Request for exemption for use of Pb and Cr6+ compounds in electric and electronic initiators of explosives for civil (professional) use

Resumé

Compounds of Pb and Cr6+ are basic raw materials to produce electric and electronica initiators (EEI) of explosives for civil (professional) use. These initiators are used for the extraction of oils and minerals and for construction, demolition and other activities, which are the basis for various industrial and non-industrial sectors (e.g. Construction, Healthcare, Food industry, etc.

For the purpose of this Request for exemption according to Article 5, par. 1 of the 2011/65/ES (RoHS II) Directive, the electric and electronic initiators (EEI) is understood to mean all the electric and electronic equipment (EEE) meeting the definition of EEE according to the RoHS II Directive and being marketed in European Union by LTD. These EEE include assembled electric and electronic detonator and the individual components of the electric detonator (electric fuse, electric fusehead and electric elemented cup). The exemption request is submitted jointly by LTD. for all the EEE concerned because of the same function and the principle of use.

10 January 2018

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Exemption Request Form

1 Name and contact details

Name and contact details of applicant:

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Company is the owner of company AUSTIN DETONATOR ASSEMBLY s.r.o. (furthermore, only LTD.).

Company is member of FEEM (Federation of European Explosives Manufactures).

Date of submission:

Ing. Jaroslav Koňařík

2 Reason for application

Please indicate where relevant:

☒ Request for new exemption in: see bellow

☐ Request for amendment of existing exemption in

☐ Request for extension of existing exemption in

☐ Request for deletion of existing exemption in:

☐ Provision of information referring to an existing specific exemption in:

☐ Annex III ☐ Annex IV

No. of exemption in Annex III or IV where applicable: _____

Proposed or existing wording: _____

Duration where applicable: _____

☐ Other: _____

LTD. applies for an exemption for the use of Pb and Cr^{6+} compounds in electric and electronic iniciators (EEI[1]) that are included in Category 11 (Other EEE not covered by any of Categories 1 to 10 listed in Annex I) of Annex I to Directive 2011/65/EC pursuant to Article 5 (1) a). These iniciators are supplied to the European Union market exclusively for civil (professional[2] and industrial[3]) use. The electric and electronic iniciators did not previously fall under the scope of the 2002/95/EC (RoHS I) Directive. However, the definition of the "electric and electronic equipment (EEE)" has been amended according to the Article 3 (1) to include the EEE into the scope of the 2011/65/EC Directive (RoHS II) in the current wording and after 22 July 2019 also into the scope of the 2002/96/EC Directive concerning waste electrical and electronic equipment (WEEE).

LTD. as a manufacturer and importer of EEIs[1] has come to a complicated situation due to the setting of the European Union ban on EEIs[1] based on Pb and Cr^{6+} compounds containing more than 0.1% % after 22 July 2019 according to Article 2 (2) for several reasons:

Reason 1: EEIs meet the EEE definition in Article 3 (1) of the RoHS II Directive, but by their very nature they are completely beyond the scope of RoHS II and 2002/96/EC (WEEE).

According to Article 3 (1) of RoHS II, '*electrical and electronic equipment*' or '*EEE*' means *equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1 000 volts for alternating current and 1 500 volts for direct current."*

Based on this definition, the following EEIs[1] manufactured by LTD. falling into the scope of RoHS II are placed on the EU market:

1) assembled electric detonator,
2) assembled electronic initiator,
3) defined components of the electric detonator intended for industrial use[3]
   a) **electric fuse** assembled of an electric fusehead and leading wires,

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[1] **EEI - Electric and electronic initiators** include electric and electronic detonator and the individual components of the electric detonator (electric fuse, electric fusehead and electric elemented cup).

[2] **Professional use** – the final use of EEI for the extraction of minerals, fossil fuels and contruction and demolition activities; use of electric igniter in the film industry and in fireworks

[3] **Industrial use** – the use for the contstruction of detonators or other initiators from the individual components (electric igniter, electric fusehead, electric elemented cup) produced by LTD., which are placed on the EU market separately. The construction of initiators is done by the downstrean user himself.

b) **electric fusehead**

- meets the RoHS II definition of the EEE only after the leading wires are connected, thereby assembling an electrical fuse;

c) **electric elemented cup** assembled of assembled shell and assembled delay charge

- meets the RoHS II definition of the EEE only after the electrical fuse is connected, thus assembling the electric detonator.

The aim of the RoHS II Directive according to Article 1 is *"laying down rules on the restriction of the use of hazardous substances in electrical and electronic equipment (EEE) with a view to contributing to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste EEE. "*

The aim of the 2002/96/EC (WEEE) Directive according to Article 1 is *"as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers and in particular those operators directly involved in the treatment of waste electrical and electronic equipment. "*

Both objectives are not fully respected in civil (professional and industrial) use of EEI[1], as the EEI[1] will be completely destroyed in practice. This means that there is no waste that can be reused, recycled or processed in the sense of Article 3 (d)[4], (e)[5] and (h)[6] of Directive 2002/96/EC as for other categories of EEE listed in Annex I of RoHS II (eg household appliances, consumer electronics, lighting equipment, vending machines).

Reason 2: Compliance with the conditions set out in Article 5 (1) a) RoHS II

Article 5 (1) a) of the RoHS II Directive states that "*For the purposes of adapting Annexes III and IV to scientific and technical progress, and in order to achieve the objectives set out in Article 1, the Commission shall adopt by means of individual delegated acts in accordance with Article 20 and subject to the conditions laid down in Articles 21 and 22, the following measures:*

- *their elimination or substitution via design changes or materials and components which do not require any of the materials or substances listed in Annex II is scientifically or technically impracticable,*
- *the reliability of substitutes is not ensured,*
- *the total negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the total environmental, health and consumer safety benefits thereof.*

LTD. has been involved in the development and research of alternative substances for Pb and Cr^{6+} compounds used in initiator production (EEI[1] and non EEI[7]) for more than 20 years. The very

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[4] "Reuse" according to the Directive 2002/96/EC *"means any operation by which WEEE or components thereof are used for the same purpose for which they were conceived, including the continued use of the equipment or components thereof which are returned to collection points, distributors, recyclers or manufacturers"* (Article 3, (d))

[5] *"Recycling" according* to the Directive 2002/96/EC *"means the reprocessing in a production process of the waste materials for the original purpose or for other purposes, but excluding energy recovery which means the use of combustible waste as a means of generating energy through direct incineration with or without other waste but with recovery of the heat"* (Article 3, e))

[6] "*Treatment*" according to the Directive 2002/96/EC "*means any activity after the WEEE has been handed over to a facility for depollution, disassembly, shredding, recovery or preparation for disposal and any other operation carried out for the recovery and/or the disposal of the WEEE*"

[7] **The non-electric initiator of explosives** (non EEI) is not the subject of this exemption request because it does not meet the definition of EEE in Article 3 (1) of RoHS II. For the purpose of this exemption request, Non EEIs are only given for the purpose of completing the overall facts about the assortment produced in LTD., scientific research work within the whole range of LTD. and for an overall analysis of economic impacts on LTD and the global market. Non EEIs are based on the same principle as other initiators falling under RoHS II. Non EEI also

technology of initiator production is severely dangerous, because it mainly uses explosive substances (substances very sensitive to external stimuli). Tested substitutes to explosives and pyrotechnics must be handled under stringent criteria and their physicochemical properties must be well described and documented in order to prevent or at least mitigate the risks arising from the handling of these substances and mixtures. The selected substitutes must therefore be fully compatible with the individual initiator components in order to limit unwanted explosions and human health hazards. From literary sources, from practical experience of the LTD. and other FEEM members, it is clear that the search for alternative substances used in the heavy metal-free explosive industry is a global trend. As a result of the countless tested substitutes, only a small part of them has practical use with great restrictions.

