CALDER INDUSTRIAL MATERIALS LTD

SAFETY DATA SHEET

Lead metal massives (general and high purity grades)

Safety Data Sheet according to REACH Regulation (EC 1907/2006), and CLP Regulation (EC 1272/2008).

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Name of Substance: **Lead metal massives (general grade) [particle diameter ≥1mm]**
Lead metal massives (high purity grade) [particle diameter ≥1mm]

EC number:	**231-100-4**
EC name:	**Lead**
CAS number (EC inventory):	**7439-92-1**
REACH Registration number	**01-2119513221-59-0036**

1.2 Relevant identified uses of the substance or mixture and uses advised against

Uses considered in Exposure Scenarios [short summaries attached as an Annex].
1 Primary Lead Production
2 Secondary Lead Production
3 Lead Battery Production
4 Lead Sheet Production
5 Use of Lead in production of Hot-Dip Galvanised Steel
6 Use of Lead Metal in production of a range of lead articles (e.g. cast, rolled, extruded production; ammunition and lead shot)
7 Use of lead in the production of leaded steels
8 Lead powder production
9 Use of lead metal in lead oxide production
10 Use of molten lead as heat transfer fluid in closed process
11 Professional use of lead solder

No specific uses advised against have been identified, other than legal restrictions on the use of lead.

1.3 Details of the supplier of the safety data sheet
Calder Industrial Material Limited
Jupiter Drive
Chester West Employment Park
Chester
CH1 4EX

1.4 Emergency telephone number

In case of emergency **Tel. (0044 1244 390093 during office hours)**

SECTION 2: Hazards Identification

2.1 Classification of the substance or mixture

2.1.1 Industry classification proposals

Name	Classification	Specific concentration limits, M-factors
Lead metal massives (general and high purity grades); [particle diameter ≥1mm]	**Repr. 1A**; H360FD: May damage fertility. May damage the unborn child. **Lact.**: H362; May cause harm to breast-fed children. **STOT RE1**; H372: Causes damage to organs through prolonged or repeated exposure.	
Lead metal massives (general and high purity grades); [particle diameter >1mm]	**Repr. 1A**; H360FD: May damage fertility. May damage the unborn child. **Lact.**: H362; May cause harm to breast-fed children. **STOT RE1**; H372: Causes damage to organs through prolonged or repeated exposure	Repr. 1A; H360D; C ≥0.03%

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2.2 Label elements†

Classification Labelling and Packaging Regulation EC 1272/2008

Danger

H360FD May damage fertility. May damage the unborn child.
H362 May cause harm to breast-fed children.
H372 Causes damage to central nervous system, blood and kidneys through prolonged or repeated exposure.

† *A derogation from labelling requirements exists for metals in massive form. Such metals do not require a label according to Annex 1 to Regulation (EC) No 1272/2008 if they do not present a hazard to human health by inhalation, ingestion or contact with skin or to the aquatic environment in the form in which they are placed on the market, although classified as hazardous in accordance with the criteria of that Annex*.

2.3 Other hazards

Melting or operations generating dust, fume or vapours can result in sufficient lead entering the body to be hazardous to health. Oxidation products (including lead compounds) may also form on the surface of metallic lead. Lead is heavy and care should be taken when lifting and handling.

See Section 11 for more information on the health hazards.

SECTION 3: Composition/information on ingredients

3.1 Substances

Constituent	EC Number	Concentration (% w/w)	Hazard classification
Lead	231-100-4	>90	**Repr. 1A**; **H360FD**: May damage fertility. May damage the unborn child. **Lact.; H362:** May cause harm to breast-fed children. **STOT RE1; H372:** Causes damage to organs through prolonged or repeated exposure.

Impurity	EC Number	Concentration (% w/w)	Hazard classification
Antimony	231-146-5	<10	**H351;**
Copper	231-159-6	0.03 – 0.06	n/a
Non hazard impurities	n/a	Remainder	n/a

3.2 Mixtures

Not applicable

SECTION 4: First Aid Measures

4.1 Description of first aid measures

EYE CONTACT: Ensure that contact lenses are removed before rinsing eyes. Separate eyelids, wash the eyes thoroughly with water (15 min). Seek medical attention if irritation persists.
INHALATION: Fresh air. Get medical attention if pain still persists..
SKIN CONTACT: Remove any contaminated clothing. Wash affected area with water and soap immediately and rinse thoroughly. Seek medical attention if irritation persists.
INGESTION: Rinse out mouth and give plenty of water to drink. Seek medical attention. Show this safety data sheet.

4.2 Most important symptoms and effects, both acute and delayed

Clinical manifestations of lead poisoning include weakness, irritability, asthenia, nausea, abdominal pain with constipation, and anaemia.

4.3 Indication of any immediate medical attention and special treatments needed
Symptoms of poisoning may occur after several hours; seek medical attention.

SECTION 5: Firefighting Measures

5.1 Extinguishing media
Water spray jet; Dry sand. Extinguishing media that must not be used for safety reasons: Full water jet; Foam.

5.2 Special hazards arising from the substance or mixture
In case of fires, hazardous combustion gases are formed: Lead fumes; Lead oxide.

5.3 Advice for fire fighters
Appropriate breathing apparatus may be required. Wear protective clothing.

SECTION 6: Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures
Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes and clothing. See section 8 for further details.

6.2 Environmental precautions
Do not discharge into the drains/surface waters/groundwater. In case of entry into waterways, soil or drains, inform the responsible authorities.

6.3 Methods and materials for containment and clearing up
Collect mechanically (preferably in dry condition). Send in suitable containers for recovery or disposal. When picked up, treat material as prescribed under heading "Disposal considerations".

6.4 References to other sections
See Sections 8 and 13 for further advice.

SECTION 7: Handling and Storage

7.1 Precautions for safe handling
Provide good ventilation of working area (local exhaust ventilation, if necessary). The product is not combustible.

