requirements and chemical safety assessment, Chapter R.11: PBT assessment, “the PBT and vPvB criteria of Annex XIII to the regulation do not apply to inorganic substances”. Therefore Mn(NO ₃) ₂ is not considered to require any further assessment of PBT properties.
12.3 Bioaccumulative potential	No potential for bioaccumulation	According to the Guidance on information requirements and chemical safety assessment, Chapter R.11: PBT assessment, “the PBT and vPvB criteria of Annex XIII to the regulation do not apply to inorganic substances”. Therefore Mn(NO ₃) ₂ is not considered to require any further assessment of PBT properties.
12.4 Mobility in soil	No potential to move into ground water	Data lacking

12.5 Results of PBT and vPvB assessment:

According to the Guidance on information requirements and chemical safety assessment, Chapter R.11: PBT assessment, “the PBT and vPvB criteria of Annex XIII to the regulation do not apply to inorganic substances”. Therefore Mn(NO₃)₂ is not considered to require any further assessment of PBT properties

12.6 Endocrine disrupting properties:

The substance is not considered an endocrine disruptor based on available literature – Data lacking.

12.7: Other adverse effects: None known

SECTION 13: DISPOSAL CONSIDERATIONS: **Include your company’s information.**

13.1 Waste treatment methods: Waste disposal in accordance with local and national laws covering waste and dangerous waste. **Include additional company specific information.**

a) Waste treatment-relevant information: **Include your company’s /national law information.**

b) Physical/chemical properties that affect waste treatment option: **None known**

c) Sewage disposal-relevant information: **Include your company’s/national laws information.**

d) Precautions for recommended waste treatment options: **Include your company’s information.**

SECTION 14: TRANSPORT INFORMATION:

Transport may take place according to national regulations or land transport (ADR/RID), sea transport (IMDG) or Air transport (ICAO-TI/IATA-DGR).

14.1 UN Number: **Include number or use not applicable if this is the case.**

14.2 UN proper shipping name: **Include name or use not applicable if this is the case.**

14.3 Transport hazard class: **Class 8**

14.4 Packaging group: **Packaging group III.**



14.5 Environmental hazard: Not hazardous to the environment

14.6 Special precautions for users: Always transport in close containers, avoid generating dust [**Amend as appropriate**]

14.7 Maritime transport in bulk according to IMO instruments **Complete as appropriate or used not applicable if this is the case.**

SECTION 15: REGULATORY INFORMATION: [Delete as appropriate and include regulatory information specific to your country...]

15.1 Safety, health and environmental regulations/legislation for the substance:

UN GHS - UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS):

According to Chapter 1.5.2 of the UN Globally Harmonized System of Classification and Labeling of Chemicals (GHS) safety data sheets (SDS) are only required for substances and mixtures that meet the harmonized criteria for physical, health or environmental hazards. This substance meets these criteria; hence a safety data sheet is required.

EU CLP – Classification Labeling and Packaging Regulation: According to Article 59(2)(b) of (EC) No 1272/2008 (CLP), which amends REACH article 31(1), safety data sheets (SDS) are only required for substances and mixtures/special preparations that meet the harmonized criteria for physical, health or environmental hazards. Mn(NO₃)₂ meets this criterion, hence a SDS according to 453/2010/EC is needed – this template is designed to meet this criteria.

EU REACH – Registration, Evaluation and Authorisation of Chemicals: REACH article 31(7) requires relevant exposure scenarios from the Chemical Safety Report (CSR) to be annexed to the SDS. These exposure scenarios are only required for hazard-classified substances or mixtures. This substance is hazard-classified according to CLP, therefore exposure scenarios are required. Ask your REACH/Chemical regulatory team.

