

TECHNICAL DATASHEET

PENOX TBLS+® 'Next Generation'

TBLS+®
Next
Generation

Main Battery Applications:

All types of lead acid batteries.

Description:

TBLS+® is a tetra basic lead sulphate produced by the reaction of lead oxide with sulphuric acid, chemical formula $PbSO_4 \cdot 4 PbO$.

TBLS+® has a d50 sub-micron particle size and is specially treated for applications in the battery industry (lead accumulator). The product is sold as a slurry, suspended in water.

The content of tetrabasic seed crystals in the slurry is adjusted to min. 32 % by the producer.

PENOX TBLS+®:

Recommended addition rate from 0.5 to 1.5 % of the lead oxide weight in the paste recipe.

Physical/Chemical Data:

TBLS+® is free of carbon compounds and other components that can affect the battery.

Solids ¹⁾		39 - 45 %	DIN ISO 787-2
Particle Size	d 99	< 3.6 µm	PV 109, Laser Diffraction
	d 50	< 0.6 µm	PV 109, Laser Diffraction
Density of the Slurry ¹⁾		1.45 - 1.75 g/cm ³	DIN EN ISO 787-10
Content of seeds ²⁾		> 32 %	PV 261, FTIR Spectroscopy
Pb (total) of the lead compound		83-85 %	PV 265, EDTA Titration
Impurities	Iron	< 20 ppm	PV 450, ICP

1) depends on the content of tetra basic seed crystals of the raw material

2) adjusted by the producer

Packaging: upon agreement – buckets and IBCs available.

All technical data and information are for guidance and assistance in your application. The particulars are made to the best of our knowledge but without liability.

**Battery
Additives**

TBLS+® FOR ALL TYPES OF AUTOMOTIVE AND INDUSTRIAL BATTERIES

PENOX GmbH developed tetra-basic lead sulphate seeding material (with a particle size of 0.5 micron) enabling the battery manufacturer to produce tetra-basic cured positive active materials with control of the porosity and the crystal size of positive active material. Due to the fact that TBLS+® is delivered as a slurry it is possible to distribute the seeds very homogeneously within the paste by adding 0.5% up to 2% of the product.

Industrial battery manufacturers are using TBLS+® successfully to increase the initial capacity of the battery without losing any performance in deep cycle tests.

For Advanced Batteries EFB/AGM, TBLS+® can replace expensive advanced carbons in the negative plate to improve high current and dynamic charge acceptance.

ADVANTAGES

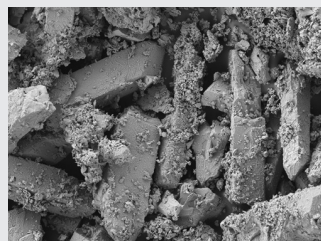
- › Formation of a porous PAM structure during charging operations to support acid exchange and battery operation
- › Formation of smaller lead sulphate crystal structures during discharge operations
- › Formation of conductive areas close to the wires during deep discharge operations or longer periods without battery operation, that improves high current acceptance during charging operations
- › Increase in service life due to stable crystalline structures during discharge/charge operations
- › TBLS+® reduces water consumption
- › TBLS+® is supplied as a slurry which supports the homogenous distribution of the seeds in the paste

SIGNIFICANT PERFORMANCE IMPROVEMENT OF LAB

Tetrabasic (4-basic) lead sulphate

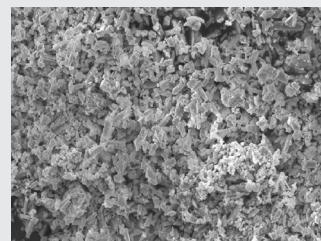
- › Gives more stable capacity C20 in discharge and recharge applications
- › Limits passivation after deep discharge (Sb free effect)
- › Improves cycling performance under partial state of charge
- › Avoids softening of the active material in lifetime tests (hot cycling tests at 60 °C and more)
 - › **Longer lifetime batteries**
 - › **Less variation for battery performance during lifetime**

WHY TETRA BASIC WITH TBLS+®?



without TBLS+®

→ 10 µm



with 1% TBLS+®

→ 10 µm

SAVE MONEY – INCREASE PERFORMANCE

AUTOMOTIVE AND INDUSTRIAL:

- › Curing/drying – time savings
- › Formation – time and energy savings
- › Increase of cycle life performance

AUTOMOTIVE:

- › TBLS+® improves porosity in the PAM, direct AM savings of up to 6.5%
- › With 1% TBLS+® porosity improves in the PAM, direct AM savings of up to 6.5%
- › With 1% TBLS+® and battery redesign, total savings of up to 10%
- › TBLS+® balances the battery »electrical system«, improves NAM performance

COMPOSITION

TBLS+® is a tetra basic lead sulphate produced by the reaction of lead oxide with sulphuric acid, chemical formula PbSO₄, 4 PbO.

TBLS+® has a very small particle size and is specially treated for applications in the battery industry (lead accumulator). The product is supplied as a slurry, suspended in water.

The minimum content of tetrabasic seed crystals in the slurry is 32%. A special additive avoids the formation of agglomerates in the slurry and increases the shelf life of the material.

