10 November 2016

Background document for lead monoxide (lead oxide)

Document developed in the context of ECHA's seventh Recommendation for the inclusion of substances in Annex XIV

ECHA is required to regularly prioritise the substances from the Candidate List and to submit to the European Commission recommendations of substances that should be subject to authorisation. This document provides background information on the prioritisation of the substance, as well as on the determination of its draft entry in the Authorisation List (Annex XIV of the REACH Regulation). Information comprising confidential comments submitted during public consultation(s), or relating to content of registration dossiers which is of such nature that it may potentially harm the commercial interest of companies if it was disclosed, is provided in a confidential annex to this document.

Information relevant for prioritisation and/or for proposing Annex XIV entries provided during the public consultation on the inclusion of lead monoxide on the authorisation list or in the registration dossiers (as of the last day of the public consultation, i.e. 18 February 2016) was taken into consideration when finalising the recommendation and is reflected in the present document.

The background document also describes how ECHA has taken into account the MSC opinion.

Contents

1. Identity of the substance

Chemical name: Lead monoxide (lead oxide)
EC Number: 215-267-0
CAS Number: 1317-36-8
IUPAC Name: Lead monoxide

2. Background information for prioritisation

Priority was assessed by using the General approach for prioritisation of SVHCs for inclusion in the list of substances subject to authorisation[1]. Results of the prioritisation of all substances included in the Candidate List by June 2014 and not yet included or recommended in Annex XIV of the REACH Regulation is available at http://echa.europa.eu/documents/10162/13640/prioritisation_results_CL_substances_nov_2015_en.pdf.

The prioritisation results of the substances included in the draft 7th recommendation have been updated as necessary after the public consultation. The updated results are available at https://echa.europa.eu/documents/10162/13640/prioritisation_results_draft7threc_substances_feb2016_en.pdf

2.1. Intrinsic properties

Lead monoxide was identified as a Substance of Very High Concern (SVHC) according to Article 57 (c) as it is classified in Annex VI, part 3, Table 3.1 (the list of harmonised classification and labelling of hazardous substances) of Regulation (EC) No 1272/2008 as Toxic for Reproduction, Category 1A, H360D ("May damage the unborn child"), and was therefore included in the Candidate List for authorisation on 19/12/2012, following ECHA's decision ED/169/2012.

2.2. Volume used in the scope of authorisation

The amount of lead monoxide manufactured and/or imported into the EU is according to registration data above 100,000 t/y (approx. 540,000 t/y according to information submitted in the public consultation on the 6th draft Annex XIV recommendation (ComRef, 2015)).

Part of the volume is for uses that appear not to be in the scope of authorisation, such as uses as intermediate in the manufacture of PVC stabilisers, certain pigments, explosives, technical ceramics, frits and glass (including lead special glass and lead crystal glass) as well as some uses as laboratory reagent and in chemical analysis. Based on information provided during the public consultation on the 6th draft recommendation, the share of the total tonnage for these uses is estimated at ~6.5%. It is recognised that the intermediate/non-intermediate status of some of these uses is a complex issue (e.g. in the manufacture of glass and frits), and it is stressed that this prioritisation exercise is not taking a formal position whether certain uses of the substance are regarded as uses as intermediates in accordance with the definition in Article 3(15).

Therefore, in conclusion, the volume in the scope of authorisation is estimated to be in the range of 100,000 - 1,000,000 t/y based on registrations and further information.

[1] Document can be accessed at http://echa.europa.eu/documents/10162/13640/gen_approach_svhc_prior_in_recommendations_en.pdf

More detailed information on the main uses and the relative share of the total tonnage is provided in Annex I.

2.3. Wide-dispersiveness of uses

Registered uses of lead monoxide which appear to be in the scope of authorisation include uses at industrial sites (e.g. production of batteries and rubber, use in adsorbents and catalysts) (ECHA, 2016).

In addition, according to the information submitted during the public consultation on the 6th draft recommendation, the substance is also used for surface treatment (plating) and in lubricant/corrosion inhibitor products in the aerospace industry (ComRef, 2015).

Professional uses as laboratory reagent and in chemical analysis are registered and the information provided indicates that the conditions for the generic exemption for SRD are not always met (based on the tonnage for that use)[2]. However, based on the information provided in registrations and during the public consultation on the 6th draft recommendation it appears that the use may rather fulfil the description of an industrial use (use limited to industrial facilities and does not seem to be widespread).