15.2 Chemical Safety Report (CSR): A chemical safety assessment has been carried out for this substance.

SECTION 16: OTHER INFORMATION:

- a) **If using this template to develop your company's SDS** in the case of a revised safety data sheet, a clear indication of where changes have been made to the previous version of the safety data sheet is required in this section, unless such indication is given elsewhere in the safety data sheet, with an explanation of the changes, if appropriate. A supplier of a substance or mixture shall be able to provide an explanation of the changes upon request
- b) **A key/legend to abbreviations and acronyms used in the SDS should be added in this section.**
- c) **Key Literature:**
 1. Adhikari S, Naqvi AA, Pani KC, Pillai BR, Jena JK & Sarangi N (2007). Effect of Manganese and Iron on Growth and Feeding of Juvenile Giant River Prawn, *Macrobrachium rosenbergii* (De-Man). *Journal of the World Aquaculture Society*. 38(1):161-168.
 2. Akoume MY, Perwaiz S, Yousef IM and Plaa GL (2003). Synergistic role of 3-hydroxy-3-methylglutaryl coenzyme A reductase and cholesterol 7 α -hydroxylase in the pathogenesis of manganese-bilirubin induced cholestasis in rats. *Toxicol Sci* 73:378-385.



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3. Aschner M, Erikson KM and Dorman DC (2005). Manganese dosimetry: species differences and implications for neurotoxicity. *Crit Rev Toxicol* 35:1-32.
4. Assem, F. L., et al, (2011); The Mutagenicity and carcinogenicity of inorganic manganese compounds: A synthesis of the evidence, *Journal of toxicology and environment, part B*
5. Atwal SS and Tremain SP (2010). Mn(NO₃)₂.4H₂O: Determination of Melting/Freezing Temperature and Flammability (Solids). Testing laboratory: Harlan Laboratories Limited, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0045. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2010-01-20.
6. Bales CW, Freeland-Graves JH, Lin PH, Stone JM and Dougherty V (1987). Plasma Uptake of Manganese - Influence of Dietary factors. American Chemical Society, Washington DC.
7. Bataineh H, Al-Hamood MH and Elbetieha AM (1998). Assessment of aggression, sexual behaviour and fertility in adult male rat following long-term ingestion of four industrial metal salts. *Human and Experimental Toxicology*, 17:570-576.
8. Bataineh HN, Bateineh ZM & Daradka H (2007). Short-term exposure of female rats to industrial metal salts: effect on implantation and pregnancy. *Reproductive Medicine and Biology*, 6: 179-183.
9. Biesinger KE & Christensen GM (1972). Effects of Various Metals on Survival, Growth, Reproduction, and Metabolism of *Daphnia magna*. *Journal of the Fisheries Research Board of Canada*.29:1691-1700.
10. Cardwell A (2009a). Evaluation of Chronic Toxicity of Manganese to the Aquatic Oligochaete, *Aeolosoma* sp. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas Street SW, Albany, OR 97321. Report no.: 598-5231-002. Owner Company: International Manganese Institute, 17 rue Duphot, 75001 Paris, France. Report date: 2009-03-06.
11. Cardwell A (2009b). 42- days Chronic Toxicity of Manganese to the freshwater amphipod crustacean, *Hyalella azteca*. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas St. SW, Albany, Oregon 97321, USA. Report no.: 598-5232-002. Owner company: International Manganese Institute, 17 rue Duphot, 75001 Paris, Franc. Report date: 2009-03-06.
12. Cardwell A (2009c). Life-Cycle Toxicity of Manganese to the Midge, *Chironomus tentans*. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas St. SW, Albany, Oregon 97321, USA. Report no.: 598-5231-002. Owner Company: International Manganese Institute, 17 rue Duphot, 75001 Paris, France. Report date: 2009-03-06.
13. Davies H & Brinkman S (1995). Acute toxicity of manganese to brown trout (*salmo trutta*) in hard water. Federal aid Project #F-243, Colorado Division of Wildlife, Fort Collins, Colorado.
14. Davies P & Brinkman S (1994). Acute and chronic toxicity of manganese to exposed and unexposed Rainbow and brown trout. Federal aid project F-243-1, Colorado Division of Wildlife, Fort Collins, Colorado.