HOW MUCH TBLS+®? ¹⁾

› SLI batteries for standard/flooded applications:

0.8 to 1 % TBLS+® results in a 4 basic PbSO₄ crystal 10 -12 µm

› AGM / Gel / EFB batteries:

1 to 1.5 % TBLS+® results in a 4 basic PbSO₄ crystal <10 µm

› Batteries for deep cycling applications:

0.3 to 0.8% TBLS+® results in 4 basic PbSO₄ crystals <20 µm

¹⁾ The final crystal size is also dependent upon the acid:oxide ratio in the paste mix

TECHNICAL DATA

Solids	content	%	39 - 45	DIN ISO 787-2
Particle Size	d99	µm	< 3.6	PV109, Laser Diffraction
	d50	µm	< 0.6	PV109, Laser Diffraction
Density of the slurry ²⁾	type	g/cm ³	1.45 - 1.75	DIN EN ISO 787-10
Content of seeds	content	%	> 32	PV261, FTIR Spectroscopy
Pb (total) of the lead compound	content	%	83 - 85	PV265, EDTA Titration
Iron	max.	%	0.002	PV 450, ICP

TBLS+® is free of carbon compounds and other components that can affect the battery.

²⁾ depends on the content of tetra basic seed crystals of the raw material



SAFETY DATA SHEET

TBLS+

According to Regulation (EC) No 1907/2006, Annex II, as amended. Commission Regulation (EU) No 2015/830 of 28 May 2015.

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

1.1. Product identifier

Product name	TBLS+
Chemical name	Pentalead tetroxide sulphate
REACH registration number	01-2119534590-43-0007
CAS number	12065-90-6
EC number	235-067-7

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

Identified uses	Uses considered in Exposure Scenarios (short summaries in Annex): 1 Lead Battery Production 2 Professional use of batteries 3 Consumer use of batteries
Uses advised against	No specific uses advised against are identified.

1.3. Details of the supplier of the safety data sheet

Supplier	PENOX GmbH Deutz Muelheimer Strasse 173 D-51063 Cologne Germany +49-221-67170 +49-221-6717 211 info@penox.de
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1.4. Emergency telephone number

Emergency telephone	+49 (0) 162 297 0072 +44 (0) 7810 805 350 +49 (0) 162 297 0071
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SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (EC 1272/2008)

Physical hazards	Not Classified
Health hazards	Acute Tox. 4 - H302 Acute Tox. 4 - H332 Carc. 2 - H351 Repr. 1A - H360Df Lact. - H362 STOT RE 1 - H372
Environmental hazards	Aquatic Acute 1 - H400 Aquatic Chronic 1 - H410

2.2. Label elements

TBLS+

EC number 235-067-7

Pictogram



Signal word Danger

Hazard statements

H302+H332 Harmful if swallowed or if inhaled.
 H351 Suspected of causing cancer.
 H360Df May damage the unborn child. Suspected of damaging fertility.
 H362 May cause harm to breast-fed children.
 H372 Causes damage to organs through prolonged or repeated exposure.
 H410 Very toxic to aquatic life with long lasting effects.

Precautionary statements

P263 Avoid contact during pregnancy/ while nursing.
 P273 Avoid release to the environment.
 P280 Wear protective clothing, gloves, eye and face protection.
 P308+P313 IF exposed or concerned: Get medical advice/ attention.
 P405 Store locked up.
 P501 Dispose of contents/containers to the officially prescribed waste facility out.

Supplementary precautionary statements

P202 Do not handle until all safety precautions have been read and understood.
 P260 Do not breathe dust.
 P264 Wash contaminated skin thoroughly after handling.
 P270 Do not eat, drink or smoke when using this product.
 P271 Use only outdoors or in a well-ventilated area.
 P301+P312 IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell.
 P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
 P330 Rinse mouth.
 P391 Collect spillage.

2.3. Other hazards

Post-natal exposure of children to inorganic lead compounds is associated with adverse effects on neurobehavioural development.

SECTION 3: Composition/information on ingredients

3.1. Substances

Product name	TBLS+
Chemical name	Pentalead tetroxide sulphate
REACH registration number	01-2119534590-43-0007
CAS number	12065-90-6
EC number	235-067-7
Composition comments	Pentalead tetraoxide sulphate >40-50%

SECTION 4: First aid measures

4.1. Description of first aid measures

General information	Get medical attention if any discomfort continues. Show this Safety Data Sheet to the medical personnel.
Inhalation	Move affected person to fresh air and keep warm and at rest in a position comfortable for breathing. Maintain an open airway. Get medical attention.

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Ingestion	Rinse mouth thoroughly with water. Get medical attention immediately.
Skin contact	Remove contaminated clothing. Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing.
Eye contact	Remove any contact lenses and open eyelids wide apart. Rinse with water. Continue to rinse for at least 15 minutes. Get medical attention if irritation persists after washing.
Protection of first aiders	First aid personnel should wear appropriate protective equipment during any rescue.

4.2. Most important symptoms and effects, both acute and delayed

General information	The severity of the symptoms described will vary dependent on the concentration and the length of exposure.
Inhalation	A single exposure may cause the following adverse effects: Headache. Exhaustion and weakness. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer.
Ingestion	May cause discomfort if swallowed. Stomach pain. Nausea, vomiting. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer. Anaemia.
Skin contact	Prolonged contact may cause dryness of the skin. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer.
Eye contact	No specific symptoms known. May be slightly irritating to eyes.