Finally, according to registrations the substance is used in articles (e.g. rubber articles).

Some uses have been reported in registrations which however may not take place anymore:

During the public consultation on the SVHC identification (RCOM, 2012) non-registered, potentially professional, uses in graphite containing dispersion pastes, machining, scraping compounds and friction breaks were mentioned by industry. However the lead registrant in a recent update of its registration dossier specified that these uses did not happen/do not happen anymore and provided further information on why these uses were mentioned before.

The lead registrant and most of the member registrants have updated their registrations in April - June 2014. They have, inter alia, removed the professional and consumer use in paints and pigments (e.g. artists' paints) from their registrations. There are some members who have not updated their registration and the professional and consumer uses in paints (and professional use of adsorbents) remain in their dossiers. Other members have updated their dossiers and kept these uses. However, all these members refer to the lead registrant's CSR which no longer supports these uses. No own CSRs have been received from these members.

More detailed information on uses is provided in Annex I.

2.4. Further considerations for priority setting

It appears that lead monoxide is used in similar applications (batteries) with orange lead (lead tetroxide), pentalead tetraoxide sulphate and tetralead trioxide sulphate. However, it has not been assessed whether the function of these substances in these applications is the same and whether or under which conditions substitution could happen in practice.

[2] Information confirmed by the Precious Metals and Rhenium Consortium (ComRef, 2016)

2.5. Conclusion

Verbal descriptions and Scores			Total Score (= IP + V + WDU)	Further considerations
Inherent properties (IP)	Volume (V)	Wide dispersiveness of uses (WDU)		
Lead monoxide is classified as toxic for reproduction 1A meeting the criteria of Article 57(c) Score: 1	The amount of lead monoxide used in the scope of authorisation is >10,000 t/y Score: 15	Lead monoxide is used at industrial sites. Initial score: 5 Furthermore, the substance is used in articles in volumes >10 t/y (e.g. rubber articles) Refined score: 7	23	Grouping of lead monoxide with other lead substances used in batteries

Conclusion

On the basis of the prioritisation criteria further strengthened by grouping considerations, lead monoxide receives priority among the substances in the Candidate List (see link to the prioritisation results above). Therefore, **lead monoxide is recommended for inclusion in Annex XIV.**

3. Background information for the proposed Annex XIV entry

Draft Annex XIV entries were determined on the basis of the General approach for preparation of draft Annex XIV entries for substances to be included in Annex XIV[3]. The draft Annex XIV entries that underwent public consultation are available at:
http://echa.europa.eu/documents/10162/13640/7th_recom_draft_axiv_entries_en.pdf .

The final draft Annex XIV entries that ECHA recommends are available at:
https://echa.europa.eu/documents/10162/13640/7th_axiv_recommendation_november2016_en.pdf.

3.1. Latest application and sunset dates

The LAD slots are set in 3-month intervals (normally 18, 21 and 24 months after inclusion in Annex XIV but more slots can be considered on a case-by-case basis). In its draft recommendation ECHA had seen no reason to deviate from the three LAD slots of 18, 21 and 24 months after inclusion in Annex XIV that are normally assigned in a recommendation. Lead monoxide had been considered to be placed in the same slot with the other lead substances in this draft recommendation. Lead substances (including lead monoxide) were assigned to the 3rd LAD slot due to the potentially high number of uses and overall complexity of supply chain.

During the public consultation, based on the same considerations (high number of uses and complexity of the supply chain) the International Lead Association (ILA) and one company required extending the LAD of lead monoxide and orange lead to 35 months. The comments referred also to the precedent created by chromate compounds (Regulation 348/2013) and to the MSC opinion on the draft 6th recommendation adopted on 11 June 2015 (in which the MSC recommended a 35 months LAD for lead monoxide and orange lead). The request for a latest

[3] Document can be accessed at
http://echa.europa.eu/documents/10162/13640/recom_general_approach_draft_axiv_entries.pdf

application date of 35 months was also seconded by the Aerospace and Defence industry on the basis that the sector operates very long life cycle products for which the upkeep of legacy products need to be ensured.

In its opinion[4] the MSC proposes the consideration of a latest application date of 30 months for orange lead and lead monoxide. This proposal is based on the comments made during the public consultation.

