SAFETY DATA SHEET

ZINC PHOSPHATE PZ20/PZW2

SDS According to the REACH regulation 1907/2006/EC and CLP (GHS) regulation 1272/2008/EC.

1. IDENTIFICATION OF SUBSTANCE AND OF THE COMPANY

Trade name / Substance Name : **ZINC PHOSPHATE PZ20/PZW2**
(IUPAC : trizinc bis(orthophosphate))

REACH Registration number: 01-2119485044-40-0001

Type of use: anticorrosive pigment for: paints and inks (solid corrosive inhibitor), plants nutrient (fertilizer) (see section 16 and e-SDS).

Manufacturer : **SOCIETE NOUVELLE DES COULEURS ZINCIQUES**

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24-hour emergency number (USA) : 800 424 9300 (**CHEMTREC - USA**).
24-hour international emergency number : + 1 703 527 3887 (**CHEMTREC - USA**).

2. HAZARD IDENTIFICATION

☐**Classification of the product:**: ZINC PHOSPHATE is a classified substance (Listed Annex VI regulation CLP 1272/2008/EC) H400 very toxic to aquatic life Acute Category 1, H410 very toxic to aquatic life Chronic Category 1

∇**Labelling according to Regulation 1272/2008/EC [CLP/GHS]**

Hazard pictogram:

Signal word: **WARNING**
Hazard statements: **H410** Very toxic to aquatic life with long lasting effects

Precautionary statements:

Prevention:	**P273**	Avoid release to the environment
Response:	**P391**	Collect spillage
Disposal:	**P501**	Dispose of contents/ containers to be collected by a licensed contractor in accordance with national and local regulations.

∇**Environmental Risks**: The zinc phosphate substance is classified as very toxic to aquatic life Acute Category 1 and Chronic Category 1: Very toxic to aquatic life with long lasting effects. It is highly recommended not to allow this substance to enter the Environment.

☐**Other hazards:** none, PBT or vPvB non applicable (inorganic substance).

3. COMPOSITION/DATA ON COMPONENTS

Chemical composition: Mono constituent substance, Trizinc bis(orthophosphate) hydrate
$Zn_3(PO_4)_2$, x H_2O $2 \leq x \leq 4$ (tetrahydrated = PZ20, dihydrated = PZW2)

Pigment: White 32 - **Colour Index:** 77964

REACH Registration number: 01-2119485044-40-0001

Hazardous components or impurities: regulations 1272/2008/EC, 830/2015 UE

CAS N°	Annex VI Index N°	EINECS N°	Name	%	Symbol	Phrases
Substance						
7779-90-0	030-011-00-6	231-944-3	$Zn_3(PO_4)_2$, x H_2O	>97	GHS09 ☐WARNING	H400 H410
Impurity						
1314-13-2	030-013-00-7	215-222-5	ZnO	[0-3]	GHS09 (1) ☐WARNING	H400 H410

4. FIRST AID AND MEASURES

Description of first aid measures: Get immediately medical attention.

Specific measure: no specific requirements.

After inhaling: remove from exposure area to fresh air. Seek medical attention.

After skin contact: wash with mild soap and water until no evidence of substance remains.

After eyes contact: immediately flush eyes with water for at least 15 min, until no evidence of chemical remains. Seek medical attention if necessary.

After ingestion: Rinse mouth with water. Immediately get medical attention. Treat symptomatically and supportively. This substance may induce intestinal troubles.

Most important symptoms and effects, both acute and delayed: No further relevant information available.

Indication of any immediate medical attention and special treatment needed: No further relevant information available.

5. FIRE FIGHTING MEASURES

Suitable extinguishing media: no restriction for neighbouring fire.

Special hazards arising from the substance or mixture: not flammable substance, this substance is very toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment. Do not let this substance and its solutions contaminate the environment.

Advice for firefighters

Special personal protection equipment: wear appropriate protective equipment and an appropriate air respirator.

5. FIRE FIGHTING MEASURES (continued)

Conduct of firefighting: no specific requirement (not flammable fire retardant). Avoid creating dust under nuisance dust permitted limits. In case of fire, do not spill zinc phosphate, residues may contaminate the environment and have to be collected and stocked in special containers. Contaminated wastes have to be collected by a licensed contractor. Dike and contain fire-control water for later disposal. Do not let contaminated water contaminate the environment.

Additional information: contaminated residues/wastes must be collected by a licensed contractor for treatment or disposal.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: If dusting (upper permitted limits), dust mask with a high-efficiency particulate filter (FFP2 minimum) and with a full face-piece.

Environmental precautions: Do not sweep or wash in public stretches of water or unknown discharge, in respect with local regulations. To prevent dispersion on the floor and later in the environment, it is highly recommended to forbid walking on the product spillage. Do not discharge contaminated water in public sewage.

Methods and material for containment and cleaning up

Spill and leak procedure: Avoid/minimise residues and waste production according to local regulations. Use wet clean up technique to avoid dusting. Keep covered material in watertight and closed containers. Suck up avoiding dust (vacuum or wet device). Eliminate residues according to local regulations (dangerous waste).

Soil: Remove containers from spill area. In large spills, rescue must be in the same direction as the wind and prohibit the formation of dust clouds. Collect spills on the floor, eliminate waste according with national regulations.

Water: Not contaminate the environment. Seal the manhole sewer, prohibit access to water contaminated with this product in water systems and contain the water in area water resistant to removal by an authorized company

7. HANDLING AND STORAGE

Precautions for safe handling:

EC:

Handling : Avoid dust breathing and walking in the fallout of the product on the ground. Keep away from food stuff. Use adequate exhaust ventilation to maintain nuisance dust below permitted limits. Do not discharge contaminated water in public sewage.

Protection against fire and explosion : the product is non-flammable.

Conditions for safe storage, including any incompatibilities:

Storage conditions: store under clean, dry conditions at room temperature. Keep containers tightly sealed.

Material/Chemical incompatibility: none. However, it is recommended to store this substance away from acids and ammonia (solubility in these solvents). Storage class (VCI, Germany): 13. Seveso II Directive applies if a total sum of 200 tons environmentally dangerous substances and preparations in production and storage is exceeded.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

PROFESSIONAL EXPOSURE CONTROL

EXPOSURE LIMIT VALUE (Occupational Exposure Limits) :

Engineering controls: no specific exposure limits established for substance (OSHA, ACGIH, NIOSH). Cf §7.

Parameters of exposure controls: Total dust

Designation	Type of Data	Unit
Total dust	ACGIH-91/93	
(no special effect)	TLV: TWA (USA)	10 mg/m^3
	MAK (Germany)	6 mg/m^3 Valid as per (mm/yy) : 05 / 95
	VME France 8H	10 mg/m^3
	VME France 8H	5 mg/m^3 respirable dust

Parameters of exposure controls : ZnO – group : slightly soluble Zn compounds
(as ZnO – $Zn(OH)_2$ – $Zn_3(PO_4)_2$ – $ZnCO_3$ – Zn metal - ZnS

Designation	Type of Data	Unit
ZnO	ACGIH-91/93 USA	10 mg/m^3
	OSHA (1989)(legal limit values)	5 mg/m^3 respirable dust
	DFG (1997) (Germany)	6 mg/m^3
	Arbejdstilsynet (1992) Denmark	10 mg/m^3
	VME France	10 mg/m^3
	SZW (1997) Netherland	5 mg/m^3 fumes
	HSE (1998) UK	10 mg/m^3
	NBOSHS (1993) Suede	5 mg/m^3 fumes

OCCUPATIONAL EXPOSURE MANAGEMENT:

Zn Risk management minimizing, needs an 8 hours time weighted average exposure below the DNEL in occupational workplaces. In order to perform a real exposure on workplace, it is recommended to:

- Keep under control Zn nuisance dust exposure,
- Determine the accurate working time per shift,
- Choose appropriate Personal protective equipment (Respiratory Protective device…) with accurate safety factor.

After calculation, Risk Characterisation Ratio (RCR) must be below than 1 for safe operating conditions. For more information see extended safety data sheet.

The DNELs for inhalation derived under REACH for both groups are: (Inhalable fraction – Workers)

- $DNEL_{inhal\ soluble\ Zn\ (worker)}$ = 1 mg Zn/m^3;
- $DNEL_{inhal\ insoluble\ Zn\ (worker)}$ = 5 mg Zn/m^3;

8. EXPOSURE CONTROLS/PERSONAL PROTECTION (continued)

PERSONAL PROTECTIVE EQUIPMENT

The GES for trizinc bis(orthophosphate) production mentions the following in this respect:

- Wearing of gloves and protective clothing is compulsory (efficiency >=90%).
- With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:
  - -dust filter-half mask P1 (efficiency 75%)
  - -dust filter-half mask P2 (efficiency 90%)
  - -dust filter-half mask P3 (efficiency 95%)
  - -dust filter-full mask P1 (efficiency 75%)
  - -dust filter-full mask P2 (efficiency 90 %)
  - -dust filter-full mask P3 (efficiency 97.5%)
- Eyes: safety glasses are optional
- Information-training of the workers and their staff and line managers focused on careful hygiene behaviour.

Respiratory protection: adapted dust mask while handling the powder (for example FFP2). If possible, use a full face piece mask (upper permitted limits) when dust occurs.

Hand protection: use gloves during handling.

Eye protection: safety goggles with side shields (for example EN166).

Skin protection: Wear appropriate clothing to avoid any contact with skin.

Clothing: Employee must wear appropriate protective (impervious) clothing and equipment to prevent from any possibility of skin contact with this substance,

Other protective equipment/recommendations: observe good personal hygiene. Keep away from food stuff, drinks on the site. Wear appropriate working clothing.

ENVIRONMENT PROTECTIVE MEASURES

Avoid any dust generation. No data are available as to the Environment exposure. However, emissions have to conform to the authorised limits.

The GES for trizinc bis(orthophosphate) production mentions the following in this respect:

- Local exhaust ventilation systems (generic LEC (84%) as worst case; higher efficiencies (90-95%) are usual,
- Cyclones/filters (for minimizing dust emissions) : efficiency: 70-90% (cyclones), 50-80% (dust filters), 85-95% (double stage, cassette filters),
- Process enclosure, especially in potentially dusty units,
- Dust control: dust and Zn in dust needs to be measured in the workplace air (static or individual) according to national regulations,
- Special care for the general establishment and maintenance of a clean working environment by e.g :
- Cleaning of process equipment and workshop,
- Storage of packaged Zn product in dedicated zones.

It is impervious to keep under control the zinc phosphate emissions in the environment. If necessary an appropriate treatment device must be installed according to regulations.

Atmospheric emissions: ventilation systems must be appropriate for the level of performance required to control air emissions in accordance with current national requirements.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION (continued)

Water emissions: must be controlled to prevent contamination of public sewage, rivers, surface water according national and local regulations.

Soil emissions: Do not let this material to contaminate soils or ground.

∇PNECs for zinc (Predicted no effect concentration)

Environmental compartment	PNEC value for Zn
Freshwater	20.6 µg/L
Saltwater	6.1 µg/L
Freshwater sediment*	117.8 mg/kg sediment dry weight.
Saltwater sediment*	56.5 mg/kg sediment dry weight
Soil*	35.6 mg/kg soil dry weight**.
STP	100 µg/L

* added value, « $PNEC_{add}$ »

** This generic PNECadd, should as a rule be multiplied with a factor 3 to take into account "lab-to-field" differences in toxicity. As such, the generic corrected $PNEC_{add}$ $PNEC_{add}$ including ageing or generic $PNEC_{add,}$ ageing is **107 mg Zn/kg dw.** Soil-specific PNEC values, can further be calculated when the characteristics of the soil are documented.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties:

Physical state : solid, fine powder
Appearance : white powder
Odour : odourless

Change in physical state

Dehydration	Melting	Decomposition
∇70 - 600℃ for tetrahydrated zinc phosphate	900°C	none as long as properly used.
120 - 600℃ for trihydrated zinc phosphate	900°C	none as long as properly used.
160 - 600℃ for dihydrated zinc phosphate	900°C	none as long as properly used.