Based on practical experience gained for many years of research in LTD. it can be stated that most of the potential substitutes

1) in practice do not exhibit or only partially exhibit the properties attributed to these substances in the literature;
2) regardless some suitable properties they show several properties that restrict the usage in manufacturing EEIs[1] (e.g. water solubility, low thermic stability, reactivity with other materials);
3) are not fully compatible with the current design of the initiators;
4) are economically demanding under current operating and production conditions.

For all tested substitues, the requirement for completely safe and continuous manufacturing must be met. Some tested compounds may "behave differently" under laboratory conditions than under operating conditions. Putting into practice could be affected by operational explosions, including injuries to workers who would come into contact with this substance. Potential substitutes may also have a negative impact on the health of the workers (e.g. severe head and abdominal pain, fatigue or vomiting) because their physiological properties are currently not fully studied. Underestimating the risks and lack of knowledge of manufacturing aspects could have fatal consequences (damage to property, health and human lives). Due to threats to human life of the LTD. workers, therefore, paragraph 18 of RoHS II should be taken into account:

"*Exemptions from the substitution requirement should be permitted if substitution is not possible from the scientific and technical point of view, taking specific account of the situation of SMEs or if the negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the environmental, health and consumer safety benefits of the substitution or the reliability of substitutes is not ensured. The decision on exemptions and on the duration of possible exemptions should take into account the availability of substitutes and the socioeconomic impact of substitution.*"

Reason 3: Regulation and restrictions of the use of Pb and Cr^{6+} compounds and potential EEI substitutes by the Regulation (EC) No 1907/2006 (REACH)

The handling and use of all chemicals is regulated within the European Union by Regulation (EC) No 1906/2007 on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). The purpose of REACH is to ensure "*a high level of protection of human health and the environment, including the promotion of alternative methods for assessment of hazards of substances, as well as the free circulation of substances on the internal market while enhancing competitiveness and innovation" (*Article 1 (1) of the REACH Regulation). LTD. is defined by REACH in the supply chain to take the following roles:

- manufacturer in case of explosives that are produced directly on the premises of LTD.,

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contain Pb a Cr^{6+} substances (explosive, pyrotechnic charge) and the handling of these substances is limited by REACH, which purpose is to "*ensure a high level of protection of human health and the environment, including the promotion of alternative methods for assessment of hazards of substances, as well as the free circulation of substances on the internal market while enhancing competitiveness and innovation"* (Article 1 (1) of the REACH Regulation)

- the importer in case of supply of substances that the existing supplier has not registered properly or at all, and
- the downstream user of chemicals used for EEI[1] production (primary explosives[8], primary explisoves charges[9] and pyrotechnic delay charges[10]).

Handling of chemicals in the LTD. is regulated by the REACH Regulation as early as 2006 when this Regulation became effective. The table below (Table 1) lists the substances used for the manufacture of initiators (EEI and non EEI) which are directly regulated by this Regulation.

Table 1 The list of substances used in the LTD. and their regulation by REACH

[redacted]

It is clear from the table above that most of the Pb compounds used are identified as SVHC substances (substances of very high concern) based on their dangerous properties under Article 57 (a) to (f). At the same time, these substances have been included in the SVHC list of substances subject to authorization (the so-called Candidate List) as of 2011 pursuant to Article 59 (10) of the REACH Regulation. Substances listed in the Candidate List are progressively assigned a priority for inclusion in Annex XIV of the REACH Regulation, for which application to authorize the so-called authorization is to be submitted to European Chemical Agency (hereinafter "ECHA"). The other substances listed in the table have not been identified as SVHCs on the basis of their hazardous properties and so far have not been the subject of any recommendation to include Pb compounds and Cr^{6+} compounds on the Candidate List.

[redacted]

[8] **Primary explosives** are Pb compounds capable of very rapid transition from explosive burning to detonation, at very short times (10-6 s) and in very small quantities (mg). These substances are very sensitive to external stimuli, so they must be subjected to strict safety conditions when manufactured and handled. Due to this property, the explosives used for the production of the initiators are produced directly at the LTD site.

[9] **Primary explosive charges** are Pb-based explosives enriched with other chemicals increasing e.g. the sensitivity of the explosive (sensitizer) or the oxygen balance of the blasting charges (Pb-based oxidants).

[10] **Pyrotechnic charges** are mechanical mixtures of substances (combustibles, oxidants based on the compounds Pb and Cr^{6+}, binders or other auxiliary substances) which, after appropriate initiation, react exothermically. The pyrotechnic charges are used in the initiators to obtain a time gap between the initiation and the effect of the system.

[11] Background document for [redacted], ECHA, 10/11/2016, Helsinky, Finland. Dostupné z [redacted]

[redacted]

In the case of Cr^{6+} compounds, the situation is different considering the handling of these compounds in EEIs[1] and their marketing on the EU market is limited only by RoHS II.

Due to the above stated uncertainties, LTD. has decided to make use of the exemption option under Article 5 (1) of the RoHS II Directive for the use of Pb and Cr^{6+} compounds in EEIs[1] and their marketing within the EU. Following the proposal for the inclusion of lead tetroxide in Annex XIV, LTD began to work to process the REACH authorization application dossier for the use of this substance in the manufacture of initiators (EEI[1] and non EEI[7]).

2.1 Summary of the reasons for applying for the category 11 exemption of Annex I for the use of Pb and Cr^{6+} in EEI

The criteria for granting an exemption from the RoHS II Directive are defined in Table 2 of the document "*Standard application form and guidance for RoHS exemptions on the basis of Article 5 (8) of Directive 2011/65/EU*". In the table below (Table 2), the criteria in Article 5 (1) are given for the Pb and Cr^{6+} compounds in the EEI, indicating their compliance/non-compliance and indicating the appropriate reason. At the same time, other reasons for submitting an exemption request are added.

Table 2 Summary of the reasons for submitting an exemption request under Article 5 (1) of the RoHS II Directive

Substitution is scientifically of technically impracticable	✓ (reason no. 2)
Reliability of a substitute	✓ (reason no. 2)
Negative environmental, health and consumer impact of substitution outweigh benefits thereof	N. A. absence of alternative
Other reasons:	
EEIs meet the EEE definition in Article 3 (1) of the RoHS II Directive, but by their very nature are completely beyond the scope of RoHS Directives II and 2002/96/EC (WEEE)	✓ (reason no. 1)
Regulating and restriction of the handling and use of Pb and Cr^{6+} compounds and potential EEI substitutes by REACH Regulation	✓ (reason no. 3)

From the above summary, it is clear that the use of Pb and Cr^{6+} in EEI meets all the criteria for exemption under Article 5 (1) of RoHS II.

3 Summary of the exemption request

By the definition of "electrical and electronic equipment" or "EEE" as referred to in Article 3 (1) of the RoHS Directive II, the following electrical and electronic initiators (hereinafter referred to as EEI) placed on the EU market by LTD. are covered by this Directive:

1) assembled electric initiator,
2) assembled electronic initiator,
3) defined components of the electric initiator (placed on the EU market individually)
    a) electric fuse (assembled of electric fusehead and the leading electric wire),
    b) electric fusehead (meets the RoHS II definition of the EEE only after the leading wires are connected, thereby generating an electrical fuse),
    c) loaded electric initiator assembled of loaded shell and loaded retarder (meets the RoHS II definition of the EEE only after the electrical fuse is connected, thus assembling the electric initiator).