ECHA has carefully assessed the requests made in the comments submitted in the public consultation as well as the MSC opinion. The use of a substance in legacy spare parts as described above appears to ECHA not to be a reason to prolong LADs. ECHA fully agrees that complexity of the supply chain seems to be one of the main factors affecting the time needed to prepare an application for authorisation. Furthermore, ECHA agrees that lead monoxide and orange lead have a high number and a high diversity of uses. In recognition of the concerns raised and to support a better spread of the workload for the Committees (RAC and SEAC), Commission and ECHA secretariat, ECHA recommends a longer LAD for lead monoxide and orange lead than proposed in the draft recommendation.

ECHA recommends the following transitional arrangements:

Latest application date (LAD):	Date of inclusion in Annex XIV plus **27 months**
Sunset date (SSD):	18 months after LAD

It is recognised that lead monoxide and orange lead are used in similar applications as pentalead tetraoxide sulphate and tetralead trioxide sulphate for which a LAD of 24 months is recommended (e.g. production of batteries). The recommended LADs do not impede joint applications for authorisation for those uses that are similar for the 4 substances. Applicants can always submit an application for authorisation before the latest application date.

More information on the structure and complexity of the supply chain of lead monoxide is provided in Annex I (section 3).

3.2. Review period for certain uses

In its draft recommendation ECHA had seen no ground to include in Annex XIV any review period.

During the public consultation ECHA did not receive comments requesting upfront review period for certain uses.

ECHA therefore **does not recommend to include in Annex XIV any review periods** for uses of lead monoxide.

[4] MSC opinion on ECHA's 7th draft recommendation

3.3. Uses or categories of uses exempted from authorisation requirement

3.3.1. Exemption under Article 58(2)

In its draft recommendation, ECHA had not proposed any exemption for (categories of) uses of lead monoxide on the basis of Article 58(1)(e) in combination with Article 58(2) of the REACH Regulation.

During the public consultations on the draft 6th recommendation and on the draft 7th recommendation[5], ECHA received a number of requests for exemptions, for specific uses or broader spectrum of uses (e.g. covered by certain legislation) (ComRef, 2015; ComRef, 2016). The list of uses for which an Article 58(2) exemption request has been received is presented in the table below for the 4 lead substances included in the draft recommendation. Many of these requests refer to the extensive body of legislation relevant to lead and its compounds.

Table 1. Uses of lead compounds for which an Article 58(2) exemption request has been received.

Substance	**Use**
Lead monoxide, lead tetroxide, pentalead tetraoxide sulphate and tetralead trioxide sulphate	Batteries
Lead monoxide and lead tetroxide	Manufacture of pyrochlore antimony lead yellow
Lead monoxide and lead tetroxide	Technical / Piezo-ceramics
Lead monoxide and lead tetroxide	Frits
Lead monoxide and lead tetroxide	Glass (including special glass and crystal glass)
Lead monoxide	Glass frits (semiconductor industry)
Lead monoxide and lead tetroxide	Rubber
Lead monoxide	Electroplating
Lead monoxide and lead tetroxide	Airlines e.g. lead oxide is used in dry film lubricant products (and in batteries)
Lead monoxide	Laboratory reagent / processing aid for analysis of precious metal content of secondary and complex materials
Lead monoxide	Propellants in rocket motors
Lead monoxide	Catalysts and adsorbents
Lead monoxide and lead tetroxide	Explosives and detonators
Pentalead tetraoxide sulphate and tetralead trioxide sulphate	PVC stabiliser (virgin and recycled PVC)

[5] All exemption request submitted during the public consultation on the 6th and on the 7th draft recommendation are assessed in the 7th recommendation round, this is as the substance was not included in the 6th recommendation.

Lead monoxide	Manufacture of PVC stabilisers
Tetralead trioxide sulphate	Production of microporous plastic separators for lead-based batteries

After assessing the information provided in the public consultations, the MSC in its opinion concludes that there could possibly be grounds for exemptions from authorisation for the uses of lead monoxide, orange lead, pentalead tetraoxide sulphate and tetralead trioxide sulphate that are regulated under the RoHS[6] and ELV[7] legislation. However, MSC notes that these pieces of legislation do not regulate the whole lifecycle and may therefore not offer the same level of protection for the environment or human health as could be achieved under the authorisation scheme.

For other uses of lead monoxide, orange lead, pentalead tetraoxide sulphate and tetralead trioxide sulphate MSC is of the opinion that no information was submitted during the public consultation that would form the basis for inclusion of a specific exemption under Article 58(2) in Annex XIV.