Flash point : not applicable.
Flammable properties : not combustible, fire retardant.
Explosion risk : not applicable.
Vapour pressure (20℃) : not applicable.
Specific gravity : 3.3 – 3.4 g/cm^3 ISO 787/10
Solubility (water 20℃) : 0.03 g/l.
pH (20℃) : 6 - 8 ISO 787/9
Other information : none
Partition coefficient: n-octanol-water : not applicable

10. STABILITY AND REACTIVITY

Reactivity: unreactive with respect to materials commonly used in transport, handling and storage of industrial materials

∇**Chemical stability:** stable at room temperature and at temperatures up to 70°C (dehydration).

Possibility of hazardous reactions: None hazardous reactions if stored and handled in accordance

Conditions to avoid: Keep clear of acids and bases (solubility in these media)

Incompatible materials: No further relevant information available

Hazardous decomposition products: no hazardous decomposition product in normal storage conditions.

11. TOXICOLOGICAL PROPERTIES

Toxicity

∇**LD_{50} oral (rat Wistar):**	> 5 000 mg/kg. Klein & Glaser based on cross-reading from zinc oxide
∇**LC_{50} Inhalation Dusts and mists:**	>5.7 mg/L 4H (Klimisch and all 1982) based on cross-reading from zinc oxide

Additional information: With LD_{50} values consistently exceeding 2,000 mg/kg bw, slightly soluble compounds such as, trizinc bis(orthophosphate) (LD_{50} is > 5,000) show low level of acute oral toxicity, not leading to classification for acute oral toxicity.
Trizinc bis(orthophosphate) (based on cross-reading from zinc oxide) is of low acute inhalation toxicity (i.e., LC_{50} values of > 5.7 mg/L/4Hrs), not leading to classification for acute inhalation toxicity.

Primary irritant effect:

Skin: not irritant (based on cross-reading from ZnO : Löser, 1977; Lansdown, 1991)
Eyes: not irritant (Mirbeau et al, 1999)
Respiratory tract: not irritant (based on cross-reading from ZnO: Klimish et al, 1982)

Sensitization: No sensitizing effects known (based on cross-reading from ZnO: Van Huygevoort, 1999 g,h)

Repeated dose toxicity:

- **Specific target organ toxicity (single exposure):**
  No experimental or epidemiological sufficient evidence for specific target organ toxicity (single exposure) (based on cross-reading from ZnO) ; no classification for target organ toxicity (single exposure: STOT-SE required) (Heydon and Kagan, 1990; Gordon et al., 1992; Mueller and Seger, 1985 [Cited in Chemical Safety report (CSR) Trizinc bis(orthophosphate). 2010]).

- **Specific target organ toxicity (repeated exposure):**
  No experimental or epidemiological sufficient evidence for specific target organ toxicity (repeated exposure) (based on cross-reading from ZnO) ; no classification for specific target organ toxicity (repeated exposure: STOT-RE required) (Lam et al, 1985, 1988; Conner et al. ,1988 [Cited in Chemical Safety report (CSR) Trizinc bis(orthophosphate). 2010]).

- **Aspiration hazard:**
  Not available

11. TOXICOLOGICAL PROPERTIES (continued)

Carcinogenicity, Germ cell mutagenicity, Reproductive toxicity (CMR): No further experimental or epidemiological evidence available

- **Carcinogenicity**
  No experimental or epidemiological evidence exists to justify classification of zinc compounds for carcinogenic activity (based on cross-reading between Zn compounds); no classification for carcinogenicity required (Chemical Safety report (CSR) Trizinc bis(orthophosphate). 2010)

- **Germ cell mutagenicity**
  No biologically relevant genotoxic activity (based on cross-reading between Zn compounds); no classification for mutagenicity required (Chemical Safety report (CSR) Trizinc bis(orthophosphate). 2010).

- **Reproductive toxicity**
  No experimental or epidemiological evidence exists to justify classification of zinc compounds for reproductive or developmental toxicity (based on cross-reading between Zn compounds); no classification for reproductive toxicity required (Chemical Safety report (CSR) Trizinc bis(orthophosphate). 2010)

This product is not hazardous for the human being when used properly.

12. ECOLOGICAL INFORMATION

∇Zinc Acute aquatic toxicity

The Acute aquatic toxicity database on zinc contains data on 11 standard species obtained under standard testing conditions at different pH and hardness. The full analysis of these data is given in the CSR.

The reference values for acute aquatic toxicity, based on the lowest observed EC_{50} values of the corresponding databases at different pH and expressed as Zn^{2+} ion concentration are:

Acute toxicity for fish (Oncorhynchus mykiss) as zinc	**LC_{50}** (96 h)	0.14 – 2.6 mg Zn^{2+}/l.
Acute toxicity for crustacea (Ceriodaphnia dubia) as zinc	**EC_{50}** (48 h)	0.413 mg Zn^{2+}/l. for pH <7

(48 hr Ceriodaphnia dubia test according to US EPA 821-R-02-012 standard test protocol reference: Hyne et al 2005)

Acute toxicity for algae (Selenastrum capricornutum) as zinc	**EC_{50}** (72 h)	0.136– 0.150 mg Zn^{2+}/l.

(=Pseudokircherniella subcapitata) test according to OECD 201 standard protocol; reference: Van Ginneken, 1994)

After applying the molecular weight correction (transformation/dissolution testing is not relevant since this zinc compound is considered rather soluble), the specific reference values for acute aquatic toxicity of zinc orthophosphate is (applying a PZ20 $Zn_3(PO_4)_2,4H_2O$/Zn molecular weight ratio of 2.33 and a PZW2 $Zn_3(PO_4)_2,2H_2O$/Zn molecular weight ratio of 2,15):

Acute toxicity for fish (Oncorhynchus mykiss) as	PZ20	**LC_{50}** (96 h)	0.33 – 6.06 mg PZ20/L.
	PZW2	**LC_{50}** (96 h)	0.30 – 5.59 mg PZW2/L
Acute toxicity for crustacea (Ceriodaphnia dubia) as	PZ20	**EC_{50}** (48 h)	0.96 mg PZ20/L. for pH <7
	PZW2	**EC_{50}** (48 h)	0.89 mg PZW2/L. for pH <7

(48 hr Ceriodaphnia dubia test according to US EPA 821-R-02-012 standard test protocol reference: Hyne et al 2005)

Acute toxicity for algae (Selenastrum capricornutum) as	PZ20	**EC_{50}** (72 h)	0.32 mg PZ20/L.
	PZW2	**EC_{50}** (72 h)	0.29 mg PZW2/L.

(=Pseudokircherniella subcapitata) test according to OECD 201 standard protocol; reference: Van Ginneken, 1994)

M Factor for this substance is **1** for an equivalent LC_{50} [0.1-1.0]mg/l (GHS or 1272/2008/EC regulation).

12. ECOLOGICAL INFORMATION (continued)

∇**Zinc Chronic aquatic toxicity:**

Freshwater: The chronic aquatic toxicity database on zinc contains high quality chronic NOEC (No observe effect concentration)/EC_{10} values on 23 species (8 taxonomic groups) obtained under a variety of conditions. These data, outlined in the CSR, were compiled in a species sensitivity distribution, from which the PNEC was derived (expressed as Zn^{2+} ion concentration). This PNEC is an added value, i.e. it is to be added to the zinc background in water, see table below.

Marine water: The chronic aquatic toxicity database on zinc contains high quality chronic NOEC/EC_{10} values on 39 species (9 taxonomic groups) obtained under a variety of conditions. These data, outlined in the CSR, were compiled in a species sensitivity distribution, from which the PNEC was derived (expressed as Zn^{2+} ion concentration). This PNEC is an added value, to be added on the zinc background in water, see table below.

∇**Zinc Sediment toxicity:** The chronic toxicity of zinc to sediment organisms in the freshwater was assessed based on a database containing high quality chronic NOEC/EC_{10} values on 7 benthic species obtained under a variety of conditions. These data, outlined in the CSR, were compiled in a species sensitivity distribution, from which the PNEC was derived (expressed as total Zn contained in the sediment). This PNEC is an added value, to be added on the zinc background in the sediment, see table below. For the marine sediments, a PNEC was derived using the equilibrium partitioning approach, see table below.

∇**Zinc Soil toxicity:** The chronic toxicity of zinc to soil organisms was assessed based on a database containing high quality chronic NOEC/EC_{10} values on 18 plant species, 8 invertebrate species and 17 microbial processes, obtained under a variety of conditions. These data, outlined in the CSR, were compiled in a species sensitivity distribution, from which the PNEC was derived (expressed as total Zn contained in the soil). This PNEC is an added value, to be added on the zinc background in the soil, see table below.

∇**Zinc Toxicity to micro-organisms in STP:** The PNEC for STP was derived from the NOEC: NOEC (No observe effect concentration) value of 100 µg Zn/l of Juliastuti et al. (2003) is set, applying an assessment factor of 1.

Persistence and biodegradability: Zinc is an element, and as such the criterion "persistence" is not relevant for the metal and its inorganic compounds in a way as it is applied to organic substances. An analysis on the removal of zinc from the water column has been presented as a surrogate for persistence. The rapid removal of zinc from the water column is documented in the CSR. So, zinc and zinc compounds do not meet this criterion, neither.

∇**Zinc Behavior in the environmental compartments**

Bioaccumulative potential: Zinc is a natural, essential element, which is needed for the optimal growth and development of all living organisms, including man. All living organisms have homeostasis mechanisms that actively regulate zinc uptake and absorption/excretion from the body; due to this regulation, zinc and zinc compounds do not bioaccumulate or biomagnify.

Mobility in soils: For zinc (like for other metals) the transport and distribution over the different environmental compartments e.g. the water (dissolved fraction, fraction bound to suspended matter), soil (fraction bound or complexed to the soil particles, fraction in the soil pore water,...) is described and quantified by the metal partition coefficients between these different fractions. In the CSR, a solids-water partitioning coefficient of 158.5 l/kg (log value 2.2) was applied for zinc in soils (CSR zinc 2010).

Results of PBT and vPvB assessment: Zinc and zinc compounds are not PBT or vPvB.

Others lasting effects: No further relevant information available

13. DISPOSAL

Methods of waste treatment:

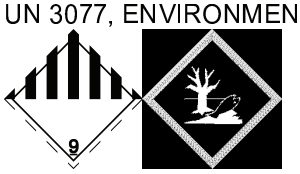
Material: Reduce as possible the amount of waste containing zinc phosphate. It is possible that contaminated waste may meet with the criteria of hazardous waste. Dispose in accordance with local environmental regulations.

* This substance does not meet the definition of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

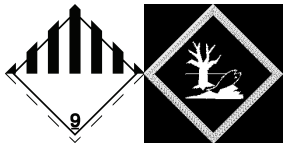
Contaminated package and containers: Empty bags can be either destroyed, or recycled according to the international norms that apply. Spoiled and unclean packaging is regulated by the ADR/IMDG.

14. TRANSPORT INFORMATION

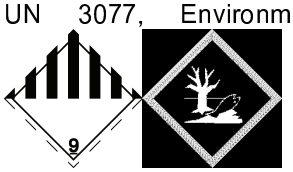
ADR: UN 3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (ZINC PHOSPHATE), 9, III, (E)



IMDG: UN 3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (ZINC PHOSPHATE), 9, III,

MARINE POLLUTANT  FS: F-A, S-F

IATA: UN 3077, Environmentally hazardous substance, solid, n.o.s. (zinc phosphate), 9, III



Packing instruction: Y956 only for Limited Quantities (inner package <5 kg) and gross weight < 30 kg, or 956

15. REGULATORY INFORMATION

Labelling according 1272/2008/EC (CLP –GHS):

Hazard pictogram:

WARNING

EINECS: 231-944-3 **CAS N°**: 7779-90-0 **Annex VI Index N°**: 030-011-00-6

Hazard statements:	**H410**	Very toxic to aquatic life with long lasting effects.
Prevention:	**P273**	Avoid release to the environment.
Response:	**P391**	Collect spillage
Disposal:	**P501**	Dispose of contents/ containers to be collected by a licensed contractor in accordance with national and local regulations.