7.2 Conditions for safe storage, including any incompatibilities
No special measures required. Do not store together with foodstuffs. Do not store together with animal feedstocks. Do not store with acids or alkalis. Do not store with combustible materials.

7.3 Specific end uses(s)
Specific Exposure Scenarios to be included as an Annex to Section 16 in a forthcoming update.

SECTION 8. Exposure Controls/Personal Protection

8.1 Control parameters

8.1.1 Human Toxicity values

OELs - Lead and inorganic compounds (as Pb):

	Limit values – 8 hours mg/m³	**Limit values – short term mg/m³**
European Union	0.15 inhalable aerosol	
Austria	0.1 inhalable aerosol	0.4 inhalable aerosol
Belgium	0.15	
Denmark	0.05 inhalable aerosol	0.10 inhalable aerosol
Finland	0.1	
France	0.1 inhalable aerosol	
Germany (AGS)	0.1 inhalable aerosol	
Hungary	0.15 inhalable aerosol 0.05 respirable aerosol	0.60 inhalable aerosol 0.2 respirable aerosol
Ireland	0.15	
Italy	0.15 inhalable aerosol	
Latvia	0.005	0.01 (15-min average)
Poland	0.05	
Spain	0.15 inhalable aerosol	
Sweden	0.1 inhalable aerosol 0.15 respirable aerosol	
Switzerland	0.1 inhalable aerosol	0.8 inhalable aerosol
United Kingdom	0.15	

Biological action levels, inorganic lead

European Union	70 µg/dL (Binding Limit Value)
Germany	40 µg/dL 10 µg/dL (for woman, age below 45 years) [Suspended]
France	40 µg/dL 30 µg/dL µg/dL (for woman of reproductive capacity)
Ireland	70 µg/dL
Spain	70 µg/dL
UK	60 µg/dL 30 µg/dL (for woman of reproductive capacity)

DN(M)ELs for workers:

Exposure pattern	**Route**	**Descriptors**	**DNEL/DMEL (appropriate unit)**	**Most sensitive endpoint**
Acute - systemic effects	Dermal (mg/kg bw /day)	NA	NA	NA
	Inhalation (mg/m^3)	NA	NA	NA
Acute - local effects	Dermal (mg/cm^2)	NA	NA	NA
	Inhalation (mg/m^3)	NA	NA	NA
Long-term - systemic effects	Systemic (µg lead /dL blood)	NOAEL = 40 µg/dL NOAEL = 10 µg/dL	40 µg/dL 10 µg/dL	Adult neurological function Developmental effect on foetus of pregnant women
Long-term – local effects	Dermal (mg/cm^2)	NA	NA	NA
	Inhalation (mg/m^3)	NA	NA	NA

8.1.2 Ecological toxicity values

Reliable acute aquatic toxicity test results (tests conducted with soluble lead salts)

Test organism	**Species**	**Endpoint**	**Value**
Algae	*Pseudokirchneriella subcapitata*	72h EC50 (pH>6.5-7.5) 72h EC50 (pH<7.5-8.5)	52.0 µg Pb/L 233.1 µg Pb/L
Invertebrates	*Daphnia magna* *Ceriodaphnia dubia*	48h EC50 (pH>7.5-8.5) 48h EC50 (pH>5.5-8.5)	107.5 µg Pb/L 73.6 µg Pb/L
Fish	*Oncorhynchus mykiss* *Pimephales promelas*	96h LC50 (pH>6.5-8.5) 96h LC50 (pH>5.5-8.5)	107.0 µg Pb/L 194.2 µg Pb/L

Listed values are for tests performed at most sensitive pH. Other organisms have also been evaluated in the chemical safety report. References are listed in Section 16.

Reliable chronic toxicity test results (tests conducted with soluble lead salts)

Compartment	**Species**	**Value (EC_{10}, NOEC)**
Freshwater	*Hyalella azteca* (42d, mortality)	8.2 µg Pb/L (dissolved lead)
Marine water	*Mytilus trossolus* (48h, developmental abnormalities)	9.2 µg Pb/L (dissolved lead)
Freshwater sediment	*Tubifex tubifex* (28d, reproduction)	573 mg Pb/kg dw
Marine sediment	*Neanthes arenaneodentata (28d, growth)*	680 mg Pb/kg dw
Terrestrial (plants)	*Hordeum vulgare* (yield based on root)	57 mg Pb/kg dw
STP Micro-organisms (Protozoa)	Protozoan community (24h-LC10)	1.0 mg Pb/L

Listed reports are for most sensitive organisms. References are listed in Section 16.

The following Predicted No Effect Concentrations have been derived for the above environmental compartments:

Compartment	**PNEC Value**
Freshwater	3.1 µg Pb/L (dissolved lead)
Marine water	3.5 µg Pb/L (dissolved lead)
Freshwater sediment (with/without bioavailability correction)	41.0/174.0 mg Pb/kg dw
Marine water sediment	164.2 mg Pb/kg dw
Terrestrial	212.0 mg Pb/kg dw
STP Micro-organisms	0.1 mg Pb/L

8.2 Exposure controls

8.2.1 Organisational measures

Personal Hygiene: Ensure workers follow simple hygiene rules (e.g. do not bite nails and keep them cut short, avoid touching or scratching face with dirty hands or gloves); Ensure workers do not wipe away sweat with hands or arms; Ensure workers use disposable tissues rather than a handkerchief; Prohibit drinking, eating and smoking in production areas, or access to eating and non-production areas in working clothes; Ensure workers wash hands, arms, faces and mouths (but preferably shower) and change into clean clothing before entering eating areas; For high exposure workplaces, separate rooms for cleaning hands, removal of clothes, showers and clean clothes may be necessary; Ensure workers handle dirty working clothes with care; Allow no personal belongings to be taken into production areas, or items that have been used in production areas to be taken home. Ensure general shop cleanliness is maintained by frequent washing/vacuuming. Clean every workplace at the end of every shift.