ECHA has carefully assessed the requests made in the comments submitted during the public consultations as well as the MSC opinion.

ECHA's detailed assessment of the requests taking into account the relevant EU legislation is provided in the section 'C.2.1. Response to requests for exemptions under Art. 58(2)' of the Response document to the comments submitted during the public consultation (RCOM, 2016).

ECHA concludes that it is not clear if there is sufficient basis to propose Art 58(2) exemptions for any uses of lead compounds. **ECHA has therefore not suggested exemptions** for uses of lead monoxide on the basis of Article 58(1) (e) in combination with Article 58(2) of the REACH Regulation in its recommendation.

If the Commission were to consider Art 58(2) exemptions possible, uses of lead compounds exempted and subject to regular review under RoHS and ELV legislation may have a stronger case for Art 58(2) exemption than other uses.

During the public consultation (both on the 6th and 7th draft recommendation) a large number of comments were submitted stating that some uses should be exempted from authorisation based on the statement that the use would fulfil the definition of an intermediate use according to Article 3(15) of REACH. ECHA notes that if a use falls under the generic exemptions from authorisation, there is no need to propose an additional specific exemption.

3.3.2. Exemption of product and process oriented research and development (PPORD)

In its draft recommendation ECHA had not proposed to include in Annex XIV any exemption from

[6] Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011L0065&from=en

[7] Directive 2000/53/EC on end-of life vehicles: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02000L0053-20130611&qid=1405610569066&from=EN

authorisation for the use of lead monoxide for PPORD.

During the public consultations on the draft 6th recommendation and on the draft 7th recommendation[8] ECHA did not receive requests for such type of exemption.

ECHA therefore **does not recommend exempting any use of lead monoxide for PPORD** from authorisation.

[8] All exemption request submitted during the public consultation on the 6th and on the 7th draft recommendation are assessed in the 7th recommendation round, this is as the substance was not included in the 6th recommendation.

4. References

ComRef (2016): "Comments and references to responses" document. Document compiling comments and references to respective answers from commenting period 18/11/2015 – 18/02/2016 on ECHA's proposal to include lead monoxide in its 7th recommendation of priority substances for inclusion in the list of substances subject to authorisation (Annex XIV).

https://echa.europa.eu/documents/10162/13640/7th_recom_comref_lead_monoxide_en.rtf

ComRef (2015): "Comments and references to responses" document. Document compiling comments and references to respective answers from commenting period 01/09/2014 – 01/12/2014 on ECHA's proposal to include lead monoxide in its 6th recommendation of priority substances for inclusion in the list of substances subject to authorisation (Annex XIV).

http://echa.europa.eu/documents/10162/13640/6th_axiv_rec_comref_lead_monoxide_en.pdf

ECHA (2016): Lead monoxide. ECHA's dissemination website on registered substances. Accessed on 18 February 2016.

https://echa.europa.eu/search-for-chemicals

RCOM (2012): "*Responses to comments*" document. Document compiled by ECHA from the commenting period 03/09/2012-18/10/2012 on the proposal to identify lead monoxide as a Substance of Very High Concern.

https://echa.europa.eu/candidate-list-table/-/dislist/details/0b0236e1807dc49b

RCOM (2016): "Responses to comments" document. Document compiling the responses to comments from commenting period 18/11/2015 – 18/02/2016 on ECHA's proposal to include lead monoxide, orange lead, pentalead tetraoxide sulphate and tetralead trioxide sulphate in its 7th recommendation of priority substances for inclusion in the list of substances subject to authorisation (Annex XIV).

https://echa.europa.eu/documents/10162/13640/7th_recom_respdoc_leads_en.pdf

ANNEX I: Further information on uses

1. Main (sector of) uses and relative share of the total tonnage

The amount of lead monoxide manufactured and/or imported into the EU is according to registration data above 100,000 t/y (approx. 540,000 t/y according to information submitted in the public consultation on the 6th draft Annex XIV recommendation (ComRef, 2015)).

