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**
Registration number	**01-2119513221-59-0074**

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

The placing on the market for supply to the general public is prohibited for 'Lead metal massives (general and high purity grades)' on its own and in mixtures at 0.3% or more Pb by weight. As such, the consumer use of lead solder is a use advised against.

In accordance with the CSR, the use of lead shot over wetlands is a use advised against.

1.3 Details of the supplier of the safety data sheet

VELLONTON LLP
1 PRINCETON MEWS, 167-169 LONDON ROAD
KINGSTON UPON THAMES, SURREY KT2 6PT
UNITED KINGDOM
Tel: +44 208 144 89 33
Fax: +44 208 043 00 72
E mail: olga.kononova@velonton.co.uk / nataliya.pakhomova@vellonton.co.uk

1.4 Emergency telephone number

In case of emergency **Tel. Tel. (+38 (06272) 2 11 69 from 08 a.m. till 17 p.m.)**

SECTION 2: Hazards Identification

2.1 Classification of the substance or mixture

The following acute Ecotoxicity Reference Values (ERVs) were used to determine the classification of **lead metal massive**:

pH range	Descriptor	ERV
6	ERV (Ecotoxicity Reference Value)	73.6 µg Pb/L (dissolved)
7	ERV (Ecotoxicity Reference Value)	37.8 µg Pb/L (dissolved)
8	ERV (Ecotoxicity Reference Value)	20.5 µg Pb/L (dissolved)

The following chronic Ecotoxicity Reference Values (ERVs) were used to determine the classification of **lead metal massive**:

pH range	Descriptor	ERV
6	ERV (Ecotoxicity Reference Value)	17.8 µg Pb/L (dissolved)
7	ERV (Ecotoxicity Reference Value)	9.0 µg Pb/L (dissolved)

8	ERV (Ecotoxicity Reference Value)	6.1 µg Pb/L (dissolved)

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.	

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.

Safety statements:
General: -
Prevention: (P 260) Do not breathe dust/fume/gas/mist/vapours/spray
(P 280) Wear protective gloves/protective clothing/eye protection/face protection
(P 281) Use personal protective equipment as required
Response: (P 308+P 313) If exposed or concerned: get medical advice/attention
Storage: -
Disposal: (P 501) Dispose of contents/container to an approved waste disposal plant

Labelling according to REACH Annex XVII, Entry 30: 'Restricted to professional users'.

† *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	>99	**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
Non-hazardous impurities	n/a	remainder	none

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: Move to fresh air. Get medical attention if pain still persists.
SKIN CONTACT: Remove 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)
Denmark	20 µg/dL
Germany	40 µg/dL 10 µg/dL (for woman, age below 45 years) [Suspended]
France	40 µg/dL 30 µg/dL (for woman of reproductive capacity)
Ireland	70 µg/dL
Spain	70 µg/dL
Italy	60 µg/dL 40 µg/dL (for woman of reproductive capacity)
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

The following Predicted No Effect Concentrations were used to determine the environmental risk of lead metal:

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 fully 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 and since carcinogenicity studies of lead metal powder have been negative. Epidemiology studies of workers exposed to inorganic lead 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 resulting in systemic uptake 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

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. Lead toxicity is expected to be greater in softer waters.

Reliable acute freshwater aquatic toxicity data (tests conducted with soluble lead salts; all toxicity data reported as dissolved lead):

Test Organisms:	Endpoint	Range of values
Fish: *Pimephales promelas, Oncorhynchus mykiss*	96h-LC_{50}	pH 5.5 – 6.5: 40.8 – 810.0 µg Pb/L pH >6.5 – 7.5: 52.0 – 3,598.0 µg Pb/L pH > 7.5 – 8.5: 113.8 – 3,249.0 µg Pb/L
Invertebrates: *Daphnia magna, Ceriodaphnia dubia*	48h-LC_{50}	pH 5.5 – 6.5: 73.6 – 655.6 µg Pb/L pH >6.5 – 7.5: 28.8 – 1,179.6 µg Pb/L pH > 7.5 – 8.5: 26.4 – 3,115.8 µg Pb/L
Algae: *Pseudokirchneriella subcapitata, Chlorella kesslerii*	72h-ErC_{50} (growth rate)	pH 5.5 – 6.5: 72.0 – 388.0 µg Pb/L pH >6.5 – 7.5: 26.6 – 79.5 µg Pb/L pH > 7.5 – 8.5: 20.5 – 49.6 µg Pb/L