4.3. Indication of any immediate medical attention and special treatment needed

Notes for the doctor	Treat symptomatically. Symptoms of poisoning may occur after several hours; therefore medical observation for at least 48 hours after the accident is recommended. In case of ingestion, induced vomiting or application of laxatives may be appropriate; treat as for lead poisoning. There needs to be regular blood monitoring to confirm exposure controls are adequate.
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SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	Carbon dioxide (CO ₂). Powder. Water spray. Large fires: Alcohol-resistant foam. Use fire-extinguishing media suitable for the surrounding fire.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture

Specific hazards	The product is non-combustible.
Hazardous combustion products	Toxic gases or vapours.

5.3. Advice for firefighters

Special protective equipment for firefighters	Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing.
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SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions	Avoid generation and spreading of dust. Use suitable respiratory protection if ventilation is inadequate. For personal protection, see Section 8.
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6.2. Environmental precautions

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Environmental precautions Do not discharge into drains or watercourses or onto the ground. Inform the relevant authorities if environmental pollution occurs (sewers, waterways, soil or air).

6.3. Methods and material for containment and cleaning up

Methods for cleaning up Provide adequate ventilation. Collect and place in suitable waste disposal containers and seal securely. This material and its container must be disposed of as hazardous waste.

6.4. Reference to other sections

Reference to other sections For personal protection, see Section 8. See Section 11 for additional information on health hazards. See Section 12 for additional information on ecological hazards. For waste disposal, see Section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Usage precautions Provide adequate ventilation. Handle and open container with care. Use suitable respiratory protection if ventilation is inadequate. The product is not flammable.

7.2. Conditions for safe storage, including any incompatibilities

Storage precautions Keep container tightly sealed when not in use. Store in a dry place.

7.3. Specific end use(s)

Specific end use(s) For further information, see attached Exposure Scenario.

SECTION 8: Exposure Controls/personal protection

8.1. Control parameters

Occupational exposure limits

Long-term exposure limit (8-hour TWA): WEL 0.15 mg/m³

WEL = Workplace Exposure Limit

Biological limit values 60 µg/dL

DNEL - Worker - all relevant routes; Long term systemic effects: 10 µg/l

PNEC

- Workers - Fresh water; Long term 3.1 µg/l
- Workers - Marine water; Long term 3.5 µg/l
- Workers - Sediment (Freshwater); Long term 174.0 mg/kg
- Workers - Sediment (Marinewater); Long term 164.0 mg/kg
- Workers - Soil; Long term 212.0 mg/kg
- Workers - STP; Long term 0.1 mg/l

8.2. Exposure controls

Protective equipment



Eye/face protection Dust-resistant, chemical splash goggles.

Hand protection Wear protective gloves made of the following material: Neoprene. Leather.

Other skin and body protection Wear protective clothing. Change work clothing daily before leaving workplace. Contaminated work clothing should not be allowed out of the workplace.

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Hygiene measures	Good personal hygiene procedures should be implemented. Do not eat, drink or smoke when using this product. Wash after use and before eating, smoking and using the toilet. Care should be taken to avoid contact with contaminants when removing contaminated clothing. Take off contaminated clothing and wash it before reuse. Clean equipment and the work area every day.
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.
Respiratory protection	Respiratory protection complying with an approved standard should be worn if a risk assessment indicates inhalation of contaminants is possible. Wear a respirator fitted with the following cartridge: Particulate filter, type P2. Half mask and quarter mask respirators with replaceable filter cartridges should comply with European Standard EN140. Check that the respirator fits tightly and the filter is changed regularly.
Environmental exposure controls	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 compound 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	Powder.
Colour	Off-white.
Odour	Odourless.
Odour threshold	Not applicable.

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pH	pH (concentrated solution): 8.69
Melting point	> 600°C
Initial boiling point and range	> 600°C
Flash point	Not applicable.
Evaporation rate	Not applicable.
Evaporation factor	Not applicable.
Flammability (solid, gas)	The product is non-combustible.
Upper/lower flammability or explosive limits	The product is non-combustible.
Vapour pressure	Not determined.
Vapour density	Not applicable.
Relative density	7.15
Solubility(ies)	32.7 mg/l water @ 20°C Soluble in the following materials: 0.07M Hydrochloric acid.
Partition coefficient	Not applicable.
Auto-ignition temperature	The product is non-combustible.
Decomposition Temperature	> 600°C
Viscosity	Not applicable.
Explosive properties	Not considered to be explosive.
Oxidising properties	Does not meet the criteria for classification as oxidising.

9.2. Other information

Particle size	5 - 2000 µm
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SECTION 10: Stability and reactivity**10.1. Reactivity**

Reactivity	There are no known reactivity hazards associated with this product.
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10.2. Chemical stability

Stability	Stable at normal ambient temperatures and when used as recommended.
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10.3. Possibility of hazardous reactions

Possibility of hazardous reactions	Under normal conditions of storage and use, no hazardous reactions will occur.
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10.4. Conditions to avoid

Conditions to avoid	Avoid excessive heat for prolonged periods of time.
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10.5. Incompatible materials

Materials to avoid	Strong oxidising agents.
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10.6. Hazardous decomposition products

Hazardous decomposition products	Does not decompose when used and stored as recommended.
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SECTION 11: Toxicological information