☐**Chemical safety assessment:** Chemical safety report was performed for the Zinc Phosphate

16. FURTHER INFORMATION

- **TOTAL LEAD** : < 0.1 %
- **SOLUBLE LEAD (HCl 0,07 N)** : < 0.1 %

UE: Zinc Phosphate storage is likely to be regulated by the SEVESO II - SEVESO III directives; it would be considered as a dangerous substance for the aquatic environment.

Important phrases (according 1272/2008/UE)

H400: Very toxic to aquatic life
H410: Very toxic to aquatic life with long lasting effects.

EUROPEAN LABELLING:

Labelling inherent in the use of this compound in mixture (regulation CLP/ GHS 1272/2010/EC)

Classification of Zinc Phosphate substance: Acute and chronic aquatic very toxic Category 1. **M** factor = 1

The mixture containing this product is classified in different categories according the following the calculation concentration rules:

- **Labelling category 1:**  ***GHS Label 09 + Warning***

  Hazard: **H410** Precautionary: P273 + P391 + P501
  when the concentration of zinc phosphate will exceed 25% in formulation (excluding any addition of other aquatic hazardous material) ***or*** *according the formula:*
  *[Σ (**M** x Concentration Chronic Category 1]) ≥ 25%:*

- **Labelling category 2:**  ***GHS Label 09***

  Hazard: **H411** Precautionary: P273 + P391 + P501
  when the concentration of zinc phosphate will be include in the range between 2,5%≤ x <25% (excluding any addition of other aquatic hazardous material) ***or*** *according the formula:*
  *[Σ (**M** x 10 x Concentration Chronic Category 1) + Σ Concentration Chronic Category 2] ≥ 25%*

- **Labelling category 3:** Hazard: **H412** Precautionary: P273 + P501
  when the concentration of zinc phosphate will be include in the range between 0.25%≤ x <2.5% (excluding any addition of other aquatic hazardous material) ***or*** *according the formula:*
  [Σ (M x 100 x Chronic Category 1) + Σ (10 x Chronic Category 2) + Σ Chronic Category 3] ≥ 25%

Numerous uses were identified for $Zn_3(PO_4)_2$. Recommended uses by the SNCZ for downstream channel are in the e-SDS

16. FURTHER INFORMATION (Continued)

GERMANY :

- **Wassergefäfrdungsklasse WGK (VwVwS)** : WGK 2 – water pollutant – in accordance with annex 3, German VwVwS.

USA :

- **RTECS n°**: TD 0590000 (Register of Toxical Effects of Chemical Substances).
- Substance listed in the Toxic Substances Control Act Inventory (TSCA) (USA).
- **Cercla hazard rating (scale 0-3)** : Toxicity 2 - Flammability 0 -Reactivity 0 - Persistence 3

HMIS Rating : H = 0 - F = 0 - PH = 0.
HMIS III : The HMIS III ratings are from the HMIS Third Edition. There have been significant changes made to the system. "PH" stands for "Physical Hazard" as defined in the OSHA Haz Com Standard and replaces the former code "R" for "Reactivity". For a more detailed explanation of the system and the ratings, please contact our Offices at: INT = 33 1 30 40 57 57.

International status of the product :

- **Australia** : Listed in the AICS.
- **Canada** : Domestic Substance List (DSL).
- **Europ (UE)**: REACH status: This substance is registered according regulation REACH 1907/2006/EC.
  EINECS registered substance.
  This substance meets with RoHS (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment) directive (2002/95/CE) for Lead, Cadmium, hexavalent Chromium, Mercury, Diphenylethers Polybrominated and Polybromated Biphenyls.
  This substance is with directive ELV (End Life of Vehicles) 2000/53/EC
- **Japan** : Listed in the MITI.
- **USA:** TSCA registered

End of safety data sheet

The information contained herein is based on the present state of our knowledge, but without liability.

Modifications compare to the former version : ☐ : Addition ∇:Text modification

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1. EXPOSURE SCENARIOS SUMMARY FOR ZINC PHOSPHATE

Generic exposure scenarios (GES) and uses

Numerous uses were identified for $Zn_3(PO_4)_2$. These are listed hereunder with the indication of the Generic Exposure Scenario (GES) that is relevant to these identified uses.

In Table 1, the generic exposure scenarios (GES) developed for trizinc bis(orthophosphate) are summarised. In general, the following steps in the supply chain were considered and documented in a GES:

- the manufacture of the substance ("GES-0")
- the formulation of the substance (GES-1)
- first tier applications of the substance, mainly as "component for solid blends and matrices" (= use in solids; GES 4) and as "component for production of dispersions, pastes and other vicious matrices" (= use in liquids; GES-5). Distinction was made between both forms because of possible differences in exposure potential. Other GES considered here were the use of the substance as an intermediate in the manufacture of other zinc compounds (GES-3) and the use of the substance as laboratory agent (GES-4).
- second tier applications, describing the downstream use of solid preparations or liquid/pasty preparations containing the substance (GES-6, GES 7, respectively).
- A specific STP scenario (wide dispersive use) on evaluation of risks due to the presence of Zinc in European Sewage treatment plants was added (GES .8) see §2

Table 1. Generic exposure scenarios for trizinc bis(orthophosphate)

Number	Sector	Uses	Code
1 (§2.1)	Formulation step	Formulation general	**$GES_{Zn3(PO4)2}$ 1**
2	First tier applications	Manufacturing of other zinc compounds	**$GES_{Zn3(PO4)2}$ 2**
3 (§2.2)		Laboratory reagent	**$GES_{Zn3(PO4)2}$ 3**
4 (§2.3)		As component for solid blends & matrices	**$GES_{Zn3(PO4)2}$ 4**
5 (§2.4)		As component for production of dispersions, pastes and other viscous matrices	**$GES_{Zn3(PO4)2}$ 5**
6 (§2.5)	Second tier applications	DU of $Zn_3(PO_4)_2$-containing solid preparations	**$GES_{Zn3(PO4)2}$ 6**
7 (§2.6)		DU of $Zn_3(PO_4)_2$-containing liquid & pasty preparations	**$GES_{Zn3(PO4)2}$ 7**
8 (§2.7)	Wide dispersive use	Wide dispersive use and STP	**$GES_{Zn3(PO4)2}$-8**
9 (§2.8)	Consumer	Consumer exposure	

Identified uses: brief description and use descriptors

Table 2. Formulation.

Identifiers	Use descriptors, Brief description of use process	Other information
F-1: Laboratory reagent	**Technical function of the substance during formulation:** Laboratory chemicals PROC: 15 PC: 21 ERC: 2, 3 **Technical function of the substance during formulation:** Laboratory chemicals	**GES$_{Zn3(PO4)2}$ 3**
F-2: Formulation of preparations	Industrial use of $Zn_3(PO_4)_2$ in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, possibly followed by packing. PROC: 1, 2, 3, 4, 5, 8a, 8b, 9, 14, 19 PC: 1, 9a, 9b, 12, 14, 15, 17, 18, 19, 24, 31, 32, 35 ERC: 2, 3 **Technical function of the substance during formulation:** Colouring agents, pigments Corrosion inhibitors and anti-scaling agents Flame retardants Food/feedstuff additives Intermediates Laboratory chemicals Plating agents and metal surface treating agents Surface active agents Source of zinc	**GES$_{Zn3(PO4)2}$ 1** Substance supplied to that use: As such Remarks: In the case of coatings and paints, fertilisers, the formulation can also be used as such (e.g. without further treatment), industrial and professional downstream uses are covered nonetheless

Table 3. Uses at industrial sites

Identifiers	Use descriptors, Brief description of use process	Other information
IW-4: Component for production of Inorganic pigments	Industrial use of Zinc ortho-phosphate or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of inorganic anticorrosive pigments and others. SU: 6a, 9, 10, 11, 12, 16, 17, 18, 0 (NACE C20.3) PROC: 1, 2, 3, 4, 5, 8a, 8b, 9, 22, 26 PC: 19, PC 0 : other: component for pigment/paint ERC: 5 **Technical function of the substance during formulation:** Colouring agents, pigments Corrosion inhibitors and anti-scaling agents Plating agents and metal surface treating agents	**$GES_{Zn3(PO4)2}$ 4** Substance supplied to that use: As such In a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: A-1: Painted /coated items with $Zn_3(PO_4)_2$ -containing paints or coatings
IW-5: Component for production of Coatings / paints, inks, enamels, varnishes	Industrial use of Zinc ortho-phosphate or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of paints and other coatings for i.e. metallic surfaces, wood products and others SU: 1, 5, 6a, 6b, 10, 11, 12, 13, 16, 17, 18 PROC: 1, 2, 3, 4, 5, 8a, 8b, 9 PC: 0: other (component for paint) ERC: 5 **Technical function of the substance during formulation:** Colouring agents, pigments Corrosion inhibitors and anti-scaling agents Plating agents and metal surface treating agents	**$GES_{Zn3(PO4)2}$ 5** Substance supplied to that use: As such In a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: A-1: Painted /coated items with $Zn_3(PO_4)_2$-containing paints or coatings
IW-7: Additive for the formulation of fertilizers	Industrial use of $Zn_3(PO_4)_2$ as an active component in the manufacturing of fertilizers preparations by mixing or blending of solid or liquid materials SU: 1, 10 PROC: 1, 2, 3, 4, 5, 8b, 9, 13 PC: 12 ERC: 5 **Technical function of the substance during formulation:** Fertilisers	**$GES_{Zn3(PO4)2}$ 4-5** Substance supplied to that use: As such In a mixture Subsequent service life relevant for that use: no
IW-9: Substrate preparation: sanding of surfaces between application of coatings	Industrial and professional use of solid substrates containing less than 25%w/w of $Zn_3(PO_4)_2$ SU: 15, 17 PROC: 21, 24, 25 PC: 9a, 9b ERC: :5	**$GES_{Zn3(PO4)2}$ 6** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: no

Table 3. Uses at industrial sites (continued)

Identifiers	Use descriptors, Brief description of use process	Other information
IW-10: Component for polymer-matrices, plastics and related preparations	Industrial use of Zinc ortho-phosphate or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices. SU: 10, 12 PROC: 2, 3, 4, 5, 6, 8a, 8b, 9, 10, 13, 14, 21, 24 PC: 32 ERC: 5 **Technical function of the substance during formulation:** Flame retardants	**$GES_{Zn3(PO4)2}$ 5** Substance supplied to that use: As such In a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: A-2: Polymer-matrices, plastics and related items
IW-11: Use of $Zn_3(PO_4)_2$ -containing paints & coatings	Industrial and professional use of surface coatings, inks and paints containing $Zn_3(PO_4)_2$. SU: 5, 6a, 6b, 10, 11, 12, 15, 16, 17, 18, 19, PROC: 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 19 PC: 9a, 9b ERC: 5 **Technical function of the substance during formulation:** Colouring agents, pigments Corrosion inhibitors and anti-scaling agents	**$GES_{Zn3(PO4)2}$ 7** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: A-1: Painted /coated items with $Zn_3(PO_4)_2$-containing paints or coatings
IW-12: Production of friction material, brake pads, brake lining	Industrial use of $Zn_3(PO_4)_2$ as an active component in the manufacturing of friction material SU: 17, 0: other (NACE C23.9.1) PROC 14, 24 PC: 9a, 14 ERC: 6d **Technical function of the substance during formulation:** Corrosion inhibitors and anti-scaling agents	**$GES_{Zn3(PO4)2}$ 7** Substance supplied to that use: As such In a mixture Subsequent service life relevant for that use: yes