Tests were conducted according to international accepted test guidelines or scientifically acceptable methods.

Reliable chronic toxicity test results (tests conducted with soluble lead salts; all toxicity data reported as dissolved lead):

Test organisms	Range of values (EC_{10}, NOEC)
Aquatic freshwater toxicity data	
Fish: *Oncorhynchus mykiss, Salmo salar, Pimephales promelas, Salvelinus fontinalis, Ictalurus punctatus, Lepomis macrochirus, Salvelinus namaycush, Cyprinus carpio, Acipenser sinensis*	17.8 – 1,558.6 µg Pb/L
Invertebrates: *Hyalella azteca, Lymnaea palustris, Ceriodaphnia dubia, Lymnaea stagnalis, Philodina rapida, Daphnia magna, Alona rectangular, Diaphanosoma birgei, Chironomus tentans, Brachionus calyciflorus, Chironomus riparius, Baetis tricaudatus.*	1.7 – 963.0 µg Pb/L
Algae: *Pseudokirchneriella subcapitata, Chlorella kesslerii, Chlamydomonas reinhardtii.*	6.1 – 190.0 µg Pb/L
Higher plants: *Lemna minor*	85.0 – 1,025.0 µg Pb/L
The most sensitive toxicity endpoints were (reproduction; *C. dubia*) and growth (*L. stagnalis*): 1.7 µg Pb/L. Symptoms of toxicity were effects on survival, growth, reproduction, hatching, (population) growth rate and malformation during development. Toxicity of dissolved lead in freshwater is dependent on the physico-chemistry of the freshwater (mainly dissolved organic carbon, pH, hardness).	
Aquatic marine toxicity data	
Fish: *Cyprinodon variegatus*	229.6 – 437.0 µg Pb/L
Invertebrates: *Mytilus trossolus, Americamysis bahia, Mytilus galloprovincialis, Neanthes arenaceodentata, Strongylocentrotus purpuratus, Paracentrotus lividus, Dendraster excentricus, Tisbe battagliai, Crassotrea gigas*	9.2 – 1,409.6 µg Pb/L
Algae: *Skeletonema costatum, Phaeodactylum tricornutum, Dunaliella tertiolecta.*	52.9 – 1,234.0 µg Pb/L
Higher plants*: Champia parvula*	11.9 µg Pb/L
The most sensitive toxicity endpoint was malformation (*M. trossulus):* 9.2 µg Pb/L. Symptoms of toxicity include effects on survival, growth, growth rate, reproduction and malformation during development	
Sediment freshwater toxicity data	
Invertebrates: *Tubifex tubifex, Ephoron virgo, Hyalella azteca, Gammarus pulex, Lumbriculus variegatus, Hexagenia limbata, Chironomus tentans*	573.0 – 3,390.0 mg Pb/kg dw
The most sensitive toxicity endpoint was reproduction (*T. tubifex*): 573.0 mg Pb/kg dw. Symptoms of toxicity include effects on survival, growth, and reproduction. Toxicity of lead in freshwater sediment is dependent on the acid volatile sulphide content (AVS) of the freshwater sediment.	
Sediment marine toxicity data	
Invertebrates: *Neanthes arenaceodentata, Leptocheirus plumulosus*	680.0 – 1,291.0 mg Pb/kg dw
The most sensitive toxicity endpoint was growth (*N. arenaceodentata*): 680.0 mg Pb/kg dw. Symptoms of toxicity include effects on survival, growth, and reproduction	
Terrestrial toxicity data (values were determined in different topsoils with contrasting properties and spiked with soluble lead salts):	
Invertebrates: *Folsomia candida*, *Proisotoma minuta, Sinella curviseta, Eisenia fetida, Eisenia andrei, Dendrobaena rubida, Lumbricus rubellus,*	34.0 – 2,445.0 mg Pb/kg dw