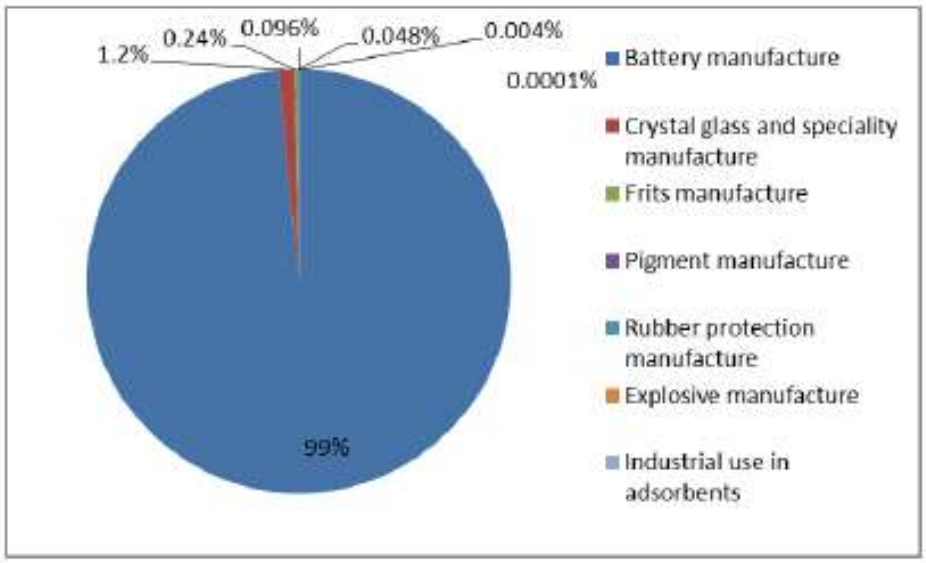
Lead monoxide has several uses in a range of EU industries. Based on information from registration dossiers and information provided by the Lead (Pb) Reach Consortium[9] during the public consultation on the draft 6th recommendation (ComRef, 2015), the uses can be summarised as follow:

- the production of automotive and industrial lead acid batteries represents the main use of lead monoxide since it represents ~94% of its total use;
- the (intermediate) uses of lead monoxide in manufacture of lead based PVC stabilisers comprises most of the rest of the relative share (~5%) (though the use of these stabilisers is being phased out due to an industry voluntary commitment);
- other (intermediate) uses include glass manufacture (1.1%), frits manufacture (0.23%), ceramics and explosive manufacture (0.003%).
- the use in the rubber production accounts for <200 t/y according to the Lead (Pb) Reach consortium, up to ~600 t/y based on other information provided during the 6th recommendation public consultation;
- the use in adsorbents (<50 t/y) and catalysts;
- use as laboratory reagents and in chemical analysis (around 15-20 t/y for the entire precious metals industry in Europe, based on information provided by the Precious Metals and Rhenium Consortium (ComRef, 2016)).

In addition, during the public consultation on the draft 6th Recommendation (ComRef, 2015) industry stated that minor volumes can be used in surface treatment (plating) and in products that provide lubrication and corrosion protection on critical aerospace products.

The figure below presents the end-use pattern of lead monoxide, as defined by the lead registrant in a recent update of its registration dossier (March 2015). It is noted that the (intermediate) use in the manufacture of PVC stabilisers is not reported anymore (suggesting that the volume for that use has significantly decreased).

[9] representing 5 of the lead monoxide registrants, ~80 companies and 12 industry associations representing the predominant uses of lead monoxide



2. Further details on the type of applications and/or functions per use[10]

2.1. Battery production

In lead acid battery production, lead monoxide is used in the production of battery pastes (further details on battery production available in ILA and EUROBAT comments - RCOM, 2012).

Lead-based batteries are widely used in automotive vehicles and industrial motive and standby applications, e.g. in forklift trucks and electric wheelchairs, as Uninterruptible Power Supply (UPS) for hospitals, IT applications and telecommunication systems including both landline and mobile telephone base station applications (RCOM, 2012).

It is reported that approximately one third of the tonnage of lead monoxide used in batteries is used in industrial batteries and the remaining two thirds in automotive batteries (RCOM, 2012).

According to industry, the collection and recycling rate of automotive batteries in Europe is 99%. No precise data for the recycling of industrial lead-based batteries was provided.

2.2. Rubber production

Several uses of lead monoxide in the rubber industry have been reported which include: use as antioxidant especially for use in contact with acids and/or steam (e.g. in rubber rollers, valves and accessories); use as vulcanizing agent (in hoses); use as adhesion promoter and corrosion inhibitor (e.g. in steel cable conveyor belts); use to reduce water absorption in membranes (RCOM, 2012). Lead monoxide is also used in specific applications such as cable insulation and sheating where specifications for electrical performance in wet conditions need to be fulfilled (ComRef, 2015). All the above applications are industrial.