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15. Davies P and Brinkman S (1994). Acute and chronic toxicity of manganese to exposed and unexposed Rainbow and brown trout. Federal aid project F-243-1, Colorado Division of Wildlife, Fort Collins, Colorado.
16. Davies PH (1980). Investigations on the toxicity of metals to fish. Colorado division of wildlife, Fish research section, Colorado.
17. Davies PH, Brinkman, S & McIntyre M (1998). Toxicity of Manganese to Early life stage and Fry of Brook Trout (*Salvelinus fontinalis*) and Rainbow trout (*Oncorhynchus mykiss*) in water hardnesses of 30 and 150 mg/L. Federal aid project #F-243R-5, Colorado Division of Wildlife, Fort Collins, Colorado.
18. Davies PH, Brinkman, S and McIntyre M (1998). Toxicity of Manganese to Early life stage and Fry of Brook Trout (*Salvelinus fontinalis*) and Rainbow trout (*Oncorhynchus mykiss*) in water hardnesses of 30 and 150 mg/L. Federal aid project #F-243R-5, Colorado Division of Wildlife, Fort Collins, Colorado.
19. Davis H, Brinkman S and McIntyre M (1998). Toxicity of manganese and zinc to Boreal toad tadpoles (*Bufo boreas*). Federal aid project #F-243R-5, Colorado Division of Wildlife, Fort Collins, Colorado.
20. Del Carmen Hernandez Soriano M, Martens J & Smolders E (2009). Toxicity of Manganese to micro-organism and to higher plants in soils. Testing laboratory: K. U. Leuven, Department of Earth and Environmental Sciences, Division of Soil and Water Management, Kasteelpark Arenberg 20, 3001 Heverlee, Belgium. Owner Company: Manganese Reach Administration, 17 rue Duphot Paris, France 75001. Report date: 2009-10-01.
21. Fechter LD (1999). Distribution of manganese in development. *Neurotoxicology* 20:197-201.
22. Finley JW (1999). Manganese absorption and retention by young women is associated with serum ferritin concentration. *Am J Clin Nutr* 70:37-43.
23. Finley JW, Penland JG, Pettit RE and Davis CD (2003). Dietary manganese intake and type of lipid do not affect clinical or neuropsychological measures in healthy young women. *J Nutr* 133:2849-2856.
24. Flanders L (2009). MnCl₂ (Eramet): L5178Y TK +/- Mouse Lymphoma Assay. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0037. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2009-11-17.
25. Goodband TJ & Mullee DM (2010). Mn(NO₃)₂.4H₂O: Acute toxicity to *Daphnia Magna*. Testing laboratory: Harlan Laboratories Ltd Shardlow Business Park Shardlow Derbyshire DE72 2GD UK. Report no.: 2702/0186. Owner Company: International Manganese Institute 17 Rue Duphot 75001 Paris FRANCE.
26. Graham R (2009). Early Life-Stage Toxicity of Manganese to the Zebrafish (*Danio rerio*) Under Flow-Through Conditions. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas St. SW, Albany, Oregon 97321-9487, USA. Report no.: 598-

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5231-002. Owner Company: International Manganese Institute, 17, rue Duphot, 75001 Paris, France. Report date: 2009-03-01.