Aporrectodea caliginosa	
Plants: *Hordeum vulgare*, *Zea mays*, *Echinochloa crus-galli*, *Lolium perenne*, *Sorgum bicolor*, *Triticum aestivum*, *Oryza sativa* and *Avena sativa, Raphanus sativus, Lycopersicon esculentum, Lactuca sativa, Cucumis sativus, Picea rubens, Pinus taeda*	57.0 – 6,774.0 mg Pb/kg dw
Micro-organisms: denitrification, N-mineralization, nitrification, basal respiration, substrate-induced respiration	97.0 – 7,880.0 mg Pb/kg dw
The most sensitive toxicity endpoint was reproduction (*F. candida*): 34.0 mg Pb/kg. Symptoms of toxicity include effects on survival, growth, hatching, yield, reproduction, and microbe mediated processes. Toxicity of lead in soils is dependent on 1) the ageing processes and 2) the Cation Exchange Capacity (eCEC) of the soil.	

Tests were conducted according to international accepted test guidelines or scientifically acceptable methods.

Toxicity data for micro-organisms (for STP) (tests conducted with soluble lead salts)***:***

Test Organisms:	**Effect**	**Range of values (EC_{10}, NOEC)**
Bacterial populations	Respiration	1.06 – 2.92 mg Pb/L
	Ammonia uptake rate	2.79 – 9.59 mg Pb/L
Protozoan community	Mortality	1.0 – 7.0 mg Pb/L

Tests were conducted according to international accepted test guidelines or scientifically acceptable methods.

For an overview of PNECs for the different compartments, refer to Section 8.1.2.

12.2 Persistence and degradability

Lead is naturally occurring and ubiquitous in the environment. Lead is obviously persistent in the sense that it does not degrade to CO_2, water, and other elements of less environmental concern. In the water compartment, lead is rapidly and strongly bound to the suspended solids of the water column. This binding and subsequent settling to the sediment allows for rapid metal removal of lead from the water column. Insignificant remobilisation of lead from sediment is expected.

12.3 Bioaccumulative potential

Available BCF/BAF data for the aquatic environment show a distinct inverse relationship with the exposure concentration demonstrating that lead is homeostatically regulated by aquatic organisms. A median BAF within environmentally relevant concentrations of 1,552 L/kg_{ww} is observed in aquatic organisms. In the soil compartment no bioaccumulation is expected. The BAFs are not significantly affected by the Pb concentration in the soil. A median BAF value for soil dwelling organisms is 0.10 kg_{dw}/kg_{ww}. Available information on transfer of Pb through the food chain indicates that lead does not biomagnify in aquatic or terrestrial food chains.

12.4 Mobility in soil

Lead metal is sparingly soluble in water and with its relatively high Kd value, is expected to be absorbed onto soils and sediments. Typical log Kd-values of 5.2, 5.7 and 3.8 have been determined for freshwater sediment, marine sediment and soil, respectively.

12.5 Results of PBT and vPvB assessment

The PBT and vPvB criteria of Annex XIII to the Regulation do not apply to inorganic substances, such as lead monoxide The criterion for persistence is not applicable for inorganic Pb. Under conditions of a standard EUSES lake, Pb meets the criteria for rapid removal from the water column (> 70% in 28 days). Bioaccumulation criterion is not applicable to inorganic substances such as Pb. However, Pb is considered to be toxic, since the most sensitive NOECs, HC5-50 and PNEC values are lower than 10 µg Pb/L.

12.6 Other adverse effects

Lead metal is not expected to contribute to ozone depletion, ozone formation, global warming or acidification.