Blood lead monitoring: Set in place a certified monitoring regime which covers all site activities; Define a policy for submitting workers to regular blood lead monitoring, including increased frequency for workers undertaking high-risk jobs and workers with elevated blood lead levels; Ensure all workers have a blood test prior to working on site. Set an "action level" that is typically 5 µg/dL below the exposure limit deemed to be safe. If the action level is exceeded, appropriate measures are to be taken, to prevent further increases in blood lead. If the safe threshold is exceeded, continue or begin ban on overtime, ensure strict hygiene procedures are followed, undertake detailed inspections to ensure correct use of personal protective equipment, undertake detailed inspections to ensure recommended workplace procedures are followed, move employee to workplace where exposure is expected to be lower or remove from lead environment altogether, further increase blood lead sampling frequency, and continue frequent sampling until results are below the first action level.

8.2.2 Personal Protection Equipment

Respiratory protection: Suitable respiratory protective device recommended. In case of brief exposure or low pollution use dust mask or half mask with particle filter P2. Assess the need to wear respiratory protective equipment in production areas. Consider use effective masks accompanied by a compliance policy (ensure proper shaving; ensure workers do not remove RPE in production areas in order to communicate). Where masks are used, employ formal mask cleaning and filter changing strategies.

Hand Protection: Protective gloves. Material of gloves: Neoprene or Leather.

Eye protection: Safety glasses.

Skin protection: Wear protective work clothing. For workers in areas of significant exposure, provide sufficient working clothes to enable daily change into clean clothes. In such cases all work clothing should be cleaned by the employer on a daily basis and is not permitted to leave the work site.

8.2.3 Environmental Protection

One or more of the following measures may if necessary be taken to reduce emissions to water:
- Chemical precipitation: used primarily to remove the metal ions
- Sedimentation
- Filtration: used as final clarification step
- Electrolysis: for low metal concentration
- Reverse osmosis: extensively used for the removal of dissolved metals
- Ion exchange: final cleaning step in the removal of heavy metal from process wastewater

One or more of the following measures may if necessary be taken to reduce emissions to air:
- Electrostatic precipitators using wide electrode spacing: Wet electrostatic precipitators:
- Cyclones, but as primary collector Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values Membrane filtration techniques can achieve
- Ceramic and metal mesh filters. PM10 particles are removed
- Wet scrubbers

Lead removal from treatment works should be at least the minimum default 84% removal used in the CSR. Solid material collected from on-site treatment must be sent for metal recovery or treated as hazardous waste. Waste water treatment sludge must be recycled, incinerated or landfilled and not used as agricultural fertiliser.

SECTION 9: Physical and Chemical Properties

9.1 Information on basic physical and chemical properties

Appearance:	Grey-blue solid
Odour:	None
Odour threshold:	Not applicable
pH:	Not applicable
Melting point:	326°C
Boiling point:	>600°C
Flashpoint:	Not applicable
Evaporation rate:	Not applicable
Flammability:	Not flammable
Upper/lower flammability limits:	Not applicable
Vapour pressure:	Not applicable
Vapour density	Not applicable

Relative density	11.45
Solubility in water:	185 mg/L at 20°C
Solubility in other solvents:	Not applicable
Partition coefficient (log Kow)	Not applicable
Autoignition temperature	Not applicable
Decomposition temperature	Not applicable
Viscosity	Not applicable
Explosive properties	Not explosive
Oxidising properties	Not oxidising

9.2 Other information
None

SECTION 10: Stability and Reactivity

10.1 Reactivity
Lead is not a reactive substance and no reactive hazards are expected.

10.2 Chemical stability
Expected to be stable under normal conditions of use.

10.3 Possibility of hazardous reactions
No hazardous reactions expected under normal conditions of use.

10.4 Conditions to avoid
Not applicable.

10.5 Incompatible materials
Strong oxidising agents.

10.6 Hazardous decomposition products
No decomposition if used as directed.

SECTION 11: Toxicological Information

11.1 Information on toxicological effects

This product has not been tested. Judgements on the expected toxicity of this product have been made based upon consideration of sparingly soluble inorganic lead compounds and the agreed harmonised classification of lead metal.

Toxicokinetic assessment	Lead is slowly absorbed by ingestion and inhalation and poorly absorbed through the skin. If absorbed, it will accumulate in the body with low rates of excretion, leading to long-term build up. Part of risk management is to take worker blood samples for analysis to ensure that exposure levels are acceptable.
(a) acute toxicity	Lead in massive form is not considered to be acutely toxic. It is not easily inhaled or ingested, and if it is accidentally ingested normally passes through the gastrointestinal system without significant absorption into the body. Lead is not easily absorbed through the skin.
(b) skin corrosion/irritation	Studies have shown that sparingly soluble inorganic lead compounds are not corrosive or irritating to skin, and this lack of effect is expected also for metallic lead. This conclusion is supported by the lack of reports of irritant effects from occupational settings.
(c) serious eye damage/irritation	Studies have shown that sparingly soluble inorganic lead compounds are not corrosive or irritating to eyes, and this lack of effect is expected also for metallic lead. This conclusion is supported by the lack of reports of irritant effects from occupational settings.
(d) respiratory or skin sensitisation	There is no evidence that lead causes respiratory or skin sensitisation.
(e) germ cell mutagenicity	The evidence for genotoxic effects of highly soluble inorganic lead compounds is contradictory, with numerous studies reporting both positive and negative effects. Responses appear to be induced by indirect mechanisms, mostly at very high concentrations that lack physiological relevance.
(f) carcinogenicity	There is some evidence that inorganic lead compounds may have a carcinogenic effect, and they have been classified by IARC as probably carcinogenic to humans (Group 2A). However, it is considered that this classification does not apply to lead in massive form, given the very low bioavailability of metallic lead. Carcinogenicity studies of lead metal powder have been negative. Epidemiology studies of workers exposed to inorganic lead

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compounds have found a limited association with stomach cancer. IARC has concluded that lead metal is possibly carcinogenic to humans (Group 2B).