TBLS+

11.1. Information on toxicological effects

Toxicological effects	The toxicity of this substance has been assessed using read-across from studies with similar inorganic lead compounds.
<u>Acute toxicity - oral</u>	
Notes (oral LD₅₀)	LD ₅₀ > 2000 mg/kg, Oral, Rat REACH dossier information.
ATE oral (mg/kg)	500.0
<u>Acute toxicity - dermal</u>	
Notes (dermal LD₅₀)	LD ₅₀ > 2000 mg/kg, Dermal, Rat REACH dossier information.
<u>Acute toxicity - inhalation</u>	
Notes (inhalation LC₅₀)	LD ₅₀ > 5 mg/l, Inhalation, Rat REACH dossier information. Sparingly soluble inorganic lead compounds have generally been found to be of relatively low acute toxicity by ingestion, in contact with skin, and by inhalation. Nevertheless current EU regulations require this substance to be classified as harmful by ingestion and inhalation.
ATE inhalation (dusts/mists mg/l)	1.5
<u>Skin corrosion/irritation</u>	
Skin corrosion/irritation	Not irritating.
Animal data	Dose: 0.5g, 4 hours, Rabbit REACH dossier information. Based on available data the classification criteria are not met.
<u>Serious eye damage/irritation</u>	
Serious eye damage/irritation	Dose: 0.1g, 72 hours, Rabbit REACH dossier information. Based on available data the classification criteria are not met.
<u>Respiratory sensitisation</u>	
Respiratory sensitisation	There is no evidence that the product can cause respiratory hypersensitivity.
<u>Skin sensitisation</u>	
Skin sensitisation	Guinea pig maximization test (GPMT) - Guinea pig: Not sensitising. REACH dossier information. Epidemiological studies have shown no evidence of skin sensitisation.
<u>Germ cell mutagenicity</u>	
Genotoxicity - in vitro	Inconclusive data. 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.
<u>Carcinogenicity</u>	
Carcinogenicity	There is evidence that highly soluble inorganic lead compounds may have a carcinogenic effect, particularly on the kidneys of rats. However, the mechanisms by which this effect occurs are still unclear. Epidemiology studies of workers exposed to inorganic lead compounds have found a limited association with stomach cancer. This has led to the classification by IARC that inorganic lead compounds are probably carcinogenic to humans (Group 2A).
IARC carcinogenicity	IARC Group 2A Probably carcinogenic to humans.
<u>Reproductive toxicity</u>	
Reproductive toxicity - fertility	Suspected of damaging fertility.
Reproductive toxicity - development	Suspected of damaging the unborn child. Post-natal exposure of children to inorganic lead compounds is associated with adverse effects on neurobehavioural development.

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Specific target organ toxicity - single exposure

STOT - single exposure Not classified as a specific target organ toxicant after a single exposure.

Specific target organ toxicity - repeated exposure

STOT - repeated exposure Lead is absorbed into the body through inhalation of spray/mist or by ingestion. Lead is accumulated in the body and may cause damage to the brain and nervous system after prolonged exposure.

Target organs Blood system Kidneys Reproductive organs Central nervous system

Aspiration hazard

Aspiration hazard Solid. Not relevant.

Toxicokinetics

Inorganic lead compounds are slowly absorbed by ingestion and inhalation and poorly absorbed through the skin. If absorbed, lead will accumulate in the body with low rates of excretion, leading to long-term build up. Part of risk management is to take blood samples from workers for analysis to ensure that exposure levels are acceptable.

General information

The severity of the symptoms described will vary dependent on the concentration and the length of exposure.

Inhalation

A single exposure may cause the following adverse effects: Headache. Exhaustion and weakness. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer.

Ingestion

May cause discomfort if swallowed. Stomach pain. Nausea, vomiting. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer. Anaemia.

Skin contact

Prolonged contact may cause dryness of the skin. Prolonged or repeated exposure may cause the following adverse effects: Suspected of causing cancer.

Eye contact

No specific symptoms known. May be slightly irritating to eyes.

Route of entry

Ingestion Inhalation Skin and/or eye contact

Target organs

Blood system Central nervous system Kidneys Reproductive organs

SECTION 12: Ecological Information

Ecotoxicity

The following acute Ecotoxicity Reference Values (ERVs) were used to determine the classification of Pentalead tetraoxide sulphate. pH6, ERV (Ecotoxicity Reference Value) 424.8 µg/l pH7, ERV (Ecotoxicity Reference Value) 218.2 µg/l pH8, ERV (Ecotoxicity Reference Value) 118.3 µg/l The following chronic Ecotoxicity Reference Values (ERVs) were used to determine the classification of Pentalead tetraoxide sulphate. pH6, ERV (Ecotoxicity Reference Value) 102.7 µg/l pH7, ERV (Ecotoxicity Reference Value) 51.9 µg/l pH8, ERV (Ecotoxicity Reference Value) 35.2 µg/l