Electric and electronic initiators are primarily used for the extraction of minerals and fossil fuels, which are subsequently used in various industrial and non-industrial sectors (e.g. construction, healthcare, food, and engineering) as well as components of a rescue integrated system to remove the consequences of floods, snow-caps, ice-bumps and fallen trees as dangerous obstacles in the waterway etc. Practical use also includes individual components of electric detonator such as electric igniter or electric fusehead when placed on the European Union market as a stand-alone product. Electric igniter (electric fusehead with leading wires) is used for firing pyrotechnic bodies in the fireworks industry.

Pb and Cr^{6+} compounds are basic raw materials for the production of explosive substances (primary explosives) and explosive mixtures (explosive and pyrotechnical charges) contained in EEIs, which by their physicochemical properties fulfill their desired function. Most of these compounds are classified as hazardous to human health and the environment. Therefore, it is a worldwide trend in the explosives industry to find suitable full-weight, heavy-metal replacements that would perform the same function as the Pb and Cr^{6+} compounds in the EEI and would not pose risks to human health and the environment. Searching and testing of replacements is a very complicated and time-consuming process, mainly because test substances must meet strict technical and safety criteria to achieve the original effect and full EEI function and to avoid the occurrence of extraordinary events. The discovery of a full substitute prior to the expiry of the deadline laid down in Article 2 (2) of RoHS II (July 22, 2019) is, in view of the above criteria and the real limitations of another important European regulation (Regulation 1907/2006 (REACH)) despite ongoing scientific research and security, not yet feasible.

After 22 July 2019 it will be forbidden to place on the EU market all EEEs in category 11 of Annex I of the RoHS Directive II which contain Pb and Cr^{6+} in a concentration greater than 0.1% by weight. The content of Pb and Cr^{6+} in pure chemicals and explosives and mixtures themselves is several times higher (Table 3) and therefore it is not possible to reach the maximum limits for the maximum weight values of Pb and Cr^{6+} tolerated in homogeneous materials according to Annex II of RoHS II.

Table 3 Percentual content of Pb and Cr^{6+} in pure chemicals used to produce explosive substances and mixtures in EEI

[redacted]

Pb and Cr^{6+} compounds only occur in explosive substances and mixtures contained in EEI, while the components themselves (taken from the point of view of the individual mechanical parts of EEI) do not contain these compounds, which was confirmed by the results of spectral analyses of these components. The results of the analyses of the presented components of EEIs, including the uncertainties of the measurements, did not exceed the limits of lead concentrations Pb ≤ 0.1%, mercury Hg ≤ 0.1%, cadmium Cd ≤ 0.1%, Cr^{6+} ≤ 0.1%. At the same time, it was found that the samples submitted did not contain an excessive amount of brominated flame retardants such as PBB and PBDE (Br ≤ 0.1%). Certificates of RoHS compliance II issued by the Electrotechnical Testing Institute s.p. are attached to this application.

Based on this information, LTD. has decided to file an exemption request under Article 5 (1) of RoHS II. A ban on placing EEI on the market would cause a societal problem for both the LTD. itself and its suppliers and end customers as well as end-users of end-use products used in everyday life (e.g. building materials, electronics, farm machinery, energy, oil and food and others) that can be considered insoluble.

LTD. seeks to point out that, despite years of research into the substitution of heavy metals (Pb and Cr^{6+}) used in the explosive industry, there is currently no fully-fledged and technically feasible substitute. For this reason, it is not possible to meet RoHS II requirements and post 22 July 2019 to market Pb and Cr^{6+} free EEIs. At the same time, this exemption request clearly demonstrates how demanding is the process of searching for and testing new substitutes and what the socioeconomic impact of the ban on placing EEIs containing Pb and Cr^{6+} on the EU market would be.

4 Technical description of the exemption request/revocation request

4.1 Description of the initiators of explosives and their application

List of relevant Annex II categories for this exemption

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☒ 11

This exception covers the following EEIs:

1) assembled electric detonator

Figure 1 Assembled electric detonator

2) assembled electronic detonator

Figure 2 Assembled electronic detonator

3) defined components of the electric detonator

a) electrical igniter (assembled from electric fusehead and a leading wire),

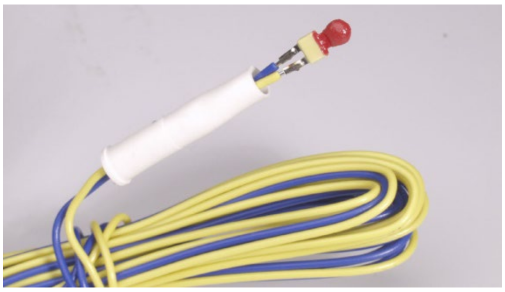


Figure 3 Electrical igniter

b) electrical fusehead

- meets the RoHS II definition of RoHS by connecting the lead wires, thereby generating an electrical fuse,

Figure 4 Electrical fusehead

c) electric elemented cup assembled of assembled shell and assembled delay charge

- meets the definition of the EEE according to RoHS II only after the electrical igniter is connected, thus assembling the electric initiator

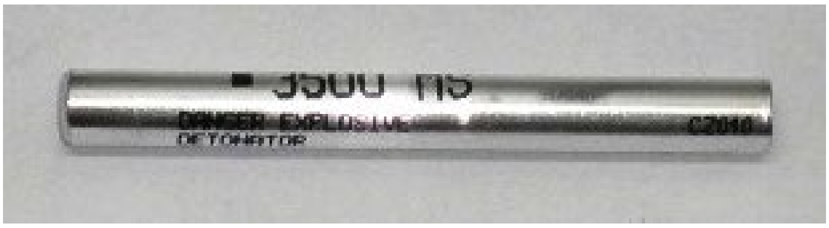


Figure 5 Electric elemented cup

For a detailed description of the function and presence of Pb and Cr^{6+} compounds in EEI, separate chapters are devoted to individual initiators.

4.1.1 Assembled electric detonator

The assembled electric detonator consists of an electric fusehead (electric fusehead including the lead wires, 4.1.3) and electric elemented cup (pyrotechnic delay charge, primary charge (explosive), secondary charge (explosive[12], 4.1.4).

[12] **Secondary explosives** are explosives, which can lead to explosive detonation. The explosive transformation of secondary explosives is a detonation that is devastating to its surroundings. Secondary explosives are predominantly used to tear solid materials such as rocks. They are most often used in mines, quarries and destruction. Such explosives are called industrial explosives. Secondary explosives can not be used on their own but always in conjunction with a detonator or other initiator. Under normal conditions, they are unable to detonate themselves – they have to be pulled by detonation of the primary explosive. When ignited, most explosives are only burning (certain detonation hazards may be present in some if they are in bulk or in closed containers).

4.1.1.1 Function of assembled electric detonator

The electrical energy is fed into the electric fusehead via the lead wires at the electric fuse. After the electrical current passes, the electric fusehead resists and releases the thermal energy to ignite the explosive fusehead for the intense flame (Figure 6, Letter A). From the fusehead header, the flame will flare on the delay pyrotechnic charge and ignite it. The delay charge burns with a defined time step and then initiates the primary fill (Figure 6, Letter B). The detonation wave initiates the secondary charge of the detonator (Figure 6, letter C). Secondary charge of the detonator generates a strong shock wave, which subsequently initiates an industrial explosion (Figure 6, Letter D.)