Table 4. Uses by professional workers

Identifiers	Use descriptors, Brief description of use process	Other information
PW-1: Use of $Zn_3(PO_4)_2$ -containing fertilizer's formulations	Professional use of $Zn_3(PO_4)_2$ containing mixture as micronutrient in fertilizer's formulations SU: 1 PROC: 2, 8a, 8b, 9, 10, 11, 13, 19, 26 PC: 12 ERC: 5 **Technical function of the substance during formulation:** Fertilisers Zinc source	**$GES_{Zn3(PO4)2}$ 7** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: no
PW-2: Use of $Zn_3(PO_4)_2$ -containing paints & coatings	Professional use of surface coatings, inks and paints containing $Zn_3(PO_4)_2$ SU: 10, 15, 17, 18, 19 PROC: 4, 5, 8a, 8b, 9, 10, 11, 13, 19, 24 PC: 9a, 9b, 18 ERC: 8c, 8f **Technical function of the substance during formulation:** Colouring agents, pigments Plating agents and metal surface treating agents	**$GES_{Zn3(PO4)2}$ 7** Substance supplied to that use: In a mixture **Subsequent service life relevant for that use: yes** Link to the subsequent service life: A-1: Painted /coated items with $Zn_3(PO_4)_2$-containing paints or coatings
PW-3: Substrate preparation: sanding of surfaces between application of coatings		**$GES_{Zn3(PO4)2}$ 6** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: no

Table 5. Consumer uses

Identifiers	Use descriptors, Brief description of use process	Other information
C-1: Use of $Zn_3(PO_4)_2$ -containing fertilizer's formulations	Generic wide dispersive use of Zn: A generic scenario on consumer STP (wide dispersive use) was developed PC 12: Fertilisers ERC 8a, 8b, 8d, 8e **Technical function of the substance during formulation:** Fertilisers Zinc source	**$GES_{Zn3(PO4)2}$ 8** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: no
C-2: Use of of $Zn_3(PO_4)_2$ -containing paints & coatings	Generic wide dispersive use of Zn: A generic scenario on consumer STP (wide dispersive use) was developed PC 1, 9a, 9b, 9c, 14, 15,18 ERC 8c, 8f **Technical function of the substance during formulation:** Colouring agents, pigments Corrosion inhibitors and anti-scaling agents Flux agents for casting Plating agents and metal surface treating agents	**$GES_{Zn3(PO4)2}$ 8** Substance supplied to that use: In a mixture Subsequent service life relevant for that use: yes Link to the subsequent service life: A-1: Painted /coated items with $Zn_3(PO_4)_2$ -containing paints or coatings

Table 6. Article service life

Identifiers	Use descriptors, Brief description of use process	Other information
SL-1: Painted /coated items with $Zn_3(PO_4)_2$ -containing paints or coatings	**Article category related to subsequent service life (AC):** AC 01, 1, 2, 7, 10, 13, 38 PROC 21, 24 ERC 10a, 11a **Technical function of the substance during formulation:** Colouring agents, pigments	Article used by: workers consumers
SL-2: Polymer-matrices, plastics and related items	**Article category related to subsequent service life (AC):** AC 13: Plastic articles **Exposure related description of article:** no exposure foreseen PROC 14, 21, 24 ERC 10a, 11a **Technical function of the substance during formulation:** Flame retardants	Article used by: workers consumers
SL-4: Brake pads and brake linings	**Article category related to subsequent service life (AC):** AC 1, 02 PROC 21, 24 ERC 10a, 10b, 12a **Technical function of the substance during formulation:** Corrosion inhibitors and anti-scaling agents	Article used by: Workers consumers

Uses advised against: None

Use descriptor system glossary :

(for more details see Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system):

SU1	Agriculture, forestry, fishery
SU5	Manufacture of textiles, leather, fur
SU6a	Manufacture of wood and wood products
SU6b	Manufacture of pulp, paper and paper products
SU9	Manufacture of fine chemicals
SU10	Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU11	Manufacture of rubber products
SU12	Manufacture of plastics products, including compounding and conversion
SU13	Manufacture of other non-metallic mineral products, e.g. plasters, cement
SU15	Manufacture of fabricated metal products, except machinery and equipment
SU16	Manufacture of computer, electronic and optical products, electrical equipment
SU17	General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment
SU18	Manufacture of furniture
SU19	Building and construction work
SU0	Others
	NACE: C20.3 - Manufacture of paints, varnishes and similar coatings, printing ink and mastics,
	NACE: C23.9.1 - Production of abrasive products

PC1	Adhesives, sealants
PC9a	Coatings and paints, thinners, paint removers
PC9b	Fillers, putties, plasters, modelling clay
PC9c	Finger paints
PC12	Fertilisers
PC14	Metal surface treatment products, including galvanic and electroplating products
PC15	Non-metal-surface treatment products
PC17	Hydraulic fluids
PC18	Ink and toners
PC19	Intermediate
PC21	Laboratory Chemicals
PC23	Leather treatment products
PC24	Lubrifiants, graisses et agents de décoffrage
PC31	Polishes and wax blends
PC32	Polymer preparations and compounds
PC35	Washing and cleaning products
PC0	Other component for paint

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC6	Calendering operations
PROC7	Industrial spraying
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC10	Roller application or brushing
PROC11	Non industrial spraying
PROC13	Treatment of articles by dipping and pouring
PROC14	Production of preparations* or articles by tableting, compression, extrusion, pelletisation
PROC15	Use as laboratory reagent
PROC19	Hand-mixing with intimate contact and only PPE available.
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
PROC24	High (mechanical) energy work-up of substances bound in materials and/or articles
PROC25	Other hot work operations with metals
PROC26	Handling of solid inorganic substances at ambient temperature

ERC2	Formulation of preparations
ERC3	Formulation in materials
ERC5	Industrial use resulting in inclusion into or onto a matrix
ERC6d	Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers
ERC8a	Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)
ERC8b	Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)
ERC8c	Wide dispersive indoor use resulting in inclusion into or onto a matrix
ERC8d	Wide dispersive outdoor use of processing aids in open systems
ERC8e	Wide dispersive outdoor use of reactive substances in open systems
ERC8f	Wide dispersive outdoor use resulting in inclusion into or onto a matrix
ERC10a	Wide dispersive outdoor use of long-life articles and materials with low release
ERC10b	Wide dispersive outdoor use of long-life articles and materials with high or intended release (including abrasive processing)
ERC11a	Wide dispersive indoor use of long-life articles and materials with low release
ERC12a	Industrial processing of articles with abrasive techniques (low release)

AC01	Other (non intended to be released): coatings for art and creative items
AC1	Vehicles
AC02	Other (intended to be released): brake pads
AC2	Machinery, mechanical appliances, electrical/electronic articles
AC7	Metal articles
AC10	Rubber articles
AC13	Plastic articles
AC38	Packaging material for metal parts, releasing grease/corrosion inhibitors

2. LOCAL EXPOSURE SCENARIOS

Introduction

Human health: Workers
The local risk characterisations at the workplace under the different exposure scenarios are described hereunder.

Consumers
Conform to the approach followed in the EU risk assessment, no separate assessments of consumer exposure are made for each exposure scenario, but all possible consumer exposures are combined in one integrated scenario: Consumers

Indirect exposure of humans via the environment
Conform to the approach followed in the EU risk assessment, no separate assessments of indirect exposure of humans via the environment are made for each exposure scenario, but indirect exposures are combined in one integrated scenario.

Environment
The local risk characterisations of the environmental compartments under the different exposure scenarios are described hereunder.

2.1 GES $Zn_3(PO_4)_2$ -1: Industrial use of $Zn_3(PO_4)_2$ in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, possibly followed by packing.

Exposure Scenario Format (1) addressing uses carried out by workers

2.1.1 Title of Exposure Scenario number $Zn_3(PO_4)_2$ GES-1: Industrial use of $Zn_3(PO_4)_2$ in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, possibly followed by packing .

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;

PROC: 1, 2, 3, 4, 5, 8a, 8b, 9, 14, 19
PC: 1, 9a, 9b, 12, 14, 15, 17, 18, 19, 23, 24, 29, 31, 32, 35
ERC: 2, 3

Further explanations (if needed)

$Zn_3(PO_4)_2$ is used in the manufacture of preparations by mixing thoroughly the starting materials, followed by direct use of packaging of the preparation. Many different industrial uses are characterised by this process. Therefore these industrial uses are all covered by this generic exposure scenario.

2.1.2. Exposure Scenario

a). Contributing scenario (1) controlling environmental exposure for the Industrial use of $Zn_3(PO_4)_2$ in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, possibly followed by packing .

Further specification:

In the described process, the zinc phosphate is:

- Removed from the packaging and stored in silos after delivery.
- Extracted from the silo, dosed and fed with the other reagents to the mixing tank. Mixing occurs batch-wise or continuously, according the process receipt. The mixing occurs in a closed tank/chamber.
- The preparation (dry or wet (solvent/paste) matrix) is further used as such or packed for further treatment/use.

Product characteristics

Product related conditions:

$Zn_3(PO4)_2$ is used in minimum 80% purity; higher grades (>95%) are usual

Amounts used

Daily and annual amount per site:

maximum 5000 T/y;

Frequency and duration of use

Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- All processes are performed indoor in a confined area. All residues containing zinc are recycled.
- Even when no process waters (e.g. when dry process throughout), some non-process water can be generated containing zinc(e.g. from cleaning)

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- Process enclosures and closed circuits where relevant and possible.
- Dust capturing and removal techniques are applied on local exhaust ventilation on furnaces and other work areas with potential dust generation.
- Containment of liquid volumes in sumps to collect/prevent accidental spillage

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
- Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric (or bag) filters (up to 99% efficiency), wet scrubbers (50-99% efficiency). This may create a general negative pressure in the building.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

- In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000, ISO 1400X series, or alike, and, when applicable, by being IPPC-compliant.
  - Such management system should include general industrial hygiene practice e.g.:
    - information and training of workers,
    - regular cleaning of equipment and floors,
    - procedures for process control and maintenance,...
- Treatment and monitoring of releases to outside air, and exhaust gas streams (process & hygiene), according to national regulation.
- SEVESO 2 compliance, if applicable

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

- In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
zinc producers = 3.1 %
zinc compound producers = 0.056 %
downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*,
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*,
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*,
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06,
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request)

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;

- All residues are recycled or handled and conveyed according to waste legislation.

b). Contributing scenario (2) controlling worker exposure for the Industrial use of $Zn_3(PO_4)_2$ in the formulation of preparations by mixing thoroughly, dry or in a solvent, the starting materials with potentially pressing, pelletizing, sintering, possibly followed by packing .

Further specification

$Zn_3(PO_4)_2$ is used in the manufacture of preparations by mixing thoroughly the starting materials, followed by direct use of packaging of the preparation. Many different industrial uses are characterised by this process. Therefore these industrial uses are all covered by this generic exposure scenario.

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

- The concentration of $Zn_3(PO_4)_2$ in the mixtures can cover a broad range (<= 5% up to >25%) depending on the application.
- The preparation can be solid or liquid.
- When the preparation is in solid state, it can be in a) powdery, b) glassy or c) pelletized form. In the powder form, it can be characterised by high dustiness in a worst case situation.

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's expo-sure

Max 5000T/y = 14T/d = 5T/shift depending on the application.

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- elevated temperature steps (~=100°C) can occur
- all indoor processes in confined area.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Process enclosures and closed circuits where relevant and possible.
- Local exhaust ventilation on furnaces and other work areas with potential dust generation, dust capturing and removal techniques.
- Containment of liquid volumes in sumps to collect/prevent accidental spillage

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Local exhaust ventilation systems (high efficiency 90-95%)
- Cyclones/filters (for minimizing dust emissions) : efficiency: 70-90% (cyclones), 50-80% (dust filters), 85-95% (double stage, cassette filters)
- Process enclosure, especially in the drying /calcination / packaging (potentially dusty) units
- Dust control: dust and Zn in dust needs to be measured in the workplace air (static or individual) according to national regulations.
- Special care for the general establishment and maintenance of a clean working environment by e.g.:
    - Cleaning of process equipment and workshop
- Storage of packaged Zn product in dedicated zones

Organisational measures to prevent /limit releases, dispersion and exposure

In general integrated management systems are implemented at the workplace e.g. ISO 9000, ISO-ICS 14000, or alike, and are, when appropriate, IPPC-compliant.

Such management system would include general industrial hygiene practice e.g.:

- information and training of workers on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- procedures for process control and maintenance,...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of gloves and protective clothing is compulsory (efficiency >=90%).