12.1. Toxicity

Acute aquatic toxicity

LE(C)₅₀ 0.01 < L(E)C₅₀ ≤ 0.1

M factor (Acute) 10

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Acute toxicity - fish	pH 5.5 - 6.5
	LC ₅₀ , 96 hours: 0.04 - 0.81 mg/l, Pimephales promelas (Fat-head Minnow), Onchorhynchus mykiss (Rainbow trout)
	pH >6.5 - 7.5
	LC ₅₀ , 96 hours: 0.052 - 3.598 mg/l, Pimephales promelas (Fat-head Minnow), Onchorhynchus mykiss (Rainbow trout)
	pH >7.5 - 8.5
	LC ₅₀ , 96 hours: 0.113 - 3.249 mg/l, Pimephales promelas (Fat-head Minnow), Onchorhynchus mykiss (Rainbow trout)
Acute toxicity - aquatic invertebrates	pH 5.5 - 6.5
	LC ₅₀ , 48 hours: 0.073 - 0.655 mg/l, Daphnia magna, Ceriodaphnia dubia
	pH >6.5 - 7.5
	LC ₅₀ , 48 hours: 0.028 - 1.179 mg/l, Daphnia magna, Ceriodaphnia dubia
	pH >7.5 - 8.5
	LC ₅₀ , 48 hours: 0.026 - 3.115 mg/l, Daphnia magna, Ceriodaphnia dubia
Acute toxicity - aquatic plants	pH 5.5 - 6.5
	ErC ₅₀ , 72 hours: 0.072 - 0.388 mg/l, Pseudokirchneriella subcapitata, Chlorella kesslerii
	pH >6.5 - 7.5
	ErC ₅₀ , 72 hours: 0.026 - 0.079 mg/l, Pseudokirchneriella subcapitata, Chlorella kesslerii
	pH >7.5 - 8.5
	ErC ₅₀ , 72 hours: 0.020 - 0.049 mg/l, Pseudokirchneriella subcapitata, Chlorella kesslerii
Acute toxicity - microorganisms	EC ₁₀ , NOEC, Respiration: 1.06 - 2.92 mg/l, Bacteria
	EC ₁₀ , NOEC, Ammonia uptake rate: 2.79 - 9.59 mg/l, Bacteria
	EC ₁₀ , NOEC, Mortality: 1.0 - 7.0 mg/l, Protozoan
Chronic aquatic toxicity	
NOEC	0.01 < NOEC ≤ 0.1
Degradability	Non-rapidly degradable
M factor (Chronic)	1
Chronic toxicity - fish early life stage	Freshwater fish
	EC ₁₀ , NOEC: 0.0178 - 1.558 mg/l, Onchorhynchus mykiss (Rainbow trout), Salmo salar, Pimephales promelas (Fat-head Minnow), Salvelinus fontinalis, Ictalurus punctatus, Lepomis macrochirus (Bluegill), Salvelinus namaycush, Cyprinus carpio (Common carp), Acipenser sinensis
	Marinewater fish
	EC ₁₀ , NOEC: 0.229 - 0.437 mg/l, Cyprinodon variegatus (Sheepshead minnow)
Chronic toxicity - aquatic invertebrates	Freshwater invertebrates
	EC ₁₀ , NOEC: 0.0017 - 0.963 mg/l, Hyalella azteca, Lymnaea palustris, Ceriodaphnia dubia, Lymnaea stagnalis, Philodina rapida, Daphnia magna, Alona rectangular, Diaphanosoma birgei, Chironomus tentans, Brachionus calyciflorus, Chironomus riparius, Baetis tricaudatus
	Marinewater invertebrates
	EC ₁₀ , NOEC: 0.0092 - 1.409 mg/l, Mytilus trossolus, Americamysis bahia, Mytilus galloprovincialis, Neanthes arenaceodentata, Strongylocentrotus purpuratus, Paracentrotus lividus, Dendraster excentricus, Tisbe battagliai, Crassostrea gigas
	Sediment (Freshwater)
	EC ₁₀ , NOEC: 573 - 3,390 mg/kg, Tubifex tubifex, Ephoron virgo, Hyalella azteca, Gammarus pulex, Lumbriculus variegatus, Hexagenia limbata, Chironomus tentans
	Sediment (Marinewater)
	EC ₁₀ , NOEC: 680 - 1,291 mg/kg, Neanthes arenaceodentata, Leptocheirus plumulosus

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Chronic toxicity - aquatic plants	Freshwater plants EC ₁₀ , NOEC: 0.0061 - 0.190 mg/l, <i>Pseudokirchneriella subcapitata</i> , <i>Chlorella kesslerii</i> , <i>Chlamydomonas reinhardtii</i> EC ₁₀ , NOEC: 0.085 - 1.025 mg/l, <i>Lemna minor</i> Marinewater plants EC ₁₀ , NOEC: 0.0529 - 1.234 mg/l, <i>Skeletonema costatum</i> , <i>Phaeodactylum tricornutum</i> , <i>Dunaliella tertiolecta</i> EC ₁₀ , NOEC: 0.0119 mg/l, <i>Champia parvula</i>
Chronic toxicity - micro-organisms	EC ₁₀ , NOEC: 97.0 - 7,880.0 mg/kg, denitrification, N-mineralization, nitrification, basal respiration, substrate-induced respiration
Toxicity to terrestrial invertebrates	EC ₁₀ , NOEC: 34.0 - 2,445.0 mg/kg, <i>Folsomia candida</i> , <i>Proisotoma minuta</i> , <i>Sinella curviseta</i> , <i>Eisenia fetida</i> , <i>Eisenia andrei</i> , <i>Dendrobaena rubida</i> , <i>Lumbricus rubellus</i> , <i>Aporrectodea caliginosa</i>
Toxicity to terrestrial plants	EC ₁₀ , NOEC: 57.0 - 6,774.0 mg/kg, <i>Hordeum vulgare</i> , <i>Zea mays</i> , <i>Echinochloa crus-galli</i> , <i>Lolium perenne</i> , <i>Sorghum bicolor</i> , <i>Triticum aestivum</i> , <i>Oryza sativa</i> , <i>Avena sativa</i> (oat), <i>Raphanus sativus</i> , <i>Lycopersicon esculentum</i> , <i>Lactuca sativa</i> , <i>Cucumis sativus</i> , <i>Picea rubens</i> , <i>Pinus taeda</i>

12.2. Persistence and degradability

Persistence and degradability	Lead is naturally occurring and ubiquitous in the environment. Lead is obviously persistent in the sense that they do 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 remobilization of lead from sediment is expected.
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12.3. Bioaccumulative potential

Bioaccumulative potential	BAF: 1,552 L/kg, Algae BAF: 0.10 kg/kg, Soil Bioaccumulation is unlikely.
Partition coefficient	Not applicable.