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
Dispose of in accordance with local regulations

SECTION 14: Transport Information

	ADR/RID/AND	**IMDG Code**	**IATA DGRs**
14.1 UN Number	-	-	-
14.2 UN Proper Shipping Name	-	-	-

14.3 Transport Hazard Class(es)	**-**	**-**	**-**
14.4 Packing Group	**-**	**-**	**-**
14.5 Environmental hazards	**No**	**No**	**-**
14.6 Special precautions for user	**No specific transport precautions**		
14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	**Not transported by sea in bulk**		
14.8 Other Information	***IMDG Code Segregation Group (if none applicable insert "Not Applicable"*):** **Segregation Groups 7 and 9 (Voluntary application)**		

SECTION 15: Regulatory Information

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

Lead metal is included on the REACH Candidate List of Substances of Very High Concern for Authorisation (Toxic to Reproduction, Category 1A; Article 57c)

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

- Annex XVII, Entry No. 30 (regarding supply to the general public)
- REACH Annex XVII, Entry No. 63
- Ecological permission for emissions No 1412600000 – 00165
- Health safety and labour protection: No 0555.15.14 0554.15.14б 0552.15.14б 0549.15.14б 0548.15.14

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 is the 3rd SDS to the format required by Commission Regulation (EU) No 453 / 2010

Legal Statement:

The information contained within this Safety Data Sheet is the property of the members of the Lead REACH Consortium. Only legal entities with legitimate access may use this data.

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.

Annex: Exposure Scenarios

ES 1 Primary lead production

1. Title		
Identified Use	Use of concentrates and other lead bearing materials in primary lead production	
Systemic title based on use descriptor	PC7, ERC1	
2. Operational conditions and risk management measures		
Involved PROCs	Involved Tasks	
PROC 26	Raw material handling: ore/concentrate delivery, loading/unloading, and furnace feed mixing	
PROC 22, 8b	Sintering: feeding/unloading, sinter plant operation	
PROC 22, 1, 2	Smelting: furnace operation (blast, rotary, and reverbatory furnaces)	
PROC 23	Refining and casting: decopperisation, softening (As, Sb, Sn removal), silver separation, zinc distillation, casting of lead ingots/slabs or lead alloy ingots	
PROC 21	Internal logistics: storage and shipment of finished goods, intra-facility transport	
PROC 28	Others: repair, cleaning, and maintenance, quality control, and engineering	
2.1 Control of workers exposure		
Product characteristic	Raw material is principally lead concentrates, although some scrap metallic lead, used lead-acid batteries, production residues, ashes, sludge and filter dust may be used. These materials will have varying levels of dustiness. The product is massive lead metal, usually as ingots or bars with low dust.	
Amounts used	Not restricted	
Frequency and duration of use/exposure	Full shift (8 hours) exposure for all workplaces other than sintering (part shifts, < 8 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	Outdoor handling of bulk ores and raw materials Indoor handling, room volume >1000 m^3	
Technical conditions and measures at process level (source) to prevent release	Full containment of furnace operations, reaction vessels and other handling operations. Manual handling of ores and finished metal.	
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	26,000 tonnes/annum/site	
Frequency and duration of use	Continuous use/release, up to 326 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):	0.26
	Estimated fraction released to air (g/tonne):	25.41
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 dross, flue dust, slag. These waste products are mainly recycled in the production process or landfilled.			
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):	32.9 µg/dL	40.0 µg/dL	0.82
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	0.91 µg/l	3.1 µg/l	0.29
	Marine:	0.051 µg/l	3.5 µg/l	0.015
	Freshwater sediment:	164.15 mg/kg dw	174.0 mg/kg dw	0.94
	Marine water sediment:	60.72 mg/kg dw	164.2 mg/kg dw	0.37
	Terrestrial:	28.52 mg/kg dw	212.0 mg/kg dw	0.13
	Sewage treatment plant:	0.012 mg/l	0.1 mg/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 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	
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 3: Lead Battery Production