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

- dust filter-half mask P1 (efficiency 75%)
- dust filter-half mask P2 (efficiency 90%)
- dust filter-half mask P3 (efficiency 95%)
- dust filter-full mask P1 (efficiency 75%)
- dust filter-full mask P2 (efficiency 90 %)
- dust filter-full mask P3 (efficiency 97.5%)

Eyes: safety glasses are optional

2.2 GES $Zn_3(PO_4)_2$ -3: Industrial and professional use of $Zn_3(PO_4)_2$ as active laboratory reagent in aqueous or organic media, for analysis or synthesis.

Exposure Scenario Format (1) addressing uses carried out by workers

2.2.1 Title of Exposure Scenario number $Zn_3(PO_4)_2$ GES-3: Industrial and professional use of $Zn_3(PO_4)_2$ as active laboratory reagent in aqueous or organic media, for analysis or synthesis.

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;
PROC: 15
PC: 21
ERC: 2, 3

2.2.2. Exposure Scenario

a) Contributing scenario (1) controlling environmental exposure for the Industrial and professional use of $Zn_3(PO4)_2$ as active laboratory reagent in aqueous or organic media, for analysis or synthesis.

Further specification:

The $Zn_3(PO_4)_2$ is used for

- Analysis: sample (solid or liquid) treatment or preparation: the substance is in the sample or in the reagents
- or synthesis: manipulations are usually under ventilation (e.g. laminar flow, ventilation hood)
- The substance is used
  - at the industrial scale, in industrial installations for air control and water treatment
  - at the professional scale by laboratories

Product characteristics

Product related conditions:

$Zn_3(PO_4)_2$ is used in minimum 80% purity; higher grades (> 95%) are usual

Amounts used

Daily and annual amount per site:

maximum 5 T/y (industrial scale)
maximum 0.5 T/y (professional scale)

Frequency and duration of use

Use is usually intermittent but continuous use is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

If applicable: default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- All processes are performed indoor in a confined area, with dedicated laboratory equipment. All solid residues containing zinc are recovered for recycling.

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- Process enclosures and closed circuits where relevant.
- If relevant, dust capturing and removal techniques are applied on local exhaust ventilation (centralised treatment, scrubbers, filters,...)
- Containment of liquid volumes to collect waste streams

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- At industrial scale, the waste waters will be treated in the on-site waste water treatment techniques that can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
- At professional scale, the emissions are treated usually by STP. Professional services will be used for treating waste streams e.g. for the recovery of metallic solids (for recycling), and for the recovery of e.g. acid solutions containing the substance.
- Air emissions are controlled by use of filters and/or other air emission abatement devices e.g. fabric (or bag) filters (up to 99% efficiency), wet scrubbers (50-99% efficiency). This may create a general negative pressure in the laboratory.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

- In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000/9001, ISO 1400X series, or alike, and, when applicable, by being IPPC-compliant.
    - Such management system should include general industrial hygiene practice e.g.:
        - information and training of laboratory personnel,
        - regular cleaning of equipment and floors,
        - procedures for process control and maintenance,...
- Treatment and monitoring of releases to outside air, and exhaust gas streams according to national regulation.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m^3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

- In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

- At industrial scale:

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
Zinc producers = 3.1 %
Zinc compound producers = 0.056 %
Downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request

- At professional scale:

Fraction of daily/annual use expected in waste: 42% of all articles, 58% of the zinc used is recycled.

Appropriate waste codes:
20 01 34 20 01 40 20 03 01 20 03 07

Suitable Disposal:
Waste from end-of-life articles can be disposed of as municipal waste, except when they are separately regulated, like electronic devices, batteries, vehicles, etc.
Disposal of wastes is possible via incineration (operated according to Directive 2000/76/EC on the incineration of waste) or landfilling (operated according to Reference Document on the Best available Techniques for Waste Industries of August 2006 and Council Directive 1999/31/EC and Council Decision 19 December 2002).

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request)

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;
All residues are recycled or handled and conveyed according to waste legislation. .

b) Contributing scenario (2) controlling worker exposure for the Industrial use of $Zn_3(PO_4)_2$ as active laboratory reagent in aqueous or organic media, for analysis or synthesis.

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

- $Zn_3(PO_4)_2$ is used in minimum 80% purity; higher grades (>95%) are usual
- The sample can be solid or liquid.
- When the preparation is in solid state, it can be in a) powdery, b) glassy or c) pelletized form. In the powder form, it can be characterised by high dustiness in a worst case situation.

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's expo-sure

maximum 5 T/y (industrial scale)
maximum 0.5 T/y (professional scale)

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

Use is usually intermittent but continuous use is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- high temperature steps can occur in protected zones (fume cupboards);
- all indoor processes in confined area, including hazardous substances cabinets.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Process enclosures and closed circuits where relevant and possible.
- Local exhaust ventilation on work areas with potential generation of dust or fumes, dust capturing and removal techniques (fume cupboards).
- Containment of liquid volumes and collection in special circuits

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Local exhaust ventilation systems are provided where needed on the benches and in the fume cupboards.
- Process enclosures if relevant
- Dust control: dust to be measured in the workplace air according to national regulations.
- Special care for the general establishment and maintenance of a clean working environment by e.g.:
  - Cleaning of process equipment and laboratory
- Storage of Zn products in dedicated zones, e.g.: hazardous substances cabinets

Organisational measures to prevent /limit releases, dispersion and exposure

In general integrated management systems are implemented at the workplace e.g. ISO 9000/9001, ISO-14000, or alike, and are, when appropriate, IPPC-compliant.

Such management system would include general industrial hygiene practice e.g.:

- information and training of personnel on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- procedures for process control and maintenance,...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of protective clothing is compulsory (efficiency >=90%).

Gloves can be used occasionally if risk for direct contact with the substance

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

-dust filter-half mask P1 (efficiency 75%)
-dust filter-half mask P2 (efficiency 90%)
-dust filter-half mask P3 (efficiency 95%)
-dust filter-full mask P1 (efficiency 75%)
-dust filter-full mask P2 (efficiency 90 %)
-dust filter-full mask P3 (efficiency 97.5%)

Eyes: safety glasses are optional but usually taken as “normal laboratory practice”

2.3 GES $Zn_3(PO_4)_2$ -4: Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of solid blends and matrices for further downstream use.

Exposure Scenario Format (1) addressing uses carried out by workers

2.3.1 Title of Exposure Scenario number GES $Zn_3(PO_4)_2$ - 4 : Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of solid blends and matrices for further downstream use.

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;
SU: 4, 5, 6a, 6b, 9, 10, 11, 12, 13, 16, 17, 18, 0 (NACE C20.3)
PROC: 1, 2, 3, 4, 5, 8a, 8b, 9, 13, 22, 26
PC: 12, 29, 19, PC 0 : other: component for pigment/paint, zinc source for animal feed
ERC: 5

Further explanations (if needed)

$Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -containing preparations are used in the manufacture of dry preparations by mixing thoroughly the starting materials, possibly followed by pressing or pelletizing, and finally packaging of the preparation.

2.3.2 Exposure Scenario

a) Contributing scenario (1) controlling environmental exposure for the Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$-formulations as component for the manufacture of solid blends and matrices for further downstream use.

Name of contributing scenario

Further specification:

In the described process, the $Zn_3(PO_4)_2$ (/Zn compound) containing preparation/mixture is optionally:

- Pressed at high temperature (>1000°C), grinded and re-pressed/sintered or fritted at high temperature
- Molten at high temperature (>500°C) and further cast as glassy material
- Pressed and pelletized at low temperature

And subsequently packed, or used as such, in further treatment/use

Product characteristics

Product related conditions:

$Zn_3(PO_4)_2$ (Zn compound) in the preparation can be > 25%, usually <5%

Amounts used

Daily and annual amount per site:

maximum 5000 T/y;

Frequency and duration of use

Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- All dry processes throughout, no process waters. Even when no process waters occur (with dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)
- High temperature steps are possible.
- All processes are performed indoor in a confined area. High temperature steps are possible. All residues containing zinc are recycled.

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- Local exhaust ventilation on furnaces and other work areas with potential dust generation.
- Dust capturing and removal techniques are applied.
- Process enclosures where relevant and possible.

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- No process waters, so possible emissions to water are limited and non-process related.
- On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
- Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric or bag filters, wet scrubbers. This may create a general negative pressure in the building.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000, ISO 1400X series, or alike, and, when appropriate, by being IPPC-compliant.

  - information and training of workers,
  - regular cleaning of equipment and floors,
  - procedures for process control and maintenance,...
- Treatment and monitoring of releases to outside air, and exhaust gas streams (process & hygiene), according to national regulation.
- SEVESO 2 compliance, if applicable.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m^3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
Zinc producers = 3.1 %
Zinc compound producers = 0.056 %
Downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06,
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;

- All residues are recycled or handled and conveyed according to waste legislation.
- Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products
- Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.

b) Contributing scenario (2) controlling worker exposure for the Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of solid blends and matrices for further downstream use.

Name of contributing scenario 2:

Industrial formulation of dry preparations/mixtures by mixing thoroughly the zinc compounds with the other starting materials, with possible pressing, pelletizing, sintering and packaging of the preparations/mixtures

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

The concentration of $Zn_3(PO_4)_2$ in the mixtures can be up to >25% but is usually of the order of <= 5%, depending on the application.
The preparation is in the solid state, usually with a low level of dustiness; however, powder forms can occur, the high dustiness is therefore applied as a worst case

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's expo-sure

Max 5000T/y = 15T/d = 5T/shift depending of application.

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- Dry processes: dry operational conditions throughout the process; no process waters;
- high temperature steps can occur;
- indoor processes in confined area.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Local exhaust ventilation on furnaces and other work areas with potential dust generation, dust capturing and removal techniques
- Process enclosures where appropriate

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Local exhaust ventilation systems and process enclosures are generally applied
- Cyclones/filters (for minimizing dust emissions): efficiency 70%-90% (cyclones); dust filters (50-80%)
- Local exhaust ventilation LEV in work area: efficiency 84% (generic LEV)

Organisational measures to prevent /limit releases, dispersion and exposure

Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).

In general integrated management systems are implemented at the workplace e.g. ISO 9000, ISO14000, or alike, and are, when appropriate, IPPC-compliant.

Such management system would include general industrial hygiene practice e.g.:

- information and training of workers on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- procedures for process control and maintenance,...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of gloves and protective clothing is compulsory (efficiency >=90%).

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

- dust filter-half mask P1 (efficiency 75%)
- dust filter-half mask P2 (efficiency 90%)
- dust filter-half mask P3 (efficiency 95%)
- dust filter-full mask P1 (efficiency 75%)
- dust filter-full mask P2 (efficiency 90 %)
- dust filter-full mask P3 (efficiency 97.5%)

Eyes: safety glasses are optional

2.4 GES $Zn_3(PO_4)_2$ -5: Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices.

Exposure Scenario Format (1) addressing uses carried out by workers

2.4.1 Title of Exposure Scenario number GES $Zn_3(PO_4)_2$ - 5 : Industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices.

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;
SU: 1, 5, 6a, 6b, 8, 10, 11, 12, 13, 16, 17, 18
PROC: 1, 2, 3, 4, 5, 6, 8a, 8b, 9, 10, 12, 13, 14, 21, 24
PC: 12, 32, 0: other (component for paint/zinc source in animal feed)
ERC: 5

Further explanations (if needed)

$Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$ -containing preparations are used in the manufacture of liquid preparations by mixing thoroughly the starting materials, with a solvent in order to obtain a solution, dispersion or paste.

2.4.2 Exposure Scenario

a) Contributing scenario (1) controlling environmental exposure for the industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$-formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices.

Further specification:

In the described process, the zinc phosphate containing preparation/mixture is:

- unpacked and stored in silos
- Extracted from the silo, dosed and fed with the other reagents and/or solvents to the mixing tank, batch-wise or continuously, according the process receipt.
- The resulting zinc salt containing mixture (solution, dispersion, paste) is directly further processed, or packed, for further treatment/use.

Product characteristics

Product related conditions:

$Zn_3(PO_4)_2$ in preparation can be > 25%, usually <5%

Amounts used

Daily and annual amount per site:

maximum 5000 T/y;

Frequency and duration of use

Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- Even when no process waters occur, some non-process water can be generated containing zinc (e.g. from cleaning)
- All processes are performed indoor in a confined area.
- All residues containing zinc are recycled.