Depending on the specific application, lead oxides might be used to fulfil one or more functions ranging from corrosion protection/antioxidants, water swelling resistance, rubber metal adhesion promoters, functional fillers (as gas diffusion barriers), bonding agent in materials exposed to

[10] The section is limited to uses likely to be in the scope of authorisation

sea and water neutralizers forming insoluble and stable salts to co-agents in rubber crosslinking. In some compounds all these functions need to be fulfilled.

2.3. Adsorbent / catalyst

The use of lead monoxide in adsorbent and catalyst is reported in registrations.

One company commenting during the public consultation on the draft 6th recommendation reported using a low quantity of adsorbent (<50t/y) in the removal of arsine and sulphur compounds from hydrocarbon streams (e.g. cracked gases) (ComRef, 2015).

One catalysts manufacturer commenting during the public consultation on the draft 7th recommendation indicated using lead monoxide for the manufacture of catalysts used exclusively in the oil refining and petrochemicals industries. The substance is used in two types of applications: in catalysts and in catalyst precursors where lead monoxide is fully transformed into lead sulphide before being used as catalyst. In this last application lead monoxide is claimed to be used as intermediate. Other comments received on the use in catalysts relate to the special use of lead acetate where lead monoxide could be formed in the catalyst (e.g. Lindlar catalyst) (ComRef, 2015).

2.4. Anti-corrosion and lubricant products

Lead monoxide is part of formulations used in aerospace and defence industry to provide lubrication and corrosion protection on critical aerospace products where the technical requirements are significantly demanding. Dry film lubricants utilise lead monoxide due to its thermal stability and low coefficient of friction in temperatures up to 650°C. Specialty uses include rings, seals and bearing races (ComRef, 2015).

2.5. Surface treatment

Use of lead monoxide for surface treatment (plating) is reported in comments received during the public consultation on the draft 6th recommendation (ComRef, 2015) for localized and selective applications (e.g. in the manufacture of bearings for equipment such as larger engines and compressors). The treatment can be required at production stage or at maintenance stage for repair purposes. The Printing, Oil & Gas, Marine, Aerospace and Automotive industries are reported to rely on this surface treatment activity (ComRef, 2015).

2.6. Laboratory reagent and in chemical analysis

Use as laboratory reagent and in chemical analysis is reported in several registration dossiers. The Precious Metals and Rhenium Consortium (PMC) commenting on this use during the publication consultation on the draft 7th recommendation indicated that the substance is used when applying the "fire assay" method for the determination of the precious metals content in secondary raw materials and other complex materials.

3. Structure and complexity of supply chains

Detailed information on the structure and complexity of supply chains involved in the use of lead monoxide is not readily available. Indicative information on the sectors concerned can be retrieved from the identity of the comment submitters during public consultations. The following

European sector-specific associations have commented during the SVHC and draft 6th recommendation public consultations[11]:

- ELOA (European Lead Oxide Association, representative of lead oxide manufacturers)
- EUROBAT (Association of European Automotive and Industrial Battery Manufacturers)
- ETRMA (European Tyre & Rubber Manufacturers' Association)
- Europacable
- AEA (European Association of Airlines)
- ACEA (European Automobile Manufacturers' Association)
- PMC (Precious Metals and Rhenium Consortium) hosted by EPMF (European Precious Metals Federation)
- ASD (AeroSpace and Defense Industries association of Europe)

Comments were also received from glass, frits, ceramics, crystal, lead stabilisers and explosives associations[12] which uses of lead monoxide were claimed as intermediate. Based on information available it was concluded that these uses may indeed fulfil the intermediate definition.

3.1. Suppliers

According to ECHA's dissemination website there are 58 active registrants in the EU (ECHA, 2016).

According to one comment submitted by ELOA (European Lead Oxide Association) during the SVHC public consultation (RCOM, 2012), its 6 member companies are producing 95% of the lead oxides produced in EU, out of the battery industry which produces lead oxide for internal consumption in battery manufacturing process.

ELOA's membership has manufacturing facilities in Germany, Spain, Italy or Poland.