1. Title		
Identified Use	Use of lead in lead battery production, also incorporating the manufacture and use of lead monoxide, pentalead tetraoxide sulphate and tetralead trioxide sulphate	
Systemic title based on use descriptor	SU16, SU17; ERC 5, ERC 6a; AC 1, AC 2, AC 3	
2. Operational conditions and risk management measures		
Involved PROCs	Involved Tasks	
PROC 3, 21, 22, 23	Plate manufacturing: Casting/production of grids, oxide production, mixing, pasting, and curing operations	
PROC 4, 21	Plate treatment: Jar/tank formation, plate washing, drying, cutting	
PROC 21, 25, 26	Assembly: Stacking, assembly, welding and joining operations	
PROC 4, 21	Battery formation: Acid filling, formation (wet batteries), finishing	
PROC 21	Internal logistics: Storage of raw materials and finished goods, intra-facility transport, shipment	
PROC 28	Cleaning and maintenance	
2.1 Control of workers exposure		
Product characteristic	Raw material is principally lead ingots, and sometime lead oxides. Lead sulphates are formed during the paste production process. During the different process steps varying levels of dustiness occur. The article is an assembled and sealed battery.	
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	Closed system required for oxide production and enclosed spaces for curing operations.	
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.	
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	10,400 tonnes/annum/site (of lead)	
Frequency and duration of use	Continuous use/release, up to 315 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):	0.18
	Estimated fraction released to air (g/tonne):	344.75
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 waste batteries, dross, scrap, plates, dust, swarf. These waste products are mainly recycled in the production process or incinerated			
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):	37.1 µg/dL	40.0 µg/dL	0.93
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:	167.80 mg/kg dw	174.0 mg/kg dw	0.96
	Marine water sediment:	61.15 mg/kg dw	164.2 mg/kg dw	0.37
	Terrestrial:	29.50 mg/kg dw	212.0 mg/kg dw	0.14
	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 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
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 5: Use of Lead in the Production of Hot-Dip Galvanized Steel (including wire galvanizing)

1. Title				
Identified Use	Use of lead in the production of Hot-Dip Galvanized Steel (including wire galvanizing)			
Systemic title based on use descriptor	SU15; ERC 5, PC 14; AC 7			
2. Operational conditions and risk management measures				
Involved PROCs	Involved Tasks			
PROC 23	Raw material handling			
PROC 23, 13	Hot dip galvanizing: periodic alloying additions of lead to the molten zinc bath (batch galvanizing).			
PROC 23	Wire Galvanizing: lead wire passed through a bath of molten zinc			
PROC 28	Cleaning and maintenance, quality control			
2.1 Control of workers exposure				
Product characteristic	Massive steel coated with a metallic lead layer.			
Amounts used	Not restricted			
Frequency and duration of use/exposure	Full shift exposure (8 hours) 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 >1000 m^3. Process temperature 445-460°C for molten zinc bath.			
Technical conditions and measures at process level (source) to prevent release	Enclosed system for Hot dip galvanizing and Wire Galvanizing.			
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.			
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). Thermal gloves required for Hot Dip Galvanizing and Wire Galvanizing.			
2.2 Control of environmental exposure				
Amounts used	500-1000 tonnes/annum/site			
Frequency and duration of use	Continuous use/release, up to 42 days/year			
Environment factors not influenced by risk management	No emissions to water.			
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):	No Emissions		
	Estimated fraction released to air (g/tonne):	4,000		
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	The Pb content of wastes leaving the process is insignificant.			
3 Exposure estimation				
Health Exposure Estimations (based on measures outlined in		Predicted Blood Lead Levels (Maximum)	Derived No-Effect Level	Risk Characterisation Ratio

section 2.1)	Blood lead concentrations for male workers (maximum):	<12.0 µg/dL	40.0 µg/dL	<0.3
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	No Emissions	3.1 µg/l	N/A
	Marine:	No Emissions	3.5 µg/l	N/A
	Freshwater sediment:	No Emissions	174.0 mg/kg dw	N/A
	Marine water sediment:	No Emissions	164.2 mg/kg dw	N/A
	Terrestrial:	29.6 mg/kg dw	212.0 mg/kg dw	0.14
	Sewage treatment plant:	No Emissions	0.1 mg/l	N/A