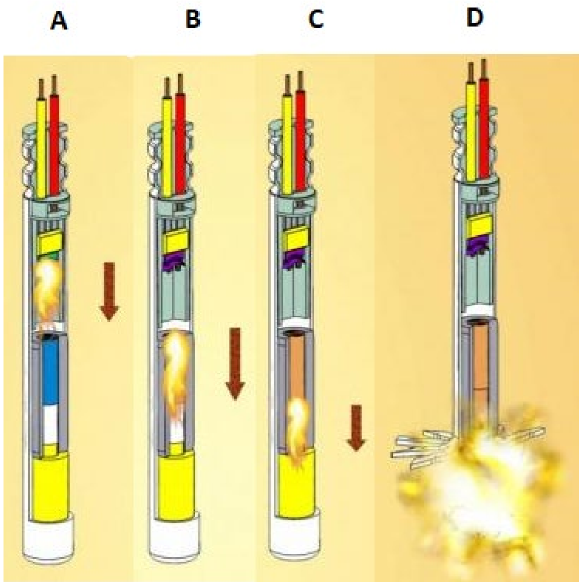


Figure 6 Principle of electric detonator function: A) fusehead ignition, B) ignition if the pyrotechnic charge and primary charge initiation, C) initiation of secondary charge, D) detonator explosion and initiation of industrial explosive

4.1.1.2 Substances used in electric detonators covered by this exemption

LTD. is asking for exempting

☒ Pb ☐ Cd ☐ Hg ☒ Cr^{6+} ☐ PBB ☐ PBDE

The Pb compounds are contained in the electric detonator in:

- **explosives (primary explosives,** Figure 7**)**Chyba! Záložka není definována.;
- **primary explosives charge**[9] (chemical base for the electric fuse/fusehead, **electric igniters/fuseheads**), where they have the function of explosives, oxidators (Figure 7);
- **pyrotechnic primary explosives (pyrotechnic delay charges)**[10], where they have a function of oxidators (Figure 7).

The Cr^{6+} compounds are in the electric detonator contained in:

- **pyrotechnic primary explosives (pyrotechnic delay charges)**[10], where they have a function of oxidators (Figure 7).

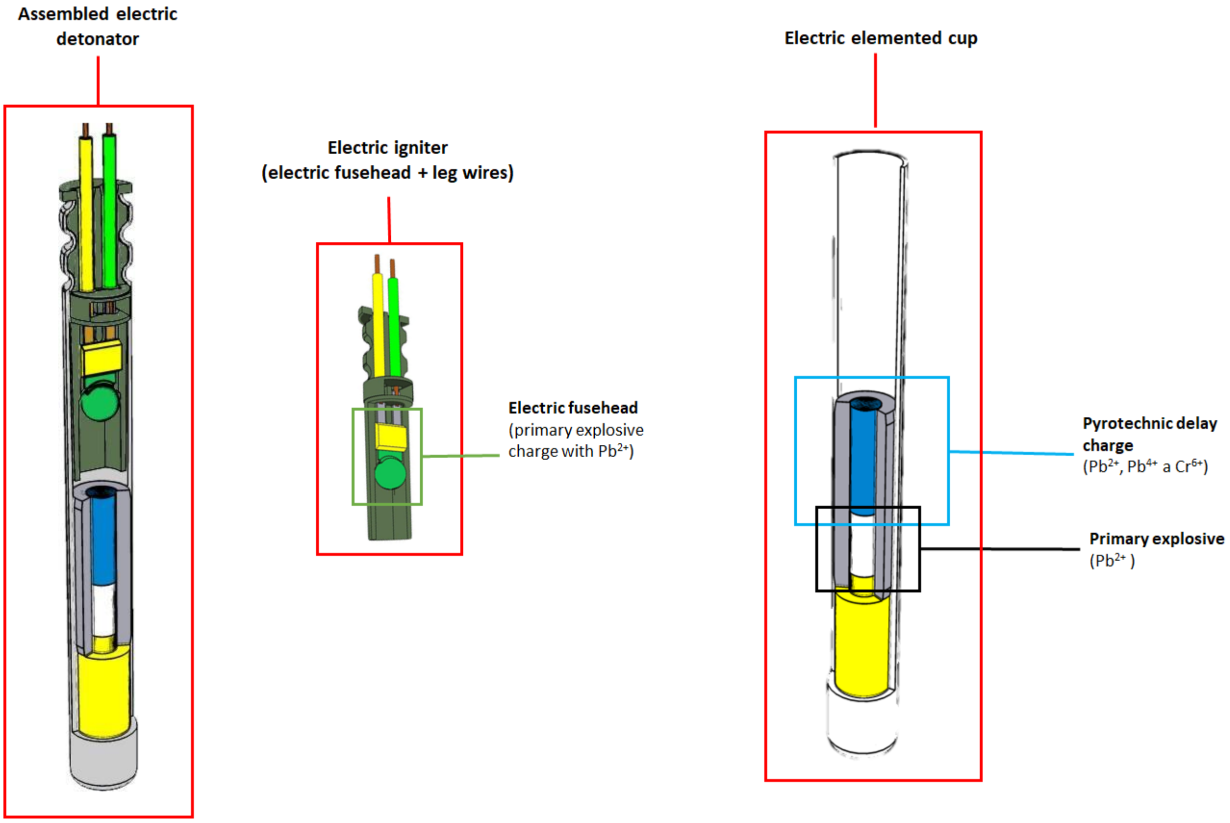


Figure 7 Indication of the presence of Pb and Cr^{6+} compounds in assembled electric initiator

4.1.2 Assembled electronic detonator

Structurally, an electronic initiator is similar to an electric initiator. It consists of an electrical initiation module[13] (EIM), an electric igniter (electric fusehead and leading wires), a primary charge (primariy explosive[8]) and a secondary charge (explosive[12]).

4.1.2.1 Function of assembled electronic detonator

The lead wires are used to communicate with the EIM[13] and to transmit electrical energy. The EIM[13] controls the function of the entire detonator, i.e. the delay time, control and firing. By means of a specific device (so-called Logger), the EIM[13] is programmed to release at the specified time the energy stored in the capacitor in the EIM[13]. The electric current is then passed through the electric fusehead to produce an intense flame. The resulting flame will ignite the primary charge. Ignition and explosion of the primary charge will cause the explosion of the secondary charge of detonator, which then initiates an industrial explosive.

4.1.2.2 Substances used in electronic detonators covered by this exemption

LTD. is asking for exempting

☒ Pb ☐ Cd ☐ Hg ☐ Cr^{6+} ☐ PBB ☐ PBDE

The Pb compounds are in the electronic detonator contained in:

- **primary explosives[8], (**Figure 7**)**

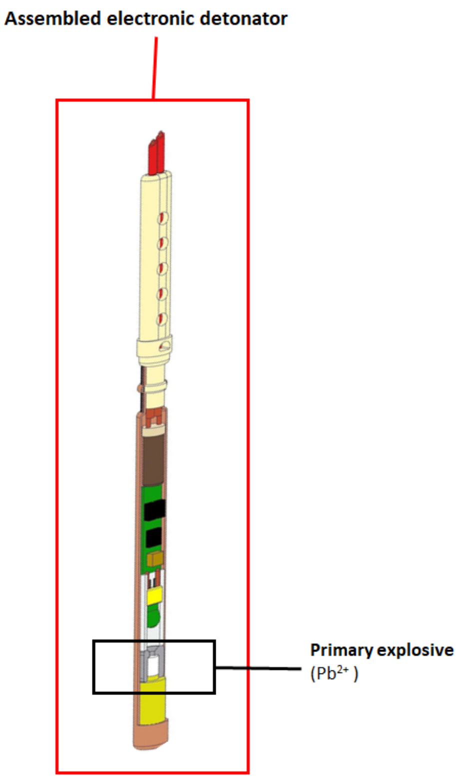


Figure 8 The presence of Pb compounds in an assembled electronic initiator

[13] **The Electrical Initiation Module (EIM)** is a small printed circuit containing a microchip and a capacitor.