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- Local exhaust ventilation on mixing tanks and other work areas with potential dust generation.
- Dust capturing and removal techniques are applied.
- Process enclosures where relevant and possible.

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- Most of the operations imply wet process-steps
- Sump containment is provided under the tanks and the filters i.o. to collect any accidental spillage
- On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
- Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric or bag filters, wet scrubbers. This may create a general negative pressure in the building.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

- In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000, ISO 1400X series, or alike, and, when applicable, by being IPPC-compliant.
    - Such management system should include general industrial hygiene practice e.g.:
        - information and training of workers,
        - regular cleaning of equipment and floors,
        - procedures for process control and maintenance,...
- Treatment and monitoring of releases to outside air, and exhaust gas streams (process & hygiene), according to national regulation.
- SEVESO 2 compliance, if applicable.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m^3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
Zinc producers = 3.1 %
Zinc compound producers = 0.056 %
Downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request)

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;

- All residues are recycled or handled and conveyed according to waste legislation.
- Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products
- Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.

b) Contributing scenario (2) controlling worker exposure for the industrial use of $Zn_3(PO_4)_2$ or $Zn_3(PO_4)_2$-formulations as component for the manufacture of dispersions, pastes or other viscous or polymerized matrices.

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

- The concentration of $Zn_3(PO_4)_2$ in the mixtures can be up to >25% but is usually of the order of <= 5%, depending on the application.
- The preparation is in the liquid state, as a paste or dispersion or other viscous or polymerized matrix, with a low level of dustiness; however, powder forms can occur, medium dustiness is therefore applied as a worst case

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's expo-sure

Max 5000T/y = 20 T/d = 7T/shift depending of application.

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- Wet processes
- All indoor processes in confined area.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Local exhaust ventilation on mixing tanks, furnaces and other work areas with potential dust generation, dust capturing and removal techniques
- Process enclosures where appropriate

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Local exhaust ventilation systems and process enclosures are generally applied
- Cyclones/filters (for minimizing dust emissions): efficiency 70%-90% (cyclones); dust filters (50-80%)
- Local exhaust ventilation LEV in work area: efficiency 84% (generic LEV)

Organisational measures to prevent /limit releases, dispersion and exposure

Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).

In general integrated management systems are implemented at the workplace e.g. ISO 9000, ISO 14000, or alike, and are, when appropriate, IPPC-compliant.

Such management system would include general industrial hygiene practice e.g.:

- information and training of workers on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- procedures for process control and maintenance,...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of gloves and protective clothing is compulsory (efficiency >=90%).

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

- dust filter-half mask P1 (efficiency 75%)
- dust filter-half mask P2 (efficiency 90%)
- dust filter-half mask P3 (efficiency 95%)
- dust filter-full mask P1 (efficiency 75%)
- dust filter-full mask P2 (efficiency 90 %)
- dust filter-full mask P3 (efficiency 97.5%)

In particular, when PROC 7, 11, 19 are involved, respiratory protection is recommended

Eyes: safety glasses are optional

2.5 GES $Zn_3(PO_4)_2$ -6: Industrial and professional use of solid substrates containing less than 25%w/w of $Zn_3(PO_4)_2$.

Exposure Scenario Format (1) addressing uses carried out by workers

2.5.1 Title of Exposure Scenario number GES $Zn_3(PO_4)_2$ -6: Industrial and professional use of solid substrates containing less than 25% w/w of $Zn_3(PO_4)_2$.

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;
SU: 15, 17, 19
PROC: 21, 24, 25
PC: 9a, 9b
ERC: industrial use:5, professional use: 8c, 8f

2.5.2. Exposure Scenario

a) Contributing scenario (1) controlling environmental exposure for the Industrial and professional use of solid substrates containing less than 25% w/w of $Zn_3(PO_4)_2$.

Further specification:

This scenario covers both the industrial scale processes and professional use. In the described process, the $Zn_3(PO_4)_2$ containing preparation/mixture is further processed, involving potentially the following steps:

- Reception/unpacking of material
- Final application, embedding, or shaping to produce the end product or article.

Product characteristics

Product related conditions:

$Zn_3(PO_4)_2$ (or Zn compound) in the article is < 25%

Amounts used

Daily and annual amount per site:

- The quantities involved in this scenario are 10-50 times smaller than in blending (GES 4-GES 5); the concentration of the zinc substance is also lower (<25%).
- Typical quantities for both Industrial and professional are 50T/y (typical), maximum 500T/y (in industrial setting).

Frequency and duration of use

Continuous production is assumed as a worst case. Usually, use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- Solid, so in principle all dry processes throughout, no process waters. Even when no process waters occur (with dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)
- In industrial and professional setting, all processes are performed indoor in a confined area. All residues containing zinc are recycled.

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- In industrial and professional setting the following applies:
  - Local exhaust ventilation on furnaces and other work areas with potential dust generation.
  - Dust capturing and removal techniques are applied.
  - Process enclosures where relevant and possible.

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- In industrial and professional setting, the following applies:
  - No process waters, so possible emissions to water are limited and non-process related.
  - If zinc emissions to water, on-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
    - By exposure modelling it is predicted that at use quantities of >100T/y, refinement of the exposure assessment to water and sediment needs to be made (exposure assessment based on real measured data and local parameters). Treatment of the emissions to water may be needed under such conditions (see "exposure estimation and risk characterisation").
  - Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric or bag filters, wet scrubbers. This may create a general negative pressure in the building.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

In general, emissions are controlled and prevented by implementing an appropriate management system. This would involve:

- information and training of workers,
- regular cleaning of equipment and floors,
- Procedures for process control and maintenance...
- Treatment and monitoring of releases to outside air, and exhaust gas streams, according to national regulation.
- SEVESO 2 compliance, if applicable.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m^3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

- If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.
- Users of Zn and Zn-compounds have to favour the recycling channels of the end-of-life products
- Users of Zn and Zn-compounds have to minimize Zn-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.

- At industrial scale:

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
Zinc producers = 3.1 %
Zinc compound producers = 0.056 %
Downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request

- At professional scale:

Fraction of daily/annual use expected in waste: 42% of all articles, 58% of the zinc used is recycled.

Appropriate waste codes:
20 01 34 20 01 40 20 03 01 20 03 07

Suitable Disposal:
Waste from end-of-life articles can be disposed of as municipal waste, except when they are separately regulated, like electronic devices, batteries, vehicles, etc.

Disposal of wastes is possible via incineration (operated according to Directive 2000/76/EC on the incineration of waste) or landfilling (operated according to Reference Document on the Best available Techniques for Waste Industries of August 2006 and Council Directive 1999/31/EC and Council Decision 19 December 2002).

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;

- All residues are recycled or handled and conveyed according to waste legislation.

b) Contributing scenario (2) controlling worker exposure for the Industrial and professional use of solid substrates containing less than 25%w/w of $Zn_3(PO_4)_2$.

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

The concentration of $Zn_3(PO_4)_2$ (or Zn compound) in the mixture is < 25%

- The mixture is in the solid state, with a low level of dustiness; however, powder forms can occur, the medium dustiness is therefore applied as a worst case.

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's expo-sure

- The quantities involved in this scenario are 10-50 times smaller than in blending (GES 4-GES 5); the concentration of the zinc substance is also lower (<25%).
- Typical quantities for both Industrial and professional are 50 T/y (typical), or 0.15 T/day, 0.05 T/shift
- Maximum use quantity is 500T/y (1.5T/d, 0.5T/shift) in industrial setting.

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- Industrial / Professional:
  - Dry processes: dry operational conditions throughout the process; no process waters;
  - Indoor processes in confined area.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Industrial /professional
  - Local exhaust ventilation on work areas with potential dust generation, dust capturing and removal techniques
  - Process enclosures where appropriate

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Industrial /professional:
  - Local exhaust ventilation systems and process enclosures are generally applied
  - Cyclones/filters (for minimizing dust emissions): efficiency 70%-90% (cyclones); dust filters (50-80%)
  - Local exhaust ventilation in work area: efficiency 84% (generic LEV)

Organisational measures to prevent /limit releases, dispersion and exposure

Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).

In general, management systems are implemented; They include general industrial hygiene practice e.g.:

- information and training of workers on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- Procedures for process control and maintenance...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of gloves and protective clothing is compulsory (efficiency >=90%).

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

- dust filter-half mask P1 (efficiency 75%)
- dust filter-half mask P2 (efficiency 90%)
- dust filter-half mask P3 (efficiency 95%)
- dust filter-full mask P1 (efficiency 75%)
- dust filter-full mask P2 (efficiency 90 %)
- dust filter-full mask P3 (efficiency 97.5%)

Eyes: safety glasses are optional

2.6 GES $Zn_3(PO_4)_2$ -7: Industrial and professional use of dispersions, pastes and polymerised substrates containing less than 25%w/w of $Zn_3(PO_4)_2$.

Exposure Scenario Format (1) addressing uses carried out by workers

2.6.1 Title of Exposure Scenario number GES $Zn_3(PO_4)_2$- 7 : Industrial and professional use of dispersions, pastes and polymerised substrates containing less than 25%w/w of $Zn_3(PO_4)_2$.

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;
SU: 1, 5, 6a, 6b, 10, 11, 12, 15, 16, 17, 18, 19, 0: other (NACE C23.9.1, Q86.2.3)
PROC: 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 11, 13, 14, 19, 24, 26
PC: 9a, 9b, 12, 14, 18
ERC: Industrial use: 5, 6d – Professional use: 8a, 8b, 8c, 8d, 8e, 8f

2.6.2. Exposure Scenario

a) Contributing scenario (1) controlling environmental exposure for the Industrial and professional use of dispersions, pastes and polymerised substrates containing less than 25%w/w of $Zn_3(PO_4)_2$

Further specification:

This scenario covers both the industrial scale processes and professional use. In the described process, the $Zn_3(PO_4)_2$ containing preparation/mixture is further processed, involving potentially the following steps:

- Reception/unpacking of material
- Final application, spraying, embedding or to produce the end product or article.

Product characteristics

Product related conditions:

$Zn_3(PO_4)_2$ (or Zn compound) in the article is < 25%

Amounts used

Daily and annual amount per site:

- The quantities involved in this scenario are 10-50 times smaller than in blending (GES 4-GES 5); the concentration of the zinc substance is also lower (<25%).
- Typical quantities for both industrial and professional are 50T/y (typical), maximum 500T/y (in industrial setting).

Frequency and duration of use

Continuous production is assumed as a worst case. Usually, use is not continuous; this has to be considered when estimating exposure.

Environment factors not influenced by risk management

Flow rate of receiving surface water:

default for generic scenario: 18,000 m^3/d, unless specified otherwise

Other given operational conditions affecting environmental exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air;

- Wet processes. All process and non-process waters should be recycled internally to a maximal extent. Even when no process waters occur, some non-process water can be generated containing zinc (e.g. from cleaning)
- In industrial and professional setting, all processes are performed in a confined area. All residues containing zinc are recycled.

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

Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factor in section 9.x.2 of the CSR);

- In industrial and professional setting the following applies:
  - Process enclosures where relevant and possible
  - Local exhaust ventilation on furnaces and other work areas with potential dust generation.
  - Dust capturing and removal techniques are applied.
  - Containment of liquid volumes in sumps to collect/prevent accidental spillage

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

Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m^3/d), degradation effectiveness and sludge treatment (if applicable);

- In industrial and professional setting, the following applies:
  - If zinc emissions to water, on-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g.: chemical precipitation, sedimentation and filtration (efficiency 90-99.98%).
    - By exposure modelling it is predicted that at use quantities of >100T/y, refinement of the exposure assessment to water and sediment needs to be made (exposure assessment based on real measured data and local parameters). Treatment of the emissions to water may be needed under such conditions (see "exposure estimation and risk characterisation").
  - Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric or bag filters, wet scrubbers. This may create a general negative pressure in the building.

Organizational measures to prevent/limit release from site

Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions.