(g) reproductive toxicity — Exposure to high levels of lead and inorganic lead compounds may cause adverse effects on male and female fertility, including adverse effects on sperm quality. Prenatal exposure to inorganic lead compounds is also associated with adverse effects on the development of the unborn child.

(h) STOT-single exposure — Inorganic lead compounds have generally been found to be of relatively low acute toxicity by ingestion, in contact with skin, and by inhalation, with no evidence of any local or systemic toxicity from such exposures. The bioavailability of lead metal is low and acute lead exposure is not expected to result in acute toxicity effects.

(i) STOT-repeated exposure — Lead is a cumulative poison and may be absorbed into the body through ingestion or inhalation; its toxicity is generally considered to be mediated through the lead cation. Although inhalation and ingestion of lead in massive form are unlikely, poor hygiene practices may result in hand to mouth transfer which may be significant over a prolonged period of time. Lead metal may also be used in such a way that inhalable particles may form, resulting in systemic uptake.

Inorganic lead compounds have been documented in observational human studies to produce toxicity in multiple organ systems and body function including the haemotopoetic (blood) system, kidney function, reproductive function and the central nervous system. There is evidence that postnatal exposure to lead is associated with effects on neurobehavioral development in children.

(j) aspiration hazard — Lead metal is a solid and aspiration hazards are not expected to occur.

SECTION 12: Ecological Information

The environmental effects have been assessed using read-across from studies with similar inorganic lead compounds.

12.1 Toxicity
Lead metal in massive form is not classified as hazardous to the aquatic environment, due to its low solubility and rapid removal from the water column. Inorganic lead compounds are considered to be acutely toxic in the environment and also to present a long term hazard to aquatic organisms. Toxicity will depend on the level of free lead ion in solution, which in turn is affected by pH, water hardness, salinity, etc. Lead toxicity is expected to be greater in softer waters.

12.2 Persistence and degradability
Lead is rapidly removed from the water column and binds to suspended solid and sediment. Lead is an inorganic substance and does not degrade. It is persistent in the environment. Biodegradation is not relevant for inorganic substances.

12.3 Bioaccumulative potential
Inorganic lead is considered to be bioaccumulating in the environment, and may accumulate in aquatic and terrestrial plants and animals.

12.4 Mobility in soil
Lead metal has very low solubility and is expected to be adsorbed onto soils and sediments. Mobility is expected to be low.

12.5 Results of PBT and vPvB assessment
The PBT and vPvB criteria in Annex XIII of the REACH Regulation do not apply to inorganic substances.

12.6 Other adverse effects
No information available.

SECTION 13: Disposal Considerations

13.1 Waste treatment methods
Should be recycled or disposed as hazardous waste. Do not allow product to reach sewage system. Different Pb-bearing wastes resulting from the processes described above are generated in the form of dross, flue dust and slag. These waste products are mainly recycled in the production process or landfilled.

European waste catalogue:
17 04 03 lead
06 04 05* wastes containing other heavy metals

SECTION 14: Transport Information

Not classified as dangerous for transport.

14.1	UN Number	Not applicable
14.2	UN Proper shipping name	Not applicable
14.3	Transport hazard class(es)	Not applicable
14.4	Packing group	Not applicable

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14.5	Environmental hazards	Not applicable
14.6	Special precautions for user	None
14.7	Transport in bulk according to Annex II of MARPOL and the IBC Code	Not transported in bulk

SECTION 15: Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Restrictions on use: this substance is subject to REACH restrictions according to:

- REACH Annex XVII, Entry No. 63

15.2 Chemical Safety Assessment

A Chemical Safety Assessment has been carried out for this product.

SECTION 16: Other Information

H Statements used in Sections 2 and 3

H360FD: May damage fertility. May damage the unborn child.
H362: May cause harm to breast-fed children.
H372: Causes damage to organs through prolonged or repeated exposure.

Revision information:

This revision has been updated to the format required by the Commission regulation (EU) 2015830 and dated 07 July 2016

Legal Statement:

List of Abbreviations

Acute Tox.: Acute Toxicity
CAS No: CAS Registry Numbers
Carc.: Carcinogenic
CLP: Classification, Labeling and Packaging of chemicals
DN(M)EL: Derived No-Effect Level or Derived Minimal Effect Level
DW: Dry weight
EC No: European Commission number
EC Name: European Commission Name
EHS: Environmentally hazardous substance
IARC: International Agency for Research on Cancer
IBC: International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk
LC_{50}: Lethal Dose, 50%
LD_{50}: Lethal Dose, 50%
MARPOL: International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978
NOAEL: No observed adverse effect level.
NOEC: No Observed Effect Concentration
OELs: Occupational Exposure Limits
P Statement: Precautionary statement
PNEC: Predicted No-Effect Level
PBT: Persistent, bio-accumulative, toxic
REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals
Repr.: Reprotoxic
STOT: Single Target Organ Toxicity
SDS: Safety Data Sheet
vPvB: Very Toxic Very Bio-accumulative
WW: Wet weight

References from Section 8.1.2

Acute Toxicity data:

Diamond JM, Koplish DE, McMahon III J and Rost R. (1997). Evaluation of the water-effect ratio procedure for metals in a riverine system. Environmental Toxicology and Chemistry, Vol 16, No 3, pp. 509-520, 1997.

Grosell M, Gerdes R, Brix KV (2006). Influence of Ca, humic acid and pH on lead accumulation and toxicity in the fathead minnow during prolonged water-borne lead exposure. Comparative Biochemistry and Physiology, Part C 143 (2006) 473-483.

Grosell M (2010b). The effects of pH on waterborne lead toxicity in the fathead minnow, Pimephales promelas - 24 February 2010. Testing laboratory: University of Miami, USA.