4.1.3 Electric igniter / electric fusehead

The electrical igniter (electrical fusehead and leading wires) is part of every electric and electronic detonator manufactured by LTD. Both the electrical igniter and the electrical fusehead are used separately by downstream users in other EEI manufacturing areas. (chapter 4.2).

4.1.3.1 Function description of the electric fuse / electric fusehead

The electrical energy is fed into the electrical fusehead via the lead wires in the electrical fuse. The resistant wire ignites after the electrical current passes. By releasing the heat energy, the explosive fusehead charge will ignite as the intense flame develops. This flame is the first step to initiating electric and electronic initiators. When using an electrical fuse / fusehead in other applications, the function is the same.

The principle of the electric fuse/electric fusehead function when used in detonators is described in chapters 4.1.1.1 (electric detonator) and 4.1.2.1 (electronic detonator).

4.1.3.2 Substances used in electrical igniter/fusehead covered by this exemption

LTD. is asking for exempting

☒ Pb ☐ Cd ☐ Hg ☐ Cr^{6+} ☐ PBB ☐ PBDE

The Pb compounds are contained in the electric fuse/electric fusehead in:

- **Primary explosive charge**[9], where they have the role of explosives, oxidators (Figure 9)

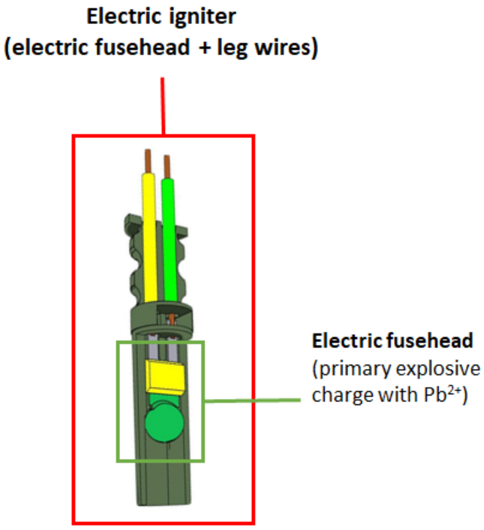


Figure 9 Indication of the Pb compounds presence in electric igniter/fusehead

4.1.4 Electric elemented cup

4.1.4.1 Function of electric elemented cup

Electric elemented cup is a component of the electric detonator produced in LTD. and together with the electrical igniter is used by the downstream user for the EEI assembly (chapter 4.2).

4.1.4.2 Substances used in covered by this exemption

LTD. is asking for exempting

☒ Pb ☐ Cd ☐ Hg ☒ Cr^{6+} ☐ PBB ☐ PBDE

The Pb compounds are contained in the electric elemented cup in:

- **primary explosives**[8] **(primary explosives,** Figure 10**)**;
- **secondary explosive charges**[9] **(pyrotechnic delay charges),** where they have the role of oxidators (Figure 10).

Cr^{6+} compounds are contained in the electric initiator in:

- **pyrotechnical charges**[10] **(pyrotechnic delay charges)**, where they have the role of oxidators (Figure 10).

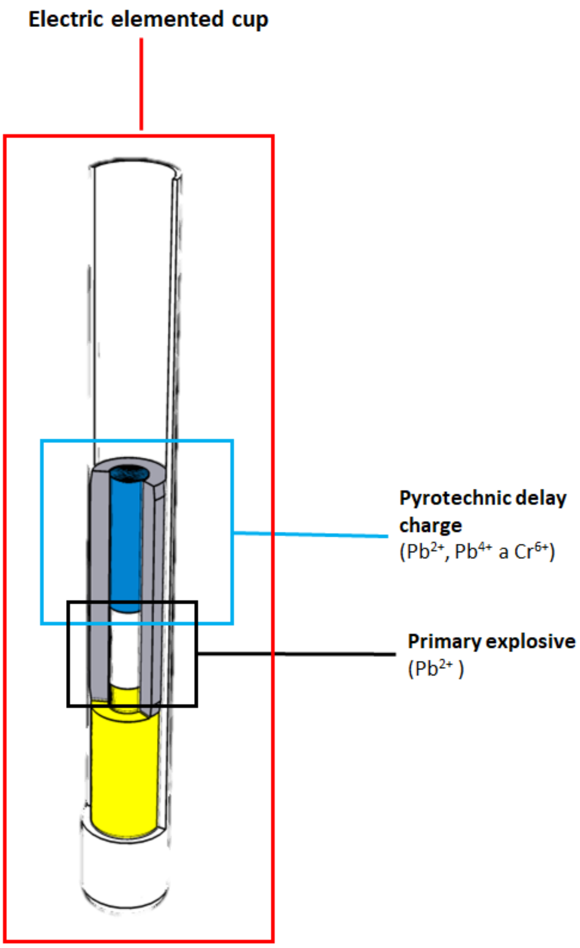


Figure 10 Indication of the Pb and Cr^{6+} compounds in electric elemented cup

4.2 Applications covered by this exemption

ELECTRIC AND ELECTRONIC DETONATORS are used in the extraction of minerals, fossil fuels and in construction and destruction works and other activities (Table 4). In many cases, both electric and electronic detonators can be used. The choice of a suitable detonator is influenced by various aspects but is primarily based on the practical experience of using the detonators themselves. For example, electronic detonators are used to optimize fragmentation of extracted rock and reduce vibrations generated during blasting operations.

Table 4 Field of application of electric and electronic detonators

	Electric detonators	Electronic detonators
	Mining of mineral resources	
Building stone	✓	✓
Ores	☒	✓
Rock-salt	✓	☒
Precious metals	✓	✓
	Mining of fossil fuels	
Natural gas	✓	☒
Oil	✓	☒
Coal	✓	✓
	Construction, demolition and other activities	
Tunneling	✓	✓
Demolition of chimneys	✓	✓
Demolition of buildings	✓	✓
Geological Research	✓	✓
Cleaning of deposits of hot plants (heating plants, power plants)	✓	☒

Electric and electronic detonators are also used by components of a rescue integrated system to remove the consequences of floods, avalanches and snow overhangs, ice bumps and falling trees as dangerous hindrances in a fairway on watercourses, and so on.

For the acquisition of basic raw materials and for the activities listed in Table 4 there is currently no effective alternative method that would perform the same function as EEI. In situations where the possibility of premature initiation of an EEI igniter can not be eliminated due to other energy, e.g. electrostatic energy, elusive currents, high-frequency energy, the non EEI[7] is preferably used. They are also used in activities requiring an "infinite" timing series.