12.4. Mobility in soil

Mobility	Slightly soluble in water.
Adsorption/desorption coefficient	log K _d 5.2 Freshwater sediment log K _d 5.7 Marine sediment log K _d 3.8 Soil

12.5. Results of PBT and vPvB assessment

Results of PBT and vPvB assessment	Substance is inorganic. Not applicable.
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12.6. Other adverse effects

Other adverse effects	No information required.
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SECTION 13: Disposal considerations

13.1. Waste treatment methods

General information	Dispose of waste product or used containers in accordance with local regulations
Waste class	ES1 - ES3: 02 01 10*, 06 03 15*, 06 04 05*, 06 05 02*, 10 04 01*, 10 04 02*, 10 04 04*, 10 04 05*, 10 04 06*, 10 04 07*, 10 04 99, 10 05 99, 10 10 10, 10 10 11*, 12 01 03*, 15 01 04*, 15 01 10*, 15 02 02*, 16 01 04*, 16 01 06*, 16 01 19, 16 06 01*, 16 06 02*, 16 08 02*, 16 08 03*, 16 11 03*, 17 04 03, 17 04 07*, 17 04 09*, 17 09 04*, 19 01 11*, 19 02 05*, 19 08 11*, 19 08 13*, 19 08 14, 19 10 02*, 19 12 03*, 19 12 11* ES4 - ES8: 20 01 34, 20 01 40, 20 03 01, 20 03 07

SECTION 14: Transport information

TBLS+**14.1. UN number**

UN No. (ADR/RID)	3287
UN No. (IMDG)	3287
UN No. (ICAO)	3287
UN No. (ADN)	3287

14.2. UN proper shipping name

Proper shipping name (ADR/RID)	TOXIC LIQUID, INORGANIC, N.O.S. (Pentalead tetraoxide sulphate)
Proper shipping name (IMDG)	TOXIC LIQUID, INORGANIC, N.O.S. (Pentalead tetraoxide sulphate)
Proper shipping name (ICAO)	TOXIC LIQUID, INORGANIC, N.O.S. (Pentalead tetraoxide sulphate)
Proper shipping name (ADN)	TOXIC LIQUID, INORGANIC, N.O.S. (Pentalead tetraoxide sulphate)

14.3. Transport hazard class(es)

ADR/RID class	6.1
ADR/RID classification code	T4
ADR/RID label	6.1
IMDG class	6.1
ICAO class/division	6.1
ADN class	6.1

Transport labels**14.4. Packing group**

ADR/RID packing group	III
IMDG packing group	III
ICAO packing group	III
ADN packing group	III

14.5. Environmental hazards

Environmentally hazardous substance/marine pollutant

**14.6. Special precautions for user**

IMDG Code segregation group	7. Heavy metals and their salts, 9. Lead and its compounds
EmS	F-A, S-A
ADR transport category	2
Emergency Action Code	2X

TBLS+

Hazard Identification Number 60
(ADR/RID)

Tunnel restriction code (E)

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

Transport in bulk according to Not applicable.

**Annex II of MARPOL 73/78
and the IBC Code**

SECTION 15: Regulatory information

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

National regulations	Health and Safety at Work etc. Act 1974 (as amended). The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (SI 2009 No. 1348) (as amended) ["CDG 2009"]. EH40/2005 Workplace exposure limits.
EU legislation	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended). Commission Regulation (EU) No 453/2010 of 20 May 2010. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (as amended).

15.2. Chemical safety assessment

A chemical safety assessment has been carried out.

SECTION 16: Other information

Abbreviations and acronyms used in the safety data sheet	CAS: Chemical Abstracts Service. ATE: Acute Toxicity Estimate. DMEL: Derived Minimal Effect Level. IBC: International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code). LC ₅₀ : Lethal Concentration to 50 % of a test population. LD ₅₀ : Lethal Dose to 50% of a test population (Median Lethal Dose). MARPOL 73/78: 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. PBT: Persistent, Bioaccumulative and Toxic substance. PNEC: Predicted No Effect Concentration. REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006. vPvB: Very Persistent and Very Bioaccumulative.
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TBLS+**Key literature references and sources for data**

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Revision comments

This is first issue.

Revision date

13/05/2016

Revision

0

SDS number

4366

TBLS+

Hazard statements in full

H302 Harmful if swallowed.

H332 Harmful if inhaled.

H351 Suspected of causing cancer.

H360Df May damage the unborn child. Suspected of damaging fertility.

H362 May cause harm to breast-fed children.

H372 Causes damage to organs through prolonged or repeated exposure.

H400 Very toxic to aquatic life.

H410 Very toxic to aquatic life with long lasting effects.

Exposure scenario

Lead Battery Production

According to Regulation (EC) No 1907/2006, Annex II, as amended. Commission Regulation (EU) No 2015/830 of 28 May 2015.