Davies PH, JP Goettl, JR Sinley and NF Smith (1976). Acute and chronic toxicity of lead to rainbow trout Salmo Gairdneri, in hard and soft water. Water Research, Vol 10, pp 199-206.

Roger JT, Richards JG, Wood CM (2003). Ionoregulatory disruption as the acute toxic mechanism for lead in the rainbow trout (Oncorhynchus mykiss). Aquatic Toxicology 64 (2003) 215-234.

Schubauer-Berigan MK et al. (1993b). pH-dependent toxicity of Cd, Cu, Ni, Pb and Zn to Ceriodaphnia dubia, Pimephales promelas, Hyalella azteca and Lumbriculus variegatus. Environmental Toxicology and Chemistry, Vol 12, pp. 1261-1266, 1993.

Spehar RL, Fiandt JT. (1986). Acute and chronic effects of water quality criteria-based metal mixtures on three aquatic species. Environ Toxicol Chem 5:917-931.

Chronic Toxicity Data:

Aery N C and Jagetiya B L (1997). Relative toxicity of Cadmium, Lead and Zinc on Barley. Commun. Soil Sci. Plant Anal., 28(11&12), 949-960. Testing laboratory: Dept. of Botany, University College of Science, M. L. Sukhaida University, Udaipur, India.

Bengtsson G., Gunnarsson T. and Rundgren S. (1986). Effects of metal pollution on the earthworm Dendrobaena Rubida (Sav.) in Acified soils. Water, Air and Soil Pollution 28 (1986) 361-383. Testing laboratory: University of Lund. Ecology Building, Helgonavagen, Sweden.

Besser JM, Brumbaugh WG, Brunson EL and Ingersoll CG (2005). Acute and chronic toxicity of lead in water and diet to the amphipod Hyalella azteca. Environmental Toxicology and Chemistry, Vol. 24, No. 7, pp. 1807-1815, 2005.

Chang F-H and Broadbent F E (1981). Influence of trace metals on carbon dioxide evolution from a yolo soil. Soil Science, vol 132 No 6, december 1981.

Farrar JD, Bridges TS. (2003). Effects of lead on Leptocheirus plumulosus, Neanthes arenaceodentata, Chironomus tentans and Hyalella azteca following long-term sediment exposures. Report for the International Lead Zinc Research Organization. US Army Engineer Research and Development Center, Vicksburg, Mississippi.

Madoni P, Davoli D, Gorbi G, Vescovi L (1996). Toxic effect of heavy metals on the activated sludge protozoan community. Water Research, 30 (1), 135-141. Testing laboratory: Istituto di Ecologica, Universita di Parma, Italy.

Madoni P, Davoli D, Guglielmi L (1999). Response to SOUR and AUR to heavy metal contamination in activated sludge. Water Research, 33 (10), 2459-2464. Testing laboratory: Dipartimento di Scienze Ambientali, Universita di Parma, Italy.

Nguyen LTH, Roman Y, Zoetardt H, Janssen CR. (2003). Ecotoxicity of lead to the tubificid oligochaete Tubifex tubifex tested in natural freshwater sediments. Draft final report to the International Lead Zinc Research Organization. Laboratory of Environmental Toxicology and Aquatic Ecology, Ghent University, Belgium.

Wood C. M. & Nadella S. (2010). Effects of salinity and DOC on Pb Toxicity to Marine Organisms. Testing laboratory: Dept. of Biology, McMaster University, Hamilton, Canada L8S 4K1. Report date: 2010-01-01.

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Annex: Exposure Scenarios

ES 2: Secondary lead production

1. Title	
Identified Use	Use of lead-batteries and scrap in secondary lead production
Systemic title based on use descriptor	ERC 1; PC 7
2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 8b, 26	Raw material handling: storage, transport and handling of batteries and other lead scrap
PROC 2	Shredding and sorting: for batteries, separation of sulphuric acid, shredding (breaking), grid-separation, elution of PbO-paste, also sorting of other lead scrap
PROC 4	Desulphurisation: sulphur removal from PbO-paste
PROC 22	Melting and smelting: melting of grids, smelting and reduction of paste
PROC23	Refining and casting: refining of lead, casting of ingots
PROC21	Storage, shipment and transport: storage and shipment of finished goods, intra-facility transport
PROC28	Repair, cleaning and maintenance
2.1 Control of workers exposure	
Product characteristic	Raw material is principally lead scrap, used lead batteries, drosses and battery oxides. These materials will have varying levels of dustiness. The product is massive lead metal, usually as ingots.
Amounts used	Not restricted
Frequency and duration of use/exposure	Full shift exposure (8 hours) for all workplaces (not restricted).
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels)
Other given operational conditions affecting workers exposure	Indoor handling, room volume >1000 m^3
Technical conditions and measures at process level (source) to prevent release	Enclosed system for melting of grids, smelting and reduction of paste.
Technical conditions and measures to control dispersion from source towards the worker	Controls give 78% minimum worker exposure reduction. Risk Management Measures include enclosure of process equipment, dilution ventilation and/or local exhaust ventilation. Pass waste air through cleaning equipment. Separation of workers via control room for melting of grids, smelting and reduction of paste. Protective gloves to be worn.
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.
Conditions and measures related to personal protection, hygiene and health evaluation	Minimum Respiratory Protective Equipment (RPE) is FFP 2 mask, except in cases where adequate ventilation/emission control in place (see also section 8).
2.2 Control of environmental exposure	
Amounts used	13,000 tonnes/annum/site
Frequency and duration of use	Continuous use/release, up to 345 days/year

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Environment factors not influenced by risk management	Dilution factor (Freshwater): 10 Dilution factor (Marine): 100	
Other given operational conditions affecting environmental exposure	Not applicable	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	See Section 8 of the SDS, above.	
	Estimated fraction released to water (g/tonne):	0.018
	Estimated fraction released to air (g/tonne):	154.65
Organisational measures to prevent/limit release from site	See Section 8 of the SDS, above.	
Conditions and measures related to external treatment of waste for disposal	Pb-bearing wastes resulting from the processes described above are generated in the form of solids (e.g. slags, matte). These should be treated by a licensed waste treatment operator (landfilled or incinerated) according to relevant waste regulation.	