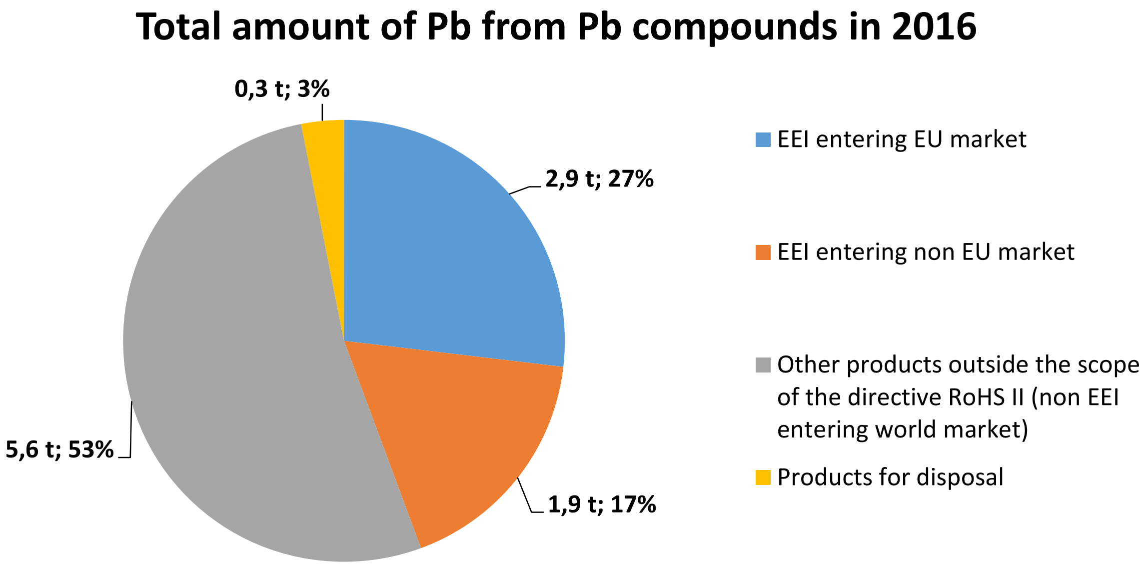
Non EEIs[7] **are by no means a possible replacement for electronic detonators** because in the case of non EEI[7], the exact timing required can not be achieved as in the case of electronic detonators. Non EEI[7] **can not be considered as a substitute for electric detonators** in places with the presence of an explosive dust-air mixture, in applications requiring separation of debris initiators, or applications requiring precise timing or resistance to high pressure and temperature.

THE ELECTRICAL IGNITER, ELECTRIC FUSEHEADS AND ELECTRIC ELEMENTED CUP are used for the assembly of electric or electronic detonators used for blasting. Furthermore, the electrical igniter is used in fireworks for firing pyrotechnic bodies and pyrotechnic effects in the film industry.

4.3 Amount of Pb and Cr^{6+} compounds entering the EU market

4.3.1 Amount of Pb from Pb compounds

In 2016, almost 27% of Pb[14] (2.9 tonnes) of the total quantity of 10.6 tonnes of Pb was consumed to produce EEIs[15] placed on the EU market. 17% of the total Pb in EEI is marketed outside the EU. 3% of the amount of Pb consumed is disposed of in non-compliant materials contaminated with an explosive (see Chapter 5). 53% of Pb is included in products that do not fall under RoHS II (non EEI). The following diagram (Scheme 1) schematically shows the percentage distribution of the total amount of consumed Pb for explosives initiators production (EEI and non EEI).

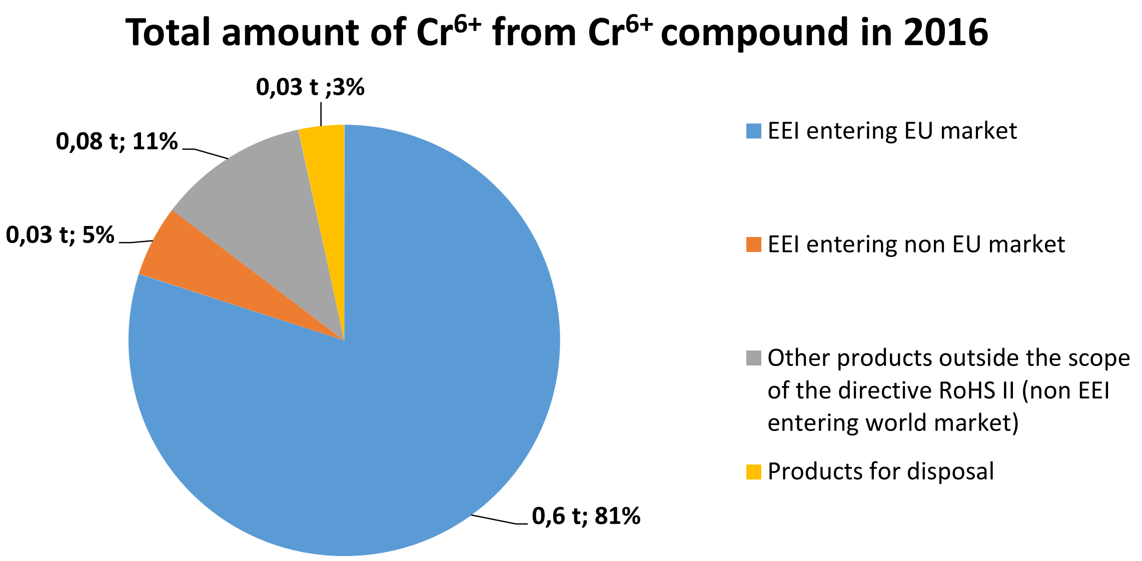


Scheme 1 Total amount of Pb from Pb compounds in 2016

4.3.2 Amount of Cr^{6+} from Cr^{6+} compound

For the EEI[16] production marketed in the EU, nearly 81% of Cr^{6+} (0.6 tons) of the total consumed amount of 0.74 tons of Cr^{6+} in LTD was consumed in 2016. This high consumption is due to the ever-increasing underground mining in the EU, which has its own specifics and requires the use of electric initiators. 5% of the total amount of Cr^{6+} in EEI is marketed outside the EU. 3% of the consumed amount of Cr^{6+} is disposed of in non-compliant materials contaminated with an explosive (see Chapter 5). 11% Cr^{6+} is included in products that do not fall under RoHS II (non EEI). The following diagram (Scheme 2) schematically shows the percentage distribution of the total amount of consumed Cr^{6+} for explosives initiators production (EEI and non EEI).

[14] The amounts of Pb and Cr^{6+} reported are calculated from all Pb and Cr6 + compounds used to make initiators in LTD. by the conversion of atomic and molar masses.
[15] Included in all EEIs produced in LTD. (see chapters 4.1.1.2, 4.1.2.2, 4.1.3.2, 4.1.4.2)
[16] Only included in assembled electric detonators (see chapter 4.1.1.2)



Scheme 2 Total amount of Cr^{6+} from Cr^{6+} compound in 2016

4.3.3 Environmental assessment, LCAs

Life Cycle Assessment: ☐ Yes ☒ No

Life Cycle Assessment (LCA) Pb and Cr^{6+} contained in EEI is not available primarily because of undetectable quantities of these substances in the final product (see chapter 4.3). LCA has not been carried out either because EEI is not used for professional use because all EEI components are destroyed by an explosion (see chapter 2). Only trace amounts of Pb and Cr^{6+} compounds, which are not detectable by sensitive analytical methods and **do not cause contamination** of the extracted raw materials, are infiltrating the extracted raw material itself.

In order to prove these claims, **the results of the analyzed salt samples** using an electric detonator in underground mines are part of the exemption request (section 4.3.3.1). Furthermore, chapter 4.3.3.2 presents the result of the **analysis of surface water samples** using an electronic detonator in surface mines. The results of these analyzes are compared with the real quantities of Pb and Cr^{6+} contained in the EEIs used.

4.3.3.1 Use of electric detonator (rock-salt for the food industry)

Rock-salt is one of the basic raw materials in industrial production and processing. In addition to the well-known use of salt as a foodstuff, salt is also used in the manufacture of detergents, glass, ceramics, cosmetics and pharmaceutical products, feeds, etc. Rock-salt is also used as a part of the spreading mixture as long as it guarantees the immediate effect of dissolving ice and snow.