27. Hernandez Soriano MDC, Degryse F and Smolders E (2010). Adsorption and desorption screening of Mn in soils (Draft report). Testing laboratory: K. U. Leuven, Department of Earth and Environmental Sciences Division of Soil and Water Management Kasteelpark Arenberg 20 3001 Heverlee Belgium.
28. Ji F, Luo XG, Lu L, Liu B and Yu SX (2006). Effect of manganese source on manganese absorption by the intestine of broilers. *Poult Sci* 85:1947-1952.
29. Järvinen R & Ahlström A (1975). Effect of dietary manganese level on tissue manganese, iron, copper and zinc concentrations in female rats and their fetuses. *Medical Biology* 53: 93-99.
30. Kuperman RG, Checkai RT, Phillips CT, Simini M, Speicher JA and Barclift DJ (2002). Toxicity Assessments of Antimony, Barium, Beryllium, and Manganese for Development of Ecological Soil Screening Levels (Eco-SSL) Using Enchytraeid Reproduction Benchmark Values. Edgewood chemical biological center, US army soldier and biological chemical command. Report no.: ECBC-TR-324.
31. Lasier PJ, Winger PV & Bogenrieder KJ (2000). Toxicity of Manganese to *Ceriodaphnia dubia* and *Hyalella azteca*. *Arch. Environ. Contam. Toxicol.*38:298-304.
32. Lauwerys R, Roels H, Genet P, Toussaint G, Bouckaert A & de Cooman S (1985). Fertility of male workers exposed to mercury vapor or to manganese dust: A questionnaire study. *American Journal of Industrial Medicine*, 7:171-176.
33. Lewis M (1978). Acute toxicity of copper, zinc and manganese in single and mixed salt solutions to juvenile longfin dace, *Agosoa chrysogaster*. *J. Fish Biolo.*13:695-700.
34. Matrone G, Hartman RH and Clawson AJ (1959). Studies of a manganese-iron antagonism in the nutrition of rabbits and baby pigs. *J Nutr* 67:309-317.
35. Maynard LS and Cotzias GC (1955). The partition of manganese among organs and intracellular organelles of the rat. *J Biol Chem* 214:489-495.
36. Morera D (2009). Toxicity of Manganese to *Pseudokirchneriella subcapitata* under static test conditions. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas street SW, Albany, OR 97321- 9487, USA. Report no.: 598-5231-002. Owner Company: International Manganese Institute, 17 rue Duphot, 75001 Paris, France. Report date: 2009-03-01.
37. Morris A & Durward R (2009). MnCl₂ (Eramet): Chromosome Aberration Test in Human Lymphocytes In Vitro. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0036. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2009-11-23.
38. NTP (1993a). NPT TR 428: NTP technical report on the toxicology and carcinogenesis of manganese (II) sulphate monohydrate in F344/N rats and B6C3F1 mice (feed studies).

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National Toxicology Program, P. O Box 12233, Research Triangle Park, NC 27709. Testing laboratory: Studies conducted on behalf of the National Toxicology Program by: Gulf South Research Institute, Battelle Columbus Laboratories, Experimental Pathology Laboratories, Inc., Integrated Laboratory Systems, Biotechnical Services, Inc. Report no.: NIH publication number: 94-3159.

39. NTP (1993b). NPT TR 428: NTP technical report on the toxicology and carcinogenesis of manganese (II) sulphate monohydrate in F344/N rats and B6C3F1 mice (feed studies). Testing laboratory: Studies conducted on behalf of the National Toxicology Program by: Gulf South Research Institute, Battelle Columbus Laboratories, Experimental Pathology Laboratories, Inc., Integrated Laboratory Systems, Biotechnical Services, Inc. Report no.: NIH publication number: 94-3159.
40. NTP (1993c). NPT TR 428: NTP technical report on the toxicology and carcinogenesis of manganese (II) sulphate monohydrate in F344/N rats and B6C3F1 mice (feed studies). Testing laboratory: Studies conducted on behalf of the National Toxicology Program by: Gulf South Research Institute, Battelle Columbus Laboratories, Experimental Pathology Laboratories, Inc., Integrated Laboratory Systems, Biotechnical Services, Inc. Report no.: NIH publication number: 94-3159.
41. Normandin L, Ann Beaupre L, Salehi F, St -Pierre A, Kennedy G, Mergler D, Butterworth RF, Philippe S and Zayed J (2004). Manganese distribution in the brain and neurobehavioral changes following inhalation exposure of rats to three chemical forms of manganese. *NeuroToxicology* 25:433-441.
42. Papavasiliou PS, Miller ST and Cotzias GC (1966). Role of liver in regulating distribution and excretion of manganese. *Am J Physiol* 211:211-216.
43. Phillips CT, Checkai RT, Kuperman RG, Simini M, Speicher JA and Barclift DJ (2002). Toxicity assessments of Antimony, Barium, Beryllium and Manganese for development of ecological soil screening levels (Ecco-SSL) using folsomia reproduction Benchmark values. ECBC-TR-326, Edgwood chemical biological center, US Army soldier and biological chemical command. Report no.: ECBC-TR-326.
44. Pooles A (2010a). Mn(NO₃)₂ • 4H₂O: ACUTE ORAL TOXICITY IN THE RAT - FIXED DOSE METHOD. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire DE72 2GD, UK. Report no.: 2702/0089. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.
45. Pooles A (2010b). Mn(NO₃)₂ • 4H₂O: ACUTE DERMAL IRRITATION IN THE RABBIT. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire DE72 2GD, UK. Report no.: 2702/0131. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.
46. Roels H, Lauwerys R, Buchet JP, Genet P, Sarhan MJ, Hanotiau I, de Fays M, Bernard A and Stanescu D (1987). Epidemiological survey among workers exposed to manganese: effects on lung, central nervous system, and some biological indices. *Am J Ind Med* 11:307-327.
47. Salehi F, Krewski D, Mergler D, Normandin L, Kennedy G, Philippe S and Zayed J (2003). Bioaccumulation and locomotor effects of manganese phosphate/sulfate mixture in