3.2. Batteries

During the SVHC and 6th recommendation public consultations, the battery sector has been represented by EUROBAT. EUROBAT is composed of ~40 members who according to EUROBAT represent over 90% of the automotive and industrial battery industry in Europe. EUROBAT membership comprises companies who manufacture and sell batteries, companies that are contractors or suppliers of raw materials, systems or equipment to battery manufacturers, and Battery Systems Integrator Members.

According to information provided by EUROBAT during the SVHC public consultation (RCOM, 2012) ~93% of the lead monoxide used in the battery industry is produced by the battery industry itself. The rest is purchased directly from lead oxide manufacturers operating in the EU.

Based on registration information complemented by information provided during public consultations (ComRef, 2015; RCOM, 2012), it appears that the manufacture of lead monoxide, the production of battery paste and the production steps leading to the final batteries often take place at the same plant. Therefore, it is assumed that the supply chain is in most cases very

[11] Comments submitted do not necessarily relate to supply chain description

[12] Cerame-Unie (the European Ceramics Industry Association), ESGA (European Special Glass Association), EDG (European Domestic Glass Association), Frit Consortium, LightingEurope , ICF (International Crystal Federation), Inorganic Pigments Consortium, European semi-conductor industry association, FEEM (Federation of European Explosives Manufacturers)

short and does not involve formulators.

Europe counts many battery production sites (>50 sites). The production process is likely to be similar in the different plants.

Key countries for lead-based battery manufacture in Europe include the Czech Republic, France, Germany, Italy, Spain, Poland and the United Kingdom.

Recycling of lead-based batteries appears to be done partly by the battery industry itself, partly by other smelters with the secondary lead being reused in the manufacture of lead oxide and tetroxide and new batteries (RCOM, 2012). The batteries returned at e.g. vehicle workshops, vehicle dealerships, accessory shops or DIY stores are picked up at collection points by specialised companies who transport and deliver the batteries to secondary smelting plants.

The battery industry itself and the downstream users are mostly dominated by non-SME companies. SMEs' role is limited to the collection and sorting of end of life batteries (ComRef, 2016).

3.3. Rubber

Lead monoxide is used as additive in rubber materials and further used for specific article applications. These articles are used by a number of sectors including: chemical industry; gas pipe installations; mining industry; automotive industry; cement industry; power plants; ports and inflatable structures manufacturers.

ETRMA (the European Tyre & Rubber Manufacturers' Association) indicates that lead monoxide is 'used in rubber' at 17 European sites located in Germany, the Czech Republic, Slovakia and Greece (ComRef, 2015).

ETRMA further indicates that 80% of rubber companies using lead oxides are represented by SMEs (RCOM, 2012). In the automotive industry there may be between 101-1,000 downstream automobile component manufacturers using the associated rubber products.

Based on the above mentioned information, it is assumed that the supply chain is composed of relatively few formulators (~17 sites), supplying a high number of articles producers, being mainly SMEs.

The supply chain does not seem to include recyclers.

3.4. Adsorbent / catalyst

The uses of lead monoxide in applications such as adsorbents or catalysts seem to be limited to specific industrial applications. The supply chain is likely to be short and would not involve many actors.

3.5. Anti-corrosion and lubricant products

According to comments received during the public consultation on the 6th draft recommendation, lead compounds are widely used within the aerospace industry for maintenance of existing fleets (even though the tonnage for those uses is expected to be low).

It can be reasonably assumed that the supply chain of mixtures containing lead oxide consists of formulators and end-users. Considering the low tonnage involved and the specificity of the applications, the number of formulators is likely to be limited. The number of end-users is likely

to be high (involving e.g. airline companies but also independent MRO (maintenance, repair and overhaul) services in Europe).

3.6. Surface treatment

Use of lead monoxide for surface treatment (plating) is reported for localized and selective applications (e.g. in the manufacture of bearings for equipment such as larger engines and compressors). However, many sectors are reported to rely on this surface treatment activity (Printing, Oil & Gas, Marine, Aerospace and Automotive industries) (ComRef, 2015). Moreover, it is mentioned that treatment can be required at production stage or at maintenance stage for repair purposes. Therefore, it can reasonably be assumed that many small actors may be involved in this activity.

3.7. Laboratory reagent and in chemical analysis

Indication of the uses of lead monoxide as laboratory reagent and in chemical analysis in quantities not exempted from the authorisation requirement came so far only from the precious metal industry. The use is limited to specific industrial applications (fire-assay method for the determination of precious metal content). The supply chain is likely to be short. No indication on the number of end-users is available.