3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio
	Blood lead concentrations for male workers (maximum):	38.1 µg/dL	40.0 µg/dL	0.95
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.84 µg/l	3.1 µg/l	0.27
	Marine:	0.051 µg/l	3.5 µg/l	0.015
	Freshwater sediment:	166.07 mg/kg dw	174.0 mg/kg dw	0.95
	Marine water sediment:	60.95 mg/kg dw	164.2 mg/kg dw	0.37
	Terrestrial:	29.30 mg/kg dw	212.0 mg/kg dw	0.14
	Sewage treatment plant:	12 µg/l	100 µg/l	0.12

4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead levels) must be below the DNEL:

DNEL for male workers: 40 µg/dL
DNEL for female workers of reproductive capacity: 10 µg/dL

ES 4: Lead sheet production

1. Title	
Identified Use	Use of secondary lead materials in lead sheet production
Systemic title based on use descriptor	SU 14, SU 15, ERC 5 ; PC 7

2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 26, 4, 23	Raw material handling: scrap delivery, loading/unloading, and furnace feed mixing
PROC 22, 23	Melting, drossing and refining
PROC 24	Milling operations
PROC 21	Sawing and slitting operations
PROC 21	Internal logistics: storage and shipment of finished goods, intra-facility transport
PROC 28	Others: repair, cleaning, and maintenance, quality control, and engineering

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2.1 Control of workers exposure				
Product characteristic	Raw materials are principally metallic scrap. Fine lead particles are generated during the process steps. Finished product is solid, dry (>90% lead purity).			
Amounts used	Not restricted.			
Frequency and duration of use/exposure	Full shift (8 hours) exposure for all workplaces other than raw material handling and melting, drossing and refining (3 hours).			
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels).			
Other given operational conditions affecting workers exposure	Indoor handling, room volume >1000 m^3. Process temperature for raw material handling <500°C. Process temperature for melting, drossing and refining <510°C.			
Technical conditions and measures at process level (source) to prevent release	Enclosed space (furnace) for melting, drossing and refining.			
Technical conditions and measures to control dispersion from source towards the worker	Controls give 78% minimum worker exposure reduction for all processes other than milling operations (17%). Risk Management Measures include enclosure of process equipment, dilution ventilation and/or local exhaust ventilation. Pass waste air through cleaning equipment.			
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.			
Conditions and measures related to personal protection, hygiene and health evaluation	Minimum Respiratory Protective Equipment (RPE) is FFP 2 mask, except in cases where adequate ventilation/emission control in place (see also section 8). Protective gloves are required.			
2.2 Control of environmental exposure				
Amounts used	14,700 tonnes/annum/site			
Frequency and duration of use	Continuous use/release, up to 296 days/year			
Environment factors not influenced by risk management	Dilution factor (Freshwater): 10 Dilution factor (Marine): 100			
Other given operational conditions affecting environmental exposure	Not applicable			
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	See Section 8 of the SDS, above.			
	Estimated fraction released to water (g/tonne):	0.008		
	Estimated fraction released to air (g/tonne):	43.44		
Organisational measures to prevent/limit release from site	See Section 8 of the SDS, above.			
Conditions and measures related to external treatment of waste for disposal	Different Pb-bearing wastes resulting from the processes described above are generated in the form of solids (dross, slag). The waste products should be treated by a licensed waste treatment operated according to relevant waste regulation.			
3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio
	Blood lead concentrations for male workers (maximum):	28.0 µg/dL	40.0 µg/dL	0.70
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.84 µg/l	3.1 µg/l	0.27
	Marine:	0.051 µg/l	3.5 µg/l	0.015
	Freshwater sediment:	144.1 mg/kg dw	174.0 mg/kg dw	0.83
	Marine water sediment:	61.2 mg/kg dw	164.2 mg/kg dw	0.37
	Terrestrial:	28.51 mg/kg dw	212.0 mg/kg dw	0.13

	Sewage treatment plant:	13 µg/l	100 µg/l	0.13

4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead levels) must be below the DNEL: DNEL for male workers: 40 µg/dL DNEL for female workers of reproductive capacity: 10 µg/dL

ES 6: Use of Lead metal in production of a range of lead articles (e.g. cast, rolled and extruded production, ammunition and lead shot)

1. Title	
Identified Use	Use of lead metal in the production of cast, rolled and extruded products, e.g. weights, foil, string, rope, bars, shot, sheathing and cables.
Systemic title based on use descriptor	SU 15, SU 17; PC 7, PC 38; AC 7, AC1, AC 2, AC 3; ERC5
2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 26	Raw material handling
PROC22, 23	Melting
PROC 23	Refining and Casting
PROC 14	Extrusion
PROC 24	Milling/Rolling
PROC 21	Sawing/Slitting
PROC 25	Soldering/Manufacture of Solder
PROC 21, 22, 23, 24, 25, 4, 5	Production of lead shot
PROC 21	Ammunition Manufacture (i.e. assembly of ammunition)
PROC 23	Addition of coating metal to bath
PROC 23	Hot dip coating
PROC 21	Storage and Shipment
2.1 Control of workers exposure	
Product characteristic	Raw material is lead ingots, bars, or other forms of massive lead (1-99% purity). Raw materials can also include lead powder and paste. Finished lead articles are in solid form.
Amounts used	Not restricted
Frequency and duration of use/exposure	4 – 8 hour shifts for all workplaces.
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels).
Other given operational conditions affecting workers exposure	Indoor handling, room volume >20m^3 for raw material handling, >60m^3 for melting and >1000m^3 for all other workplaces.
Technical conditions and measures at process level (source) to prevent release	Enclosed systems required for melting, refining and casting and possibly soldering/production of lead shot. Open systems/no direct handling required for remaining workplaces.
Technical conditions and measures to control dispersion	Controls give 78% minimum worker exposure reduction. Risk Management Measures include enclosure of process equipment, dilution ventilation and/or local exhaust ventilation. Pass waste air through cleaning