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Sprague-Dawley rats following subchronic (90 days) inhalation exposure. Toxicol Appl Pharmacol 191:264-271.

48. Salehi F, Normandin L, Krewski D, Kennedy G, Philippe S & Zayed J (2006). Neuropathology, tremor and electromyogram in rats exposed to manganese phosphate/sulfate mixture. J. Appl. Toxicol., 26: 419-426.
49. Sandstrom B, Davidsson L, Eriksson R, Alpsten M and Bogentoft C (1987). Retention of selenium (75Se), Zinc (65Zn) and manganese (54Mn) in humans after intake of a labelled vitamin and mineral supplement. J Trace Elem Electrolytes Health Dis 1:33-38.
50. SCOEL/SUM/127., (2011); EC recommendation from the scientific committee on occupational exposure limits for manganese and inorganic manganese compounds
51. Simini M, Checkai RT, Kuperman RG, Phillips CT, Speicher JA and Barclift DJ (2002). Toxicity assessments of antimony, barium, beryllium and manganese for development of ecological soil screening levels (ECO-SSL) using earthworm (*Eisenia fetida*) benchmark values. Edgewood chemical biological center, US army soldier and biological chemical command. Report no.: ECBC-TR-325.
52. Streicker MA (2009). In Vivo Micronucleus Assay of Manganese According to OECD 474 Guideline. Testing laboratory: Integrated Laboratory Systems, Inc. 601 Keystone Park Drive, Suite 100, Durham, NC 27713. Report no.: C171-001. Owner Company: Manganese Research Health Project (MHRP). Report date: 2009-09-04.
53. Stubblefield WA, Brinkman SF, Davies PH, Garrison TD, Hockett JR & McIntyre MW (1997). Effects of water hardness on the toxicity of manganese to developing brown trout (*Salmo Trutta*). Environmental Toxicology and Chemistry.16 (10):2082-2089.
54. Tapin D, Kennedy G, Lambert J & Zayed J (2006). Bioaccumulation and locomotor effects of manganese sulfate in Sprague-Dawley rats following subchronic (90 days) inhalation exposure. Toxicology and Applied Pharmacology, 211: 166-174.
55. Thompson PW & Bowles A (2009). MnCl₂ (Eramet): Reverse Mutation Assay "Ames Test" Using Salmonella Typhimurium and Escherichia Coli. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0035. Owner company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2009-09-24.
56. Tremain SP & Atwal SS (2010). Mn(NO₃)₂ • 4H₂O: DETERMINATION OF OXIDISING PROPERTIES. Testing laboratory: Harlan Laboratories Limited, Shardlow Business Park, Shardlow, Derbyshire DE72 2GD, UK. Report no.: 2702/0128. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.
57. Vryenhoef H (2010). MnSO₄: Algal Growth Inhibition Test. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0192. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.