For the use of the salt in the food industry, the Pb and Cr^{6+} content is regularly monitored.

4.3.3.1.1 Analysis of rock-salt samples

The following table (Table 5) shows the results of analyzing the measured concentrations of Pb and Cr^{6+} in extracted rock-salt, which are obtained from the largest producer of rock-salt in the world.

Table 5 Concentrations of Pb and Cr^{6+} measured in rock-salt

Substance	Measured Concentration	The limit of determination	Unit	Test method
Chrome	**< 0,020**	0,020	mg/kg	DIN EN ISO 170294-2
Lead	**< 0,020**	0,020	mg/kg	DIN EN ISO 170294-2

From the results of the rock-salt analyzes it is evident that the concentration of lead and chromium in the tested samples is below the limit of determination and the contamination of the extracted raw material has not been proven.

4.3.3.1.2 Calculation of the content of Pb and Cr^{6+} compounds in 1 tonne of disintegrated rock-salt

The rate of contamination of the raw material can be expressed using a simple calculation based on the knowledge of the number of electric detonators used for the extraction of 1 tonne of rock-salt and the amount of Pb and Cr^{6+} present in 1 electric initiator (Table 6). The data used for this calculation are guaranteed by the LTD. and a subsequent user of electric initiators in the extraction of rock-salt, one of the world's largest producers of raw material.

Table 6 The amount of Pb a Cr^{+6} compounds in dissolved rock-salt (2016)

Substance	Average number of initiators per 1t of disintegrated rock-salt [EEI / tonne]	Total amount of disintegrated rock-salt in 2016 [tonne]	Total substance content in 1 EEI [g]	Amount of substance in 1 tonne of disintegrated rock-salt [g/t]
Chrome	0,06	33 670 000	0,18	**0,0108**
Lead	0,06	33 670 000	0,07	**0,0041**

Based on the actual number of electric detonators used to dismantle one tonne of raw material (Table 6), it can be stated that the amount of Pb and Cr^{6+} in 1 tonne of extracted rock is totally negligible and does not cause any detectable contamination. At the same time, more than 30 million tonnes of rock salt are dismantled in the EU territory in 2016. The total content of these elements in the abovementioned approximately 30 million tonnes of dissolved rock salt for the year 2016 (140 kg Pb / year, 336 kg Cr^{6+} / year) was calculated from the knowledge of the number of pieces of electrical initiators used and the Pb and Cr^{6+} content.

This practical example also shows the link between the data in the charts in Chapter 4.3. In the case of Cr^{6+} consumption, it is evident that almost 50% of the total amount of Cr^{6+} (0.6 t Cr^{6+}) put on the EU market was consumed in 2016 for the extraction of rock salt. In the case of Pb consumption, it was almost 5% of the total quantity of Pb in EEI placed on the EU market (2.9 t Pb).

Due to the use of the salt in the food industry, this practical example is the worst possible scenario for the professional use of electric detonators. The types of electric detonators for rock salt extraction also contain the highest possible amount of Pb and Cr^{6+} compounds from all EEIs produced in LTD.

From the results in chapters 4.3.3.1.1 and 4.3.3.1.2, it is clear that the used initiators do not cause rock salt contamination. Consequently, the presence of Pb and Cr^{6+} in the used electric initiators does not pose any risk to the human salt consumer from the point of view of human health.

In general, it can be said that the use of electric detonators for professional use does not pose any risk either from the point of view of the threat to the environment or to human health.

4.3.3.2 The use of electronic detonator (stone)

Another practical example of the use of EEI (electronic detonator) is in the extraction of stones in selected surface quarry in the Czech Republic. In this case, it is based on real data provided by the downstream user of electronic detonator, the problem of contamination of surface water and also relationship between the amount of Pb in the used detonator and the amount of rolled stones.

4.3.3.2.1 Surface water samples analysis

For the purpose of this demonstration, the results of surface water analysis, which are regularly harvested in quarries, are used. Since electronic detonators contain Pb compounds, this parameter is primarily monitored in surface water analyses in defined fracture. Table 7 lists the results of the analyses performed.

Table 7 Concentration of the Pb compounds in surface water

Substance	Measured concentration	The limit of determination	Unit	Test method
Lead	**< 0,02**	0,05	mg/l	ICP 02: ČSN EN ISO 11885

The results show that the Pb content in the samples taken is below the detection limit of the analytical instrument used. **The use of electronic detonators therefore does not cause contamination of surface water with Pb compounds.**

4.3.3.2.2 Calculation of the content of Pb compounds in 1 tonne of the disintegrated stone

As with the use of electric detonators for rock-salt extraction and the use of electronic detonators for stone extraction, the contamination of the raw material can be expressed using a simple calculation based on the knowledge of the number of electronic detonators used to extract 1 tonne of stones and the amount of Pb present in 1 electronic detonator (Table 8). The data used for this calculation is again guaranteed by LTD. and the downstream user of the electronic detonators in the selected fracture.

Table 8 The amount of Pb compounds in the disintegrated stone (2016)

Substance	Average number of initiators per 1t of disintegrated stone [EEI / tonne]	Total amount of disintegrated stone [tonne]	Total substance content in 1 EEI [g]	Amount of substance in 1 tonne of disintegrated stone [g/t]
Lead	0,003	904 000	0,043	**0,00014**

Based on the actual number of electronic initiators used to dismantle 1 tonne of raw material (Table 8), it can be stated that the amount of Pb in 1 tonne of extracted stone is totally negligible and does not cause any detectable contamination.

From the knowledge of the number of pieces of electronic detonators used and the Pb content, the total content of this element in the abovementioned 900,000 tons of disintegrated stone for 2016[14] (0.126 kg Pb / year) was calculated.

Based on the values of the results presented in chapters 4.3.3.2.1 and 4.3.3.2.2, it can be clearly stated that the mining of the selected aggregate does not in any event result in contamination of the final raw material. The presence of Pb in the used electronic detonators does not affect the quality of surface water, mainly due to the low Pb content knowledge in the electronics detonator guaranteed by LTD. (0.043 g).

Considering the facts presented in Table 8, it can be stated that the use of electronic detonators in the extraction of any other kind of raw material does not result in contamination of

the environment by Pb compounds and consequently resulting final product after using of the electronical detonators.

5 Information on possible preparation for reuse or recycling of waste from EEIs and on provisions for appropriate treatment of waste (Waste management)

According to Article 3 (b) of Directive 2002/96/EC, for the purposes of this Directive, it is understood “*waste electrical a electronic equipment“ or “WEEE”* means “*electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/ EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding.*”

“*This Directive shall apply to electrical and electronic equipment falling under the categories set out in Annex IA provided that the equipment concerned is not part of another type of equipment that does not fall within the scope of this Directive. Annex IB contains a list of products which fall under the categories set out in Annex IA.*“ (Article 2 (1) of Directive 2002/96/EC). Category 11, which includes EEI, listed in Annex I of the RoHS Directive II, is not mentioned in Annex IA to this Directive, and EEIs do not appear on the list of equipment listed in Annex IA to Directive 2002/96/ EC.

Professional EEIs are completely destroyed during their use. There is no waste that can be reused, recycled or processed in the sense of Article 3 (d), (e) and h) of Directive 2002/96/EC (WEEE). Thus, in the case of EEI, Directive 2002/96/EC can not be applied.

A more detailed description of the disposal method after professional use of the EEI does not fall within the scope of this exemption request and is therefore no longer considered[17].