In general, emissions are controlled and prevented by implementing an appropriate management system. This would involve:

- information and training of workers,
- regular cleaning of equipment and floors,
- procedures for process control and maintenance,...
- Treatment and monitoring of releases to outside air, and exhaust gas streams, according to national regulation.
- SEVESO 2 compliance, if applicable.

Conditions and measures related to municipal sewage treatment plant

Size of municipal sewage system/treatment plant (m^3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable); please note*: the default size of the municipal STP (2000 m^3/d) will be rarely changeable for downstream uses.*

In cases where applicable: default size, unless specified otherwise.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;

- At industrial scale:

Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the zinc content of the waste is elevated enough, internal or external recovery/recycling might be considered.

Fraction of daily/annual use expected in waste:
Zinc producers = 3.1 %
Zinc compound producers = 0.056 %
Downstream users = 0.30 %

Appropriate waste codes:

02 01 10*	06 03 13*	06 03 14	06 03 15*	06 04 04*	06 04 05*	06 05 02*	08 01 11*	10 05 01	10 05 03*
10 05 05*	10 05 06*	10 05 11	10 05 99	10 10 03	10 10 05*	10 10 07*	10 10 09*	10 10 10	10 10 11*
11 01 09*	11 02 02*	11 02 03	11 02 07*	12 01 03*	12 01 04	12 01 12*	15 01 04*	15 01 10*	15 02 02*
16 01 04*	16 01 06*	16 01 18*	16 06 02*	16 08 02*	16 08 03*	16 11 02	16 11 03*	16 11 04	16 11 06
17 04 07*	17 04 09*	17 09 04*	19 02 05*	19 10 02*	19 12 03*				

Suitable disposal: Keep separate and dispose of to either
Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste,
Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.
Hazardous landfill operated under Directive 1999/31/EC.

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request

- At professional scale:

Fraction of daily/annual use expected in waste: 42% of all articles, 58% of the zinc used is recycled.

Appropriate waste codes:

20 01 34	20 01 40	20 03 01	20 03 07

Suitable Disposal:
Waste from end-of-life articles can be disposed of as municipal waste, except when they are separately regulated, like electronic devices, batteries, vehicles, etc.
Disposal of wastes is possible via incineration (operated according to Directive 2000/76/EC on the incineration of waste) or landfilling (operated according to Reference Document on the Best available Techniques for Waste Industries of August 2006 and Council Directive 1999/31/EC and Council Decision 19 December 2002).

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2012 available on request)

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;

- All residues are recycled or handled and conveyed according to waste legislation.

b) Contributing scenario (2) controlling worker exposure for the Industrial and professional use of dispersions, pastes and polymerised substrates containing less than 25%w/w of $Zn_3(PO_4)_2$.

Product characteristic

Product related conditions, e.g. the concentration of the substance in a mixture, the physical state of that mixture (solid, liquid; if solid: level of dustiness), package design affecting exposure)

The concentration of $Zn_3(PO_4)_2$ (or Zn compound) in the mixture is < 25%

- Particles can occur sporadically, the low level of dustiness is basically applied.
- Most of the processes imply the use of solutions or pastes; the "solution status" is therefore taken as the worst case.

Amounts used

Amounts used at a workplace (per task or per shift); note: sometimes this information is not needed for assessment of worker's exposure

- The quantities involved in this scenario are 10-50 times smaller than in blending (GES 5-GES 5); the concentration of the zinc substance is also lower (<25%).
- Typical quantities for both Industrial and professional are 50 T/y (typical), or 0.15 T/day, 0.05 T/shift.
- maximum use quantity is 500T/y (1.5T/d, 0.5T/shift) in industrial setting.

Frequency and duration of use/exposure

Duration per task/activity (e.g. hours per shift) and frequency (e.g. single events or repeated) of exposure

8 hour shifts (default worst case) are assumed as starting point; it is emphasised that the real duration of exposure could be less. This has to be considered when estimating exposure.

Human factors not influenced by risk management

Particular conditions of use, e.g. body parts potentially exposed as a result of the nature of the activity

Uncovered body parts: (potentially) face

Other given operational conditions affecting workers exposure

Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process into workers environment; room volume, whether the work is carried out outdoors/indoors, process conditions related to temperature and pressure.

- Industrial / Professional:
  - Wet processes, all indoor in confined area.

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

Process design aiming to prevent releases and hence exposure of workers; this in particular includes conditions ensuring rigorous containment; performance of containment to be specified (e.g. by quantification of residual losses or exposure)

- Industrial /professional
  - Local exhaust ventilation on work areas with potential dust generation, dust capturing and removal techniques
  - Process enclosures where appropriate

Technical conditions and measures to control dispersion from source towards the worker

Engineering controls, e.g. exhaust ventilation, general ventilation; specify effectiveness of measure

- Industrial /professional:
  - Local exhaust ventilation systems and process enclosures are generally applied
  - Cyclones/filters (for minimizing dust emissions): efficiency 70%-90% (cyclones); dust filters (50-80%)
  - Local exhaust ventilation in work area: efficiency 84% (generic LEV)

Organisational measures to prevent /limit releases, dispersion and exposure

Specific organisational measures or measures needed to support the functioning of particular technical measures (e.g. training and supervision). Those measures need to be reported in particular for demonstrating strictly controlled conditions (to justify exposure based waiving).

In general, management systems are implemented; They include general industrial hygiene practice e.g.:

- information and training of workers on prevention of exposure/accidents,
- procedures for control of personal exposure (hygiene measures)
- regular cleaning of equipment and floors, extended workers instruction-manuals
- procedures for process control and maintenance,...
- personal protection measures (see below)

Conditions and measures related to personal protection, hygiene and health evaluation

Personal protection, e.g. wearing of gloves, face protection, full body dermal protection, goggles, respirator; specify effectiveness of measure; specify the suitable material for the PPE (where relevant) and advise how long the protective equipment can be used before replacement (if relevant)

Wearing of gloves and protective clothing is compulsory (efficiency >=90%).

With normal handling, no respiratory personal protection (breathing apparatus) is necessary. If risk for exceedance of OEL/DNEL, use e.g.:

- dust filter-half mask P1 (efficiency 75%)
- dust filter-half mask P2 (efficiency 90%)
- dust filter-half mask P3 (efficiency 95%)
- dust filter-full mask P1 (efficiency 75%)
- dust filter-full mask P2 (efficiency 90 %)
- dust filter-full mask P3 (efficiency 97.5%)

Eyes: safety glasses are optional

2.7 GES $Zn_3(PO_4)_2$-8: Generic wide dispersive use of Zn

A generic scenario on consumer STP (wide dispersive use) was developed.

2.7.1 Generic wide dispersive use of zinc

Use descriptors

8a, 8b, 8c, 8d, 8e, 8f, 9a, 9b, 10a, 10b, 11a, 11b

Additional information

This generic exposure scenario has been created based on measured zinc concentrations in effluents from municipal STPs

2.7.2 Controlling environmental exposure

Product characteristics

Zinc is used in a variety of formulations or articles used by consumers

Amounts used

Total amounts used are not relevant since the assessment is done based on concentrations in STPs

Frequency and duration of use

Releases occur for 365 day/year, it's a wide dispersive use and STPs are also operating 365 day/year.

Environment factors not influenced by risk management

Information type	Dilution factor	Remarks
Selected for Exposure Scenario	*10*	*Freshwater default*

Other given operational conditions affecting environmental exposure

Indoor or outdoor use of products containing zinc is possible; zinc can be used in formulations that go down the drain but also in articles with non-intended releases.

Conditions and measures related to municipal sewage treatment plant

All releases are going directly into a municipal sewer. The releases are treated in an STP with removal efficiency for zinc of 80 %.

The STP is dimensioned according to the defaults in EUSES. I.e. 10,000 inhabitants equivalents and 2,000 m^3/day water treated per day.

Zinc concentrations in effluents of municipal STPs have been collected in a separate report. (Evaluation of risks due to the presence of zinc in European Sewage Treatment Plants, 2013)

The 90^{th} percentile is 91.6 µg Zn/L and reflect the situation of a realistic worst case region, Flanders (Belgium), ***in terms of population density, and density of agricultural and industrial activities.*** *The natural sources are subtracted from that 90^{th} percentile resulting in a zinc concentration of 77.6 µg/L coming from wide dispersive use of zinc in consumer products and articles.*

2.7.3 Exposure estimation and reference to its source

	Compartment	Operational conditions	Value	Unit	$PNEC_{add}$	RCR
ES 1	*PEC_{tot} stp*	*90^{th} P of zinc conc. in effluents of STPs minus the natural sources: 77.6 µg Zn/L*	*77.6*	*µg/L*	*100*	*0.78*
	PEC_{tot} freshwater		*6.4*	*µg/L*	*34.3*	*0.19*
	PEC_{tot} sediment		*73.4*	*mg/kg dw*	*117.8*	*0.62*
	PEC_{tot} soil		*55.0*	*mg/kg dw*	*107*	*0.51*

2.7.4 Guidance to DU to evaluate whether he works 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 DU 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 R16). For environmental exposure, a DU-scaling tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool) is available.

2.8 Consumer exposure

2.8.1 Introduction

$Zn_3(PO_4)_2$ can be used in several consumer products: in paint (also anti-corrosive paints), lacquers and varnishes, corrosion inhibitors, fillers, and surface treatment. In these products the percentage of zinc phosphate ranges from 0 to 20%.

Consumer exposure was assessed in detail in the EU risk assessment (Part: human health). In this assessment, it was remarked that the total daily consumer exposure could be higher than from the substance alone, by the use of consumer products containing other zinc substances at the same time. Therefore, the RA made an integrated analysis of human consumer exposure from all main consumer products (containing different zinc substances) combined. Since this combined exposure is the reality of consumer exposure, this approach is also followed in the present analysis.

The risk assessment identified the main possible sources of consumer exposure. Since the pattern of consumption of consumer products containing zinc substances has not changed significantly after the closure of the risk assessment, the analysis made in the RA is considered still relevant for the consumer exposure at present and taken over in this CSR. Conform to the approach followed in the RA, the consumer exposure analysis is identical for all zinc substances. The RA analysis indeed included not only exposure from the products, containing the 6 zinc substances evaluated under 793/93/EEC, but also the exposure from products containing other, e.g. organic zinc substances.

Related to the calculations of exposure, the main assumptions made in the RA were that uptake through inhalation was negligible and that the dermal absorption of the zinc compounds from any of the consumer products is 2% for solutions/suspensions, and 0.2% for dust/powder (same values as applied in the industrial environment).

2.8.2 Consumer exposure analysis of the RA (ECB 2008)

Remark: The section below is identical for all six zinc compounds evaluated under EU Regulation 793/93. Specific information is available for five of the six zinc compounds under evaluation (zinc phosphate, zinc distearate, zinc oxide, zinc chloride and zinc sulphate), as well as for some other zinc compounds not under evaluation. The latter information has also been included, because consumers (knowingly or unknowingly) at the same time can be exposed to several zinc-containing products, and irrespective of the original zinc compounds in these products, exposure will ultimately be to Zn^{2+}.

<u>paint</u>

- Anti-corrosive primer containing 30% zinc phosphate.
  Assuming a frequency of 0.5 events/year with a dermal exposure of 2.7 g (paintbrush) or 10.8 g (spraying; roughly estimated as 4x paintbrush) primer/event, the maximum exposure will be 1.62 g zinc phosphate/year ≈ 2.25 mg Zn^{2+}/day. With a dermal absorption of 2% the uptake is estimated to be 0.045 mg Zn^{2+} /day.

- Impregnating agent containing 40% zinc naphthenate.
  Assuming a frequency of 0.5 events/year with a dermal exposure of 2.7 g impregnating agent/event, the exposure will be 0.54 g zinc naphthenate/year ≈ 0.44 mg Zn^{2+}/day (percentage of zinc in zinc naphthenate is estimated at 30%). With a dermal absorption of 2% the uptake is estimated to be 0.0088 mg Zn^{2+}/day.