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 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. 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				

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 8: Lead Powder Production

1. Title	
Identified Use	Use of lead metal in the production of powders (Solder)
Systemic title based on use descriptor	SU 15, SU 17; PC 0, PC 7; ERC 2

2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 26	Raw material handling
PROC 22, 25	Manufacture of Solder (molten lead alloy)
PROC 27a, 27b	Powder Production: Blowing of molten lead alloy with different gases
PROC 27a, 27b, 26	Powder Production: Ultrasonic atomisation (Solder falling onto an ultrasonic horn) and Centrifugal atomisation (Solder falling onto a spinning disc)
PROC 21	Storage and Shipment

2.1 Control of workers exposure	
Product characteristic	Raw material is lead or lead alloy ingots, bars, or other forms of massive lead with a lead content usually in the range 36-99%.
Amounts used	Not restricted
Frequency and duration of use/exposure	Full shift exposure (8 hours) 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 >150 m^3 Outdoor handing for raw material processes.
Technical conditions and measures at process level (source) to prevent release	Enclosed systems are required for all workplaces other than Raw Material Handling and Storage and Shipment.
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). Leather gloves are required for all workplaces other than Raw Handling 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	No emissions to the environment.			
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):	No emissions		
	Estimated fraction released to air (g/tonne):			
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):	16.0 µg/dL	40.0 µg/dL	0.4
Environmental Exposure Estimations (based on measures outlined in section 2.2)		Predicted Exposure Concentrations (Maximum)	Predicted No Effect Concentrations	
	Freshwater:	No Emissions	3.1 µg/l	N/A
	Marine:	No Emissions	3.5 µg/l	N/A
	Freshwater sediment:	No Emissions	174.0 mg/kg dw	N/A
	Marine water sediment:	No Emissions	164.2 mg/kg dw	N/A
	Terrestrial:	28.3 mg/kg dw	212.0 mg/kg dw	0.13
	Sewage treatment plant:	No Emissions	100 µg/l	N/A
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			
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		Predicted Exposure	Predicted No Effect	

Estimations (based on measures outlined in section 2.2)		Concentrations (Maximum)	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 levels) must be below the DNEL:

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

ES 10: Use of molten lead as heat transfer fluid in closed process

1. Title	
Identified Use	Professional Use of Lead Solder
Systemic title based on use descriptor	SU 14, SU15 ; ERC 7 ; PC 16
2. Operational conditions and risk management measures	
Involved PROCs	Involved Tasks
PROC 2	Lead is used in liquid/molten form in an enclosure (main crucible belt) 24 hours per day, 365 days per year. The molten lead bath is covered by a thick layer of mineral granulates (vermiculite), so its contact between ambient air and molten lead is avoided
PROC 8b, PROC 23, PROC 24, PROC 26	Removal of the vermiculite insulation and the lead oxide solid layer. Drainage of the liquid/molten lead in open air and transfer to ancillary containers. Skimming of the ancillary crucible (lead after remelting. Filling of the crucible belt with liquid/molten lead in open air
2.1 Control of workers exposure	
Product characteristic	Molten lead is used as a heat transfer fluid in closed process.
Amounts used	Amount in tank: approx. 45 tonnes
Frequency and duration of use/exposure	8 hour shift 350 days a year. Maintenance: maximum once a year
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.

Conditions and measures related to recovery of articles at the end of service life	Not applicable			
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):	4.3 µg/dL	40µg/dL	<0.15
Environmental Exposure estimations (based on measures outlined in section 2.2)	Not applicable			
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 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 2.2)	Not applicable			
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				