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58. Warren N (2009). $Mn(NO_3)_2$: Determination of Skin Irritation Potential Using the EPISKIN™ Reconstituted Human Epidermis Model. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD, UK. Report no.: 2702-0129. Owner company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2010-03-03.
59. Warren N (2010a). $Mn(NO_3)_2 \cdot 4H_2O$: IN VITRO SKIN CORROSION IN THE SKINETHIC RECONSTITUTED HUMAN EPIDERMAL MODEL. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire DE72 2GD, UK. Report no.: 2702/0136. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.
60. Warren N (2010b). $Mn(NO_3)_2 \cdot 4H_2O$: Assessment of Ocular Irritation Potential using the SkinEthic Reconstituted Human Corneal Epithelium Model (10-Minute Exposure). Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD. Report no.: 2702-0130. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE. Report date: 2010-03-04.
61. Warren N (2010c). $Mn(NO_3)_2 \cdot 4H_2O$: THE BOVINE CORNEAL OPACITY AND PERMEABILITY ASSAY. Testing laboratory: Harlan Laboratories Ltd, Shardlow Business Park, Shardlow, Derbyshire, DE72 2GD UK. Report no.: 2702/0190. Owner Company: International Manganese Institute, 17 Rue Duphot, 75001 Paris, FRANCE.
62. WatlingHR (1983). Comparative Study of the Effects of Metals on the Settlement of *Crassostrea gigas*. Bull. Environ. Contam. Toxicol. 31, 344-351.
63. Witzleben CL, Pitlick P, Bergmeyer J and Benoit R (1968). Acute manganese overload. A new experimental model of intrahepatic cholestasis. Am J Pathol 53:409-422.
64. Young A (2009a). Short- Term Chronic Toxicity of Manganese to Duckweed (*Lemna minor*) Under Static- Renewal Exposure Conditions. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas street SW, Albany, OR 97321- 9487, USA. Report no.: 598-5231-002. Owner Company: International Manganese Institute, 17 rue Duphot, 75001 Paris, France. Report date: 2009-03-06.
65. Young A (2009b). Chronic Toxicity of Manganese to the Great Pond Snail, *Lymnaea stagnalis*. Testing laboratory: Parametrix Environmental Research Laboratory (PERL), 33972 Texas St. SW, Albany, Oregon 97321, USA. Report no.: 598-5231-002. Owner Company: International Manganese Institute, 17 rue Duphot 75001 Paris, France. Report date: 2009-03-11.
66. Youngs N (2010). Assessment of the inhibitory effect on the respiration of activated sewage sludge. Testing laboratory: Harlan Laboratories Ltd Shardlow Business Park Shardlow Derbyshire DE72 2GD UK. Report no.: 2702-0189. Owner Company: International Manganese Institute 17 Rue Duphot 75001 Paris FRANCE. Report date: 2010-02-15.
67. del Carmen Hernandez Soriano M, Mertens J & Smolders E (2009a). Toxicity of Manganese to micro-organisms and to higher plants in soil. Testing laboratory: K. U. Leuven, Department of Earth and Environmental Sciences, Division of soil and Water management, Kasteelpark Arenberg 20, 3001 Heverlee, Belgium. Owner Company: Manganese Reach Administration Association, 17 rue Duphot Paris, France 75001. Report date: 2009-10-01.

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68. del Carmen Hernandez Soriano M, Mertens J & Smolders E (2009b). Toxicity of Manganese to micro-organisms and to higher plants in soils. Testing laboratory: K. U. Leuven, Department of Earth and Environmental Sciences, Division of Soil and Water Management, Kasteelpark Arenberg 20, 3001 Heverlee, Belgium. Owner Company: Manganese Reach Administration Association, 17 rue Duphot Paris, France 75001. Report date: 2009-10-01.
69. del Carmen Hernansez Soriano M, Mertens J & Smolders E (2009). Toxicity of Manganese to micro-organisms and to higher plants in soils. Testing laboratory: K. U. Leuven, Department of Earth and Environmental Sciences, Division of Soil and Water Management, Kasteelpark Arenberg 20, 3001 Heverlee, Belgium. Owner Company: Manganese Reach Administration Association, 17 Rue Duphot Paris, France 75001. Report date: 2009-10-01.

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