from source towards the worker	equipment. LEV typically required for all processes other than storage and shipment.			
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.			
Conditions and measures related to personal protection, hygiene and health evaluation	Minimum Respiratory Protective Equipment (RPE) is FFP 2 mask, except in cases where adequate ventilation/emission control in place (see also section 8). Leather or thermal-protective gloves required for all processes other than milling/rolling, sawing/slitting and storage and shipment.			
2.2 Control of environmental exposure				
Amounts used	Not restricted.			
Frequency and duration of use	Continuous use/release, up to 300 days/year.			
Environment factors not influenced by risk management	Flow rate of receiving surface water is 37 m^{3}/s.			
Other given operational conditions affecting environmental exposure	Not applicable.			
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	See Section 8 of the SDS, above.			
	Estimated emissions released to water:	20 kg/annum/site		
	Estimated emissions released to air:	100 kg/annum/site		
Organisational measures to prevent/limit release from site	See Section 8 of the SDS, above.			
Conditions and measures related to external treatment of waste for disposal	Pb-bearing wastes resulting from the processes described above are generated in the form of solids (e.g. dross, slags). These should be treated by a licensed waste treatment operator (landfilled or incinerated) according to relevant waste regulation.			
3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio
	Blood lead concentrations for male workers (maximum):	33.7 µg/dL	40.0 µg/dL	0.84
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.622 µg/l	3.1 µg/l	0.20
	Marine:	0.049 µg/l	3.5 µg/l	0.014
	Freshwater sediment:	103.5 mg/kg dw	174.0 mg/kg dw	0.59
	Marine water sediment:	57.1mg/kg dw	164.2 mg/kg dw	0.35
	Terrestrial:	28.3 mg/kg dw	212.0 mg/kg dw	0.13
	Sewage treatment plant:	The site is assumed not to be connected with an off-site STP		
4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES				
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead levels) must be below the DNEL: DNEL for male workers: 40 µg/dL DNEL for female workers of reproductive capacity: 10 µg/dL				

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ES 7: Use of lead metal in the production of leaded steels – Industrial

1. Title		
Identified Use	Use of lead metal in the production of leaded steels	
Systemic title based on use descriptor	SU 14; PC 7; AC 7; ERC 3	
2. Operational conditions and risk management measures		
Involved PROCs	Involved Tasks	
PROC 26	Raw material handling	
PROC 22, 23	Secondary Steel making. Carried out using a ladle arc furnace. Lead is added by the addition of lead pellets or adding lead shot by deep injection into the ladle.	
PROC 23	Casting via continuous casting route or ingot casting	
PROC 21, 24, 25	Rolling / Cutting / Finishing	
PROC 21	Internal logistics	
PROC 28, 25	Others	
2.1 Control of workers exposure		
Product characteristic	Raw material is principally graphitised lead shot. The lead can be added in conjunction with other additives or separately. The lead shot is granular with a diameter of 2mm and below. The product is massive metal, usually as blooms, billets, ingots or bars. The concentration of lead in the finished steel product is typically in the range 0.2-0.35%.	
Amounts used	Not restricted	
Frequency and duration of use/exposure	Full shift exposure (8 hours) for all workplaces (not restricted).	
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels)	
Other given operational conditions affecting workers exposure	Indoor handling, room volume >1000 m^3. Outdoor storage of finished products.	
Technical conditions and measures at process level (source) to prevent release	All workplaces other than Raw Material Handling require enclosed systems with extraction.	
Technical conditions and measures to control dispersion from source towards the worker	Controls give 78% minimum worker exposure reduction. Risk Management Measures include enclosure of process equipment, dilution ventilation and/or local exhaust ventilation. Pass waste air through cleaning equipment. Leather gloves are required for all processes.	
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.	
Conditions and measures related to personal protection, hygiene and health evaluation	Minimum Respiratory Protective Equipment (RPE) is FFP 2 mask, except in cases where adequate ventilation/emission control in place (see also section 8).	
2.2 Control of environmental exposure		
Amounts used	Approx.430.7 tonnes/annum/site	
Frequency and duration of use	Continuous use/release, up to 156 days/year (3 days/week)	
Environment factors not influenced by risk management	Flow rate of receiving surface water 13.0 $m^{3/}s$	
Other given operational conditions affecting environmental exposure	Not applicable	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	See Section 8 of the SDS, above.	
	Estimated fraction released to water (g/tonne):	255.4
	Estimated fraction released to air (g/tonne):	1,686.8

Organisational measures to prevent/limit release from site	See Section 8 of the SDS, above.			
Conditions and measures related to external treatment of waste for disposal	Different Pb-bearing wastes resulting from the processes described above are generated in the form of extraction dust, slag. These waste products are mainly recycled in the production process or through off site processes.			
3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio
	Blood lead concentrations for male workers (maximum):	25.5 µg/dL	40.0 µg/dL	0.64
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.84µg/l	3.1 µg/l	0.27
	Marine:	No Emissions	3.5 µg/l	N/A
	Freshwater sediment:	166.2 mg/kg dw	174.0 mg/kg dw	0.96
	Marine water sediment:	No Emissions	164.2 mg/kg dw	N/A
	Terrestrial:	28.9 mg/kg dw	212.0 mg/kg dw	0.14
	Sewage treatment plant:	The site is assumed not to be connected with an off-site STP.		
4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES				
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead levels) must be below the DNEL: DNEL for male workers: 40 µg/dL DNEL for female workers of reproductive capacity: 10 µg/dL				