Identification

Product name	Pentalead tetraoxide sulphate
REACH registration number	01-2119534590-43-0007
CAS number	12065-90-6
EC number	235-067-7
Es reference	ES 1

1. Title of exposure scenario

Main title	Lead Battery Production
Process scope	Plate manufacturing: Casting/production of grids, oxide production, mixing, pasting, and curing operations. Plate treatment: Jar/tank formation, plate washing, drying, cutting. Assembly: Stacking, assembly, welding and joining operations. Battery formation: Acid filling, formation (wet batteries), finishing. Internal logistics: storage (raw materials, finished goods) and shipment of finished goods. Cleaning and maintenance.
Product category	PC0 Other products.
Sector of use	SU0 Other SU16 Manufacture of computer, electronic and optical products, electrical equipment SU17 General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment
Environment	
Environmental release category	ERC1 Manufacture of substances. ERC6a Industrial use resulting in manufacture of another substance (use of intermediates). ERC7 Industrial use of substances in closed systems.
Worker	
Process category	PROC0 Other process or activity. PROC3 Use in closed batch process (synthesis or formulation). PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises. PROC21 Low energy manipulation of substances bound in materials and/or articles PROC22 Potentially closed processing operations with minerals/metals at elevated temperature; industrial setting PROC23 Open processing and transfer operations with minerals/metals at elevated temperature PROC25 Other hot work operations with metals PROC26 Handling of solid inorganic substances at ambient temperature

2. Conditions of use affecting exposure (Industrial - Environment 1)

Control of environmental exposure

Environmental release category	ERC1 Manufacture of substances. ERC6a Industrial use resulting in manufacture of another substance (use of intermediates). ERC7 Industrial use of substances in closed systems.
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Product characteristics

Lead Battery Production

Physical state Solid

Amounts used

Annual amount per site: 10,676 tonnes

Frequency and duration of use

Continuous use/release.

Emission days: <315 days/year

Other given operational conditions affecting environmental exposure

Not applicable.

Environmental factors not influenced by risk management measures

Dilution Local freshwater dilution factor: 10
Local marine water dilution factor: 100

Risk management measures

Good practice See Chapter 8 of the Safety Data Sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges to air, water and soil

Air Release fraction to air from process (initial release prior to RMM): 0.03% (Estimated)

Water Release fraction to wastewater from process (initial release prior to RMM): 2.2E-5% (Estimated)

See Chapter 8 of the safety data sheet.

Conditions and measures related to external treatment of waste for disposal

Disposal method This material and its container must be disposed of as hazardous waste. Hazardous waste incineration. Landfill. Prevent environmental discharge consistent with regulatory requirements.

Fraction of daily/annual use expected in waste: primary producers = 0.22% secondary producers = 0.73% compound producers = 0.02% battery manufacturers = 1.25E-8% lead sheet manufacturers = 0.19%

2. Conditions of use affecting exposure (Workers - Health 1)

Control of workers exposure

Process category PROC0 Other process or activity.
PROC3 Use in closed batch process (synthesis or formulation).
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises.
PROC21 Low energy manipulation of substances bound in materials and/or articles
PROC22 Potentially closed processing operations with minerals/metals at elevated temperature; industrial setting
PROC23 Open processing and transfer operations with minerals/metals at elevated temperature
PROC25 Other hot work operations with metals
PROC26 Handling of solid inorganic substances at ambient temperature

Product characteristics

Physical state Solid

Amounts used

Not restricted

Lead Battery Production

Frequency and duration of use

Covers daily exposures up to 8 hours (unless stated differently).

Human factors not influenced by risk management

See Chapter 8 of the safety data sheet.

Other given operational conditions affecting workers exposure

Setting Indoor.

Room size Covers use in room size of >1000 m³.

Technical conditions and measures at process level (source) to prevent release

Technical protective measures Closed system required for oxide production and enclosed spaces for curing operations. Minimise exposure by extracted full enclosure for the operation or equipment. With local exhaust ventilation Pass waste air through cleaning equipment. Ensure that the worker is in a separated (control) room with independent air supply Removal efficiency (total): <78%

Organisational measures to prevent/limit releases, dispersion and exposure

Organisational measures See Chapter 8 of the safety data sheet.

Risk management measures

If ventilation is inadequate, suitable respiratory protection must be worn.
Filtering half-face mask (DIN EN 149)
with filter for particulates: FFP2.

3. Exposure estimation (Environment 1)

Environmental release category ERC1 Manufacture of substances.
ERC6a Industrial use resulting in manufacture of another substance (use of intermediates).
ERC7 Industrial use of substances in closed systems.

Environmental exposure Fresh water:
Exposure 0.84 µg/l, PNEC 3.1 µg/l, RCR 0.27
Marine water:
Exposure 0.051 µg/l, PNEC 3.5 µg/l, RCR 0.015
Freshwater sediment:
Exposure 167.80 mg/kg, PNEC 174 mg/kg, RCR 0.96
Marine sediment:
Exposure 61.15 mg/kg, PNEC 164.2 mg/kg, RCR 0.37
Soil:
Exposure 29.50 mg/kg, PNEC 212 mg/kg, RCR 0.14
STP:
Exposure 13 µg/l, PNEC 100 µg/l, RCR 0.13

4. Guidance to check compliance with the exposure scenario (Environment 1)

Further information on the assumptions contained in this Exposure Scenario can be found at: <http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool> Guidance is based on assumed operating conditions which may not be applicable to all sites, thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e. RCRs > 1), additional RMM or a site-specific chemical safety assessment is required. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