<u>cosmetics</u>

- Eye shadow containing 10% zinc distearate (it mainly concerns glossy, emulsion-like eye shadows).
  By an application of 10 mg/event for 3 times/day, the exposure to eye shadow is 30 mg/day, which contains 3 mg zinc distearate ≈ 0.31 mg Zn^{2+}/day. Assuming a dermal absorption of 2% the uptake is estimated to be 0.0062 mg Zn^{2+} /day.

- Sunscreen containing 10% zinc oxide (refers to a protection factor 20-25!).
  By an application of 9 g sunscreen/event, 3 events/day during 18 days/year the exposure will be 1332 mg sunscreen/day, being 107 mg Zn^{2+}/day. Assuming a dermal absorption of 2% the uptake is estimated to be 2.14 mg Zn^{2+}/ day.

- Deodorant contains 10-20% large organic zinc compounds, but apparently no ZnO.
  The dermal exposure is 3 g or 0.5g/event by using a spray or a roll-on, respectively. In both cases the use is once a day. Maximum dermal exposure to deodorant is 3000 mg/day ≈ 300 mg zinc compounds/day ≈ 30 mg Zn^{2+}/day (percentage of zinc in these zinc compounds is estimated at 10%). Assuming a dermal absorption of 2% the uptake is estimated to be 0.6 mg Zn^{2+}/day.

- Dandruff shampoo containing 5% zinc compounds such as zinc pyrithione and zinc omadine (5% is estimated based on other active components in dandruff shampoos).
  By a usage of 12 g shampoo/event for 4 times/week, the dermal exposure to shampoo will be 6800 mg/day with a content of 340 mg zinc compounds. Assuming that 10% of these compounds consist of zinc and that the dermal absorption is 2%, the uptake via the use of dandruff shampoo will be 0.68 mg Zn^{2+}/day.

<u>drugstore products</u>

- 'Baby care' ointment containing 15% zinc oxide for the irritated skin (intensive ointment) or 5% zinc oxide for protective treatment when changing diapers.
  The assumption was made that the usage will be 50 g of the intensive ointment/year, leading to a dermal exposure of 7.5 g ZnO/year ≈ 16.5 mg Zn^{2+}/day. Assuming a dermal absorption of 2% the uptake is estimated to be 0.33 mg Zn^{2+}/day.

- Gargle containing 6.88 mg zinc chloride/ml.
  Assuming a use of 10 g gargle/event (≈ 10 ml/event), 4 times/day for 4 weeks/year, and the exposure during these 4 weeks will be 1120 g gargle/year ≈ 3.1 g gargle/day, which is ≈ 10 mg Zn^{2+}/day. Assuming that almost nothing will be swallowed, there is only buccal uptake via the mucous membranes. As the contact time is very short, the uptake is assumed to be very limited. Hence, with an arbitrary absorption value of 2% the uptake is estimated to be 0.2 mg Zn^{2+}/day.

- Eye drops containing 0.25% zinc sulphate (2.5 mg/ml).
  The assumption was made that the usage will be 2 eye drops (0.025 ml/drop)/event, 6 times/day during 4 weeks/year, leading to an exposure of 8.4 ml eye drops/year ≈ 23 mg eye drops/day ≈ 0.058 mg zinc sulphate/day ≈ 0.023 mg Zn^{2+}/day. Assuming an absorption of 2% the uptake is estimated to be 0.00046 mg Zn^{2+}/day.

- Zinc oil containing 60% ZnO, which is merely used medically for the treatment of skin disorders.
  The assumption was made that the usage will be 100 g/year, leading to an exposure of 60 g ZnO/year ≈ 0.131 g Zn^{2+}/day. Assuming a dermal absorption of 2% the uptake is estimated to be 2.62 mg Zn^{2+}/day.
  Remark: it is noted that with skin disorders uptake might be higher than 2%. However, how much more is not known. Besides, it is not expected that the possible higher amount absorbed will disturb the homeostatic balance.

- Dietary supplements containing zinc.
  Results from a recent report on the food intake of the general population in the Netherlands (Hulshof et al., 1998) indicate that approximately 10% of the population uses dietary supplements, which amongst others can contain zinc. As it is not known how much zinc-containing dietary supplements are used and in what frequency, it is difficult to estimate the exposure to zinc from dietary supplements from this report.
  A dietary survey in the UK showed that <1-3% of the participants in different age groups took zinc supplements, providing median zinc intakes of 0.3-3.4 mg/day. However, the contribution of this supplemental zinc intake to the population average zinc intakes from food and supplements combined was negligible (EVM, 1999).

<u>Conclusion</u>

The compound specific exposure estimates for the different zinc compounds are taken across to the risk characterisation. However, the total daily exposure to zinc can be higher since several zinc compounds are used in consumer products. Not all of these products are used regularly or at the same time (see above). It is assumed that dandruff shampoo, deodorant, eye shadow, and possibly baby care ointment will be used on a regular basis (more than once a week), resulting in a cumulative uptake of approximately 1.6 mg Zn^{2+}/day. Therefore this value will also be taken across to the risk characterisation, as this is a more realistic calculation of the daily consumer exposure to zinc.

2.8.3 Human health risk characterisation related to combined exposure (consumers: combined for all exposure routes)

Conform to the approach followed in the EU risk assessment, consumer exposure was assessed by combining the main possible sources of consumer products containing all zinc substances together. Table 7 (taken from the Risk Assessment RA) summarises this combined exposure.

Table 7: Consumer exposure estimates:

	Internal exposure (compound specific)	internal exposure (not compound specific)
zinc metal	negligible	
zinc oxide	2.5 mg Zn^{2+}/day (5.1 including medically used zinc oil)	
zinc chloride	0.2 mg Zn^{2+}/day	
zinc sulphate	0.00046 mg Zn^{2+}/day	
zinc phosphate	0.045 mg Zn^{2+}/day	
zinc distearate	0.0062 mg Zn^{2+}/day	
personal care products used regularly		1.6 mg Zn^{2+}/day

For Zinc phosphate only data on the use of zinc phosphate in paint are available in the RA. For this use, a consumer exposure of 0.045 mg zinc/day was calculated.

Conclusion:

Considering these data, the EU risk assessment concluded the following:

Given the data available, it is concluded that zinc phosphate is of no concern for consumers with respect to acute toxicity, skin, eye and respiratory tract irritation, corrosivity and skin sensitisation.

Repeated dose toxicity

Starting point for the risk characterisation for systemic effects is the human oral NOAEL of 50 mg zinc/day. Assuming 20% absorption, this NOAEL corresponds to an internal dose of 10 mg zinc/day. The risk ratio between this (internal) NOAEL and the internal exposure by the use of paint (0.045 mg/day) is 0.0045.

However, consumer products containing zinc phosphate are probably not used regularly. Besides, consumers can also be exposed to other zinc compounds in consumer products, some of which may be used on a regular basis (more than once a week). The use of regularly used products (dandruff shampoo, deodorant, eye shadow, and possibly baby care ointment) results in a cumulative (internal) exposure of approximately 1.6 mg zinc/day. Comparing the (internal) NOAEL with this more realistic exposure, a risk ratio of 0.16 can be calculated.

These risk ratios are considered sufficiently small and it can be concluded that there is no concern for consumers, neither for zinc phosphate nor for regularly used zinc compounds taken together.

Mutagenicity/Carcinogenicity/Reproductive toxicity

Given the results from the mutagenicity studies, it is concluded that zinc phosphate is of no concern for consumers with regard to mutagenicity.

As there is no experimental or epidemiological evidence for carcinogenicity, there is no concern for carcinogenicity.

Given the data available, it is concluded that zinc phosphate is of no concern for reproductive toxicity

2.8.4 Indirect exposure of humans via the environment

The EU risk assessment (ECB 2008) assessed the risks for this scenario. Considering that:

- the production and use pattern of zinc and zinc compounds has not changed significantly since the closure of the RA, and
- the RA calculated the exposure through air and water based on the reported emissions data for zinc towards the air and water environment. These emissions have further decreased since the closure of the RA, so the analysis of the RA can be considered as realistic, but conservative for the situation today.

The analysis made in the framework of the EU RA is taken over in the present analysis as a conservative, realistic assessment of exposure of man through environment.

The related sections out of the **zinc phosphate** RA are taken over below. It should be noted that in this section the zinc cation is discussed, not the salt from which it originates.

General exposure

The most important exposure to zinc for the general population is by the ingestion of foods. Especially meat and meat products, milk and milk products, bread and starchy foods contribute to the dietary zinc intake.
The risk assessment summarised that average dietary intake of zinc by adults in nine European countries was 9.1-12.3 mg/day. Only for adult males in Germany and Italy a higher daily dietary intake of 14-15 mg/day was reported. Figures for the Netherlands reporting an average daily intake of zinc of 9.4 mg (minimum of 0.6 mg and a maximum of 39 mg) confirmed this range. A 95-percentile value of 15.4 mg (P_5=4.7, P_{10}=5.5, median=9.0, P_{90}=13.8) was calculated. The Dutch intake figures were based on a random group of 6,250 persons.
The differences in zinc intake vary due to source and variety of the food.

An epidemiological study has been carried out by Kreis (1992) in which the health effects of cadmium (and zinc) were investigated in a contaminated area in the southern part of the Netherlands (Kempenland). A population sample aged 30-69, with a residence of at least 15 years in a rural village in Kempenland (NL) was compared with a control population of an unpolluted area. About 75% of the inhabitants of both areas consumed at least half of their vegetables from local gardens. The plasma concentration of zinc did not differ between the exposed (n = 299) and the reference population (n = 295) after adjustment for age and gender. The author concluded that, in contrast to cadmium, zinc exposure probably did not differ between the two villages.

For zinc levels in groundwater, the RA mentioned data for the Netherlands. The National Soil Monitoring Network in the Netherlands reported maximum zinc concentrations in upper groundwater of 1.1 mg/l (cattle farms) and 3.1 mg/l (forest locations). Recent zinc concentrations in large surface water in the Netherlands are reported to be all below 0.1 mg/l. Recent atmospheric zinc concentrations in the Netherlands were reported to be below 0.1 µg/m^3 (annual averages). Higher concentrations, up to 14 µg/m^3, were reported for Belgium (older data).
Under normal conditions, drinking water and ambient air are minor sources of zinc intake. Cleven et al. (1993) estimated the intake by drinking water and ambient air to be <0.01 mg/day and 0.0007 mg/day, respectively. The monitoring data above indicate somewhat higher intakes, but it is to be noted that nowadays in the EU upper groundwater and large surface water are not directly representative for drinking water. It was mentioned that in the Netherlands, monitoring of zinc in drinking water was ceased (at water companies) or about to be ceased (at pump stations) (pers. comm. by RIVM-LWD, 1999).
It was concluded that the recent average dietary intake of zinc is around 10 mg/day. This value is taken across to the risk characterisation. Compared to this intake via food, intake via drinking water and ambient air is considered negligible.

Local exposure zinc phosphate

<u>Estimated local zinc concentrations in water and air around industrial facilities</u>
In the RA, surface water maximum local zinc concentrations (PEC_{add}s) of 1.23 µg/l and 175 µg/l (total zinc) were estimated for the production and processing of zinc phosphate, respectively (see 3.2.1.2).
Maximum atmospheric zinc concentrations (PEC_{add}s) were 0.285 µg/m^3 and 2.51 µg/m^3, for production and processing, respectively (see 3.2.1.2).

The PEC_{add}s mentioned above are taken across to the risk characterisation.

Conclusion:

In the EU risk assessment, the ingestion of foods was considered to be the most important exposure route of zinc for the general population, compared to which the intake by drinking water and ambient air is negligible. Recently, the average dietary intake of zinc is reported to be around 10 mg/day with a minimum of 0.6 mg and a maximum 39 mg. Both the reported average intake and the maximum intake are well below the human oral NOAEL of 50 mg/day and also well below the upper limit of safe intake as recommended by WHO (45 mg/day; 1996). Hence, it can be concluded that there is no concern for the general population exposed indirectly to zinc via the environment.

As there is no experimental or epidemiological evidence for carcinogenicity, there is no concern for carcinogenicity.

Given the data available, it is concluded that zinc phosphate is of no concern for reproductive toxicity.

End of Extended Safety Data Sheet