ES 9: Use of lead metal in lead oxide production

1. Title	
Identified Use	Use of lead metal in lead oxide production
Systemic title based on use descriptor	SU 8; ERC 6a; PC 19
2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 21, 22, 24, 26	Lead oxide production: production of crude oxide, further oxidation/calcination, grinding/milling, packaging
PROC 21	Internal logistics: storage (raw materials, finished goods) and shipment of finished goods
PROC 28	Repair, cleaning, and maintenance, quality control, engineering
2.1 Control of workers exposure	
Product characteristic	Ingots of highly refined metallic lead (99.9 %) are used as raw material. The oxidation products are powders. Varying levels of dustiness will occur during the process steps.
Amounts used	Not restricted

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Frequency and duration of use/exposure	Full shift (8 hours) exposure for all workplaces (not restricted).			
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels)			
Other given operational conditions affecting workers exposure	Indoor handling, room volume >1000 m^3. Process temperature <620°C during production of crude oxide.			
Technical conditions and measures at process level (source) to prevent release	Full containment for the Lead oxide production workplace.			
Technical conditions and measures to control dispersion from source towards the worker	Controls give 78% minimum worker exposure reduction. Risk Management Measures include enclosure of process equipment, negative draft exhaust systems and/or local exhaust ventilation. Pass waste air through cleaning equipment.			
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.			
Conditions and measures related to personal protection, hygiene and health evaluation	Minimum Respiratory Protective Equipment (RPE) is FFP 2 mask, except in cases where adequate ventilation/emission control in place (see also section 8).			
2.2 Control of environmental exposure				
Amounts used	14,000 tonnes/annum/site			
Frequency and duration of use	Continuous use/release, up to 365 days/year			
Environment factors not influenced by risk management	Dilution factor (Freshwater): 10 Dilution factor (Marine): 100			
Other given operational conditions affecting environmental exposure	Not applicable			
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	See Section 8 of the SDS, above.			
	Estimated fraction released to water (g/tonne):	0.015		
	Estimated fraction released to air (g/tonne):	6.45		
Organisational measures to prevent/limit release from site	See Section 8 of the SDS, above.			
Conditions and measures related to external treatment of waste for disposal	Pb-bearing wastes resulting from the processes described above are generated in the form of oxides. These waste products are recycled in the production process			
3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio
	Blood lead concentrations for male workers (maximum):	39.0 µg/dL	40.0 µg/dL	0.98
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.88 µg/l	3.1 µg/l	0.28
	Marine:	0.052 µg/l	3.5 µg/l	0.015
	Freshwater sediment:	160.92 mg/kg dw	174.0 mg/kg dw	0.92
	Marine water sediment:	62.31 mg/kg dw	164.2 mg/kg dw	0.38
	Terrestrial:	28.33 mg/kg dw	212.0 mg/kg dw	0.13
	Sewage treatment plant:	14 µg/l	100 µg/l	0.14
4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES				
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead				

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levels) must be below the DNEL:

DNEL for male workers: 40 µg/dL
DNEL for female workers of reproductive capacity: 10 µg/dL

ES 11: Professional Use of Lead Solder

1. Title				
Identified Use	Professional Use of Lead Solder			
Systemic title based on use descriptor	PC 7, PC 38; SU 15, SU 16, SU 17, SU 19, SU 0; AC 3, AC 7; ERC 0, ERC 8c.			
2. Operational conditions and risk management measures				
Involved PROCs	Involved Tasks			
PROC 0, PROC 4, PROC 5, PROC 15, PROC 25	Use of low temperature melting solders for electrical appliance assemblage or repair and pipe joining or assembly of stained glass articles.			
2.1 Control of workers exposure				
Product characteristic	Ingots, wire or powder of metallic alloy containing lead (typically range of 37-75%).			
Amounts used	Based on maximum professional use of 20 kg per shift.			
Frequency and duration of use/exposure	Use of lead solders is assumed to occur 0.5 - 3 hours per day, five days per week			
Human factors not influenced by risk management	See Section 8 of the SDS, above (hygiene measures affecting lead blood levels)			
Other given operational conditions affecting workers exposure	No limitations assessed			
Technical conditions and measures at process level (source) to prevent release	None needed.			
Technical conditions and measures to control dispersion from source towards the worker	Ensure good ventilation where possible.			
Organisational measures to prevent /limit releases, dispersion and exposure	See Section 8 of the core SDS, above.			
Conditions and measures related to personal protection, hygiene and health evaluation	For operations covered by this scenario, gloves should ideally be worn.			
2.2 Control of environmental exposure				
Overview	No environmental emissions during professional use.			
Conditions and measures related to recovery of articles at the end of service life	Soldered articles are expected to be recovered and recycled (by a licensed recovery operator in accordance with relevant legislation), owing to the intrinsic values of the substrates and the solders.			
3 Exposure estimation				
Health Exposure estimations (based on measures outlined in section 2.1)		Predicted Blood Lead Levels (Maximum)	Derived No Effect Level	Risk Characterisation Ratio
	Solder, electrical, stained glass, plumbing	1.55 µg/dL	40 µg/dL	0.04
	Solder, industrial (bars)	5.2 µg/dL	40 µg/dL	0.13
Environmental Exposure estimations (based on measures outlined in section	Not applicable			

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2.2)	

4 Guidance to DU to evaluate whether they work inside the boundaries set by the ES
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his implemented risk management measures are adequate. Detailed guidance for evaluation of ES can be acquired via your supplier or from the ECHA website (guidance R14, R16). For environmental exposure, a DU-Scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available. For human health, exposure (as measured blood lead levels) must be below the DNEL: DNEL for male workers: 40 µg/dL DNEL for female workers of reproductive capacity: 10 µg/dL