3. Exposure estimation (Health 1)

Lead Battery Production

Process category

PROC0 Other process or activity.
PROC3 Use in closed batch process (synthesis or formulation).
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises.
PROC21 Low energy manipulation of substances bound in materials and/or articles
PROC22 Potentially closed processing operations with minerals/metals at elevated temperature; industrial setting
PROC23 Open processing and transfer operations with minerals/metals at elevated temperature
PROC25 Other hot work operations with metals
PROC26 Handling of solid inorganic substances at ambient temperature

Exposure

Worker - all relevant routes:
Exposure 37.1 µg/l, DNEL 40 µg/l, RCR 0.93

4. Guidance to check compliance with the exposure scenario (Health 1)

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Guidance is based on assumed operating conditions which may not be applicable to all sites, thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e. RCRs > 1), additional RMM or a site-specific chemical safety assessment is required. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Exposure scenario

Professional use of batteries

According to Regulation (EC) No 1907/2006, Annex II, as amended. Commission Regulation (EU) No 2015/830 of 28 May 2015.

Identification

Product name	Pentalead tetraoxide sulphate
REACH registration number	01-2119534590-43-0007
CAS number	12065-90-6
EC number	235-067-7
Es reference	ES 2

1. Title of exposure scenario

Main title	Professional use of batteries
Process scope	Installation of sealed lead acid batteries into electrical equipment requiring an electrochemical power source.
Product category	PC0 Other products.
Sector of use	SU16 Manufacture of computer, electronic and optical products, electrical equipment SU17 General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment
<u>Worker</u>	
Process category	PROC0 Other process or activity.

2. Conditions of use affecting exposure (Industrial - Environment 1)

Control of environmental exposure

No risk management measures related to the environment are taken, as this ES does not include intended release to the environment.

Product characteristics

Physical state	Solid
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Conditions and measures related to external treatment of waste for disposal

Disposal method	Labelling specifies that sealed lead acid batteries are to be delivered to appropriate collection facilities for recycling. Incineration or landfill should only be considered when recycling is not feasible. Fraction of daily/annual use expected in waste: 25% of all articles 75% of the lead used is recycled.
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2. Conditions of use affecting exposure (Workers - Health 1)

Control of workers exposure

Process category	PROC0 Other process or activity.
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Product characteristics

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Amounts used

Professional use of batteries

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Frequency and duration of use

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Human factors not influenced by risk management

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Other given operational conditions affecting workers exposure

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Technical conditions and measures at process level (source) to prevent release

Technical protective measures Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Organisational measures to prevent/limit releases, dispersion and exposure

Organisational measures Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Risk management measures

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

3. Exposure estimation (Environment 1)

Environmental exposure Not applicable.

3. Exposure estimation (Health 1)

Process category PROC0 Other process or activity.

Exposure Not applicable.

4. Guidance to check compliance with the exposure scenario (Health 1)

Guidance is based on assumed operating conditions which may not be applicable to all sites, thus, scaling may be necessary to define appropriate site-specific risk management measures. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Exposure scenario

Consumer use of batteries

According to Regulation (EC) No 1907/2006, Annex II, as amended. Commission Regulation (EU) No 2015/830 of 28 May 2015.

Identification

Product name	Pentalead tetraoxide sulphate
REACH registration number	01-2119534590-43-0007
CAS number	12065-90-6
EC number	235-067-7
Es reference	ES 3

1. Title of exposure scenario

Main title	Consumer use of batteries
Process scope	Batteries and electrical accumulators based upon lead acid electrochemistry are used in a variety of circumstances where portable or standby (emergency) power is required. Battery size varies as a function of power demand – portable devices will contain small batteries, larger batteries will be found in semi-portable devices (e.g. Uninterruptible power supplies) and large batteries, or banks of batteries will be employed for emergency power supply to buildings or other large facilities. No environmental release of battery constituents is associated with normal service life.
Product category	PC0 Other products.

2. Conditions of use affecting exposure (Industrial - Environment 1)

Control of environmental exposure

No risk management measures related to the environment are taken, as this ES does not include intended release to the environment.

Conditions and measures related to external treatment of waste for disposal

Disposal method	Labelling specifies that sealed lead acid batteries are to be delivered to appropriate collection facilities for recycling. Incineration or landfill should only be considered when recycling is not feasible. Fraction of daily/annual use expected in waste: 25% of all articles 75% of the lead used is recycled.
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2. Conditions of use affecting exposure (Workers - Health 1)

Product characteristics

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Amounts used

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for exposure.

Frequency and duration of use

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for release.

Consumer use of batteries

Human factors not influenced by risk management

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for release.

Other given operational conditions affecting workers exposure

Not applicable since substances of concern and reaction products are handled in a closed system with no opportunities for release.

Technical conditions and measures at process level (source) to prevent release

Technical protective measures Article design limits consumer contact with batteries, often to eliminate possibilities of electrical discharge and shock.

Organisational measures to prevent/limit releases, dispersion and exposure

Organisational measures Labelling to require battery removal and return to appropriate collection or recycling centres at the end of either the service life of the battery or the article containing the battery.

Risk management measures

Not applicable for most consumers.
During occasional maintenance activity of products containing lead-acid batteries, gloves may be worn for hygienic or thermal protection purposes.
Wash hands thoroughly after handling.

3. Exposure estimation (Environment 1)

Environmental exposure Not applicable.

3. Exposure estimation (Health 1)

Exposure Not applicable.

4. Guidance to check compliance with the exposure scenario (Health 1)

Guidance is based on assumed operating conditions which may not be applicable to all sites, thus, scaling may be necessary to define appropriate site-specific risk management measures. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.