[17] **The handling of EEIs** is very specific, since each EEI includes explosives (Chapter 4.1) which are under Article 2 (1) (b). and Directive 75/442/EEC excluded from the scope of this Directive. Explosives can only be disposed of by explosion and/or burning in accordance with the applicable laws of the country. In the Czech Republic, this liquidation is carried out by a person professionally qualified with pyrotechnics certification pursuant to Act No. 61/1988 Coll., On Mining Activities, Explosives and State Mining Administration, in places and facilities designated for that purpose. With hazardous and other wastes, after the deactivation of explosives originating from both the EEI production and the disposal of their non-conforming products is already in LTD. handled in accordance with Directive 75/442/EEC on waste (within the Czech Republic, Act No. 185/2001 Coll.).

6 Analysis of possible alternative substances

Can the substance of this exemption be substituted?

☐ Yes, by

☐ Design changes

☐ Other materials

☐ Other substance

☒ No

Justification: see in below chapters

The technology of initiator manufacture itself (EEI and non EEI) is very dangerous from the point of view of protecting human health, as initiators contain primary[8] and secondary[12] explosives (chapter 4.1). In the event of undesirable initiation, these substances may, because of their sensitivity to external stimuli, endanger the lives and health of workers. Despite these facts, LTD has introduced safety measures that eliminate these risks based on years of experience in the knowledge of the properties of the explosives used. LTD. is therefore able to produce these explosive substances with success and supply initiators around the world.

Basically, the research and development projects in the LTD. are concentrating on testing the substitutes for Pb and Cr^{6+} compounds in primary explosives[8] (Pb^{2+}), primary explosive charges[9] (Pb^{2+} a Pb^{4+}) and pyrotechnic charges[10] (Pb^{2+}, Pb^{4+} a Cr^{6+}). Tested compounds are therefore divided into two groups and individually described in the chapter dedicated to primary explosives and primary explosive charges (Chapter 6.1) and pyrotechnic charges (Chapter 6.2).

In general, however, one of the most important criteria in selecting possible substitutes is knowledge of their **physico-chemical properties and practical experience**. This is to prevent or at least limit the risk of occurrence of extraordinary events during testing of these substances, which may have unintended consequences on their immediate surroundings and human lives.

6.1 Substitutes of Pb compounds used in primary explosives and primary explosive charges

The most used explosives in the past and present are the Pb-based primary explosives, such as lead azide, lead trinitroresorcinate or lead picraminate. Primary explosives are the basic compounds for EEI production, and criteria for the selection of suitable primary explosive substitutes are based on the requirements of existing and proven manufacoring technology from a human health protection point of view. The following criteria are:

a) physical-chemical properties of the tested compounds (Chapter 6.1.1),
b) toxicity of the tested compounds (Chapter **6.1.2.**),
c) environmental friendliness,
d) profitability.

6.1.1 Physical-chemical properties of the tested compounds

6.1.1.1 Primary explosives

Primary explosives substitutes must:

a) have a **high initiating strenght,**
b) be **reliably initiable by the selected impulse,**
c) be **chemically and physically stable within the required temperature range (thermal stability),**
d) have **satisfactory physical properties** (grain size, etc.)**,**

e) have **optimal sensitivity.**

In addition to these features, the tested primary explosive must meet the requirements for relatively safe and continuous production.

The initiating strenght (i.e., the limit dose) represents the property of a reliable initiation of initiators or separate primary explosives. If the initiating strenght is not sufficiently high, the explosive may not be reliably initiated. In general, the lower the initiation strenght, the greater the amount of explosive used. Greater substance batch would interfere with existing production and whole product design, which is inconsistent with paragraph 18 of the RoHS II Directive: "*Exemptions from the substitution requirement should be permitted if substitution is not possible from the scientific and technical point of view, taking specific account of the situation of SMEs or if the negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the environmental, health and consumer safety benefits of the substitution or the reliability of substitutes is not ensured. The decision on exemptions and on the duration of possible exemptions should take into account the availability of substitutes and the socioeconomic impact of substitution."* Changing existing initiators would pose a great deal of risk to workers who would handle the explosion with their potential production. Under laboratory conditions, these substances may "behave differently" than under operating conditions.

Primary explosive must also be **reliably initiable by a simple stimulus**, but at the same time insensitive enough to be safe to manufacture and manipulate. To maximize the elimination of sources of external stimuli, the production of explosives must therefore be as simple as possible. With every other operation there is a risk of possible accidents. The safety hazards of existing explosives are well known during use and most of them are well secured. When testing new replacements for which their properties are not well known, this safety risk is many times higher. In more detail, the hazards and pitfalls associated with the search for substitutes are described in Chapter 8.2.1.

A suitable primary explosive must be **physically and chemically stable within the range of temperatures required for the product to be used**. Thermal stability is a key criterion to produce initiators used, for example, in deep mining, where temperatures often reach a range of 150-200 ° C. For some products, the LTD. guarantees functionality even at 245 ° C.

6.1.1.2 Primary explosive charges

In the search for the substitutes used to produce the primary explosive charges[9] used for the manufacture of electric fuseheads (Figure 4), the following criteria must be met:

a) the sensitivity of the explosion to the external heat source,
b) brizance of the primary explosive[18],
c) wettability of the explosive when applied to the fusehead skeleton (density, viscosity),
d) thermal stability,
e) share of individual components.

In order for the primary explosive to be applied to the fusehead skeleton properly, other substances, such as different thixotropic substances, flame retardants, which in turn change the character of the charge and its combustion, are added to the system.

6.1.2 Toxicity of tested compounds

Since, in some cases, they are substances with physiological properties that are not currently fully studied, these potential substitutes may have an unhealthy effect on the health of R&D workers,

[18] By the **brizance of primary explosive** we mean the devastating effect of the explosion on its immediate surroundings by means of detonation fumes. Brizance grows with increasing initial burst density and its detonation velocity. Of course, other explosives are characterized by a certain brizance.

laboratory workers and development workshops. With potential introduction into production, these new substances with their physiological properties could also influence the health status of workers who would produce and manipulate the explosives. These undesirable medical complications (eg severe head and abdominal pain, fatigue, vomiting) were observed in the developmental activities already underway with some heavy metal-free substitutes tested. There is therefore a reasonable doubt as to the extent to which these heavy metal-free substitutes are more beneficial to human health than those that are "problematic" from the point of view of RoHS II and REACH:

"The measures provided for in this Directive should take into account existing international guidelines and recommendations and should be based on an assessment of available scientific and technical information. The measures are necessary to achieve the chosen level of protection of human health and the environment, with due respect for the precautionary principle, and having regard to the risks which the absence of measures would be likely to create in the Union. The measures should be kept under review and, if necessary, adjusted to take account of available technical and scientific information. The annexes to this Directive should be reviewed periodically to take into account, inter alia, Annexes XIV and XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)… With a view to further restrictions of substances, the Commission should re-investigate the substances that were subject to previous assessments, in accordance with the new criteria set out in this Directive as part of the first review." (paragraph 10 of RoHS II)

6.1.3 Results of testing possible substitutes for Pb compounds in primary explosives and primary explosive charges

Based on literary researches and initial tests of physicochemical parameters, the following compounds were selected as possible substitutes:

a) high nitrogen derivatives and their salts (Substance A),
b) heterocyclic derivatives and their salts (Substance B),
c) complex azide compounds (Substance C),
d) amino compounds (Substance D).

The following table (Table 9) lists the general groups of substances and some of their basic criteria, which must meet the full substitution for Pb compounds contained in explosives and explosive compounds in EEI production. If the tested Substance did not meet one of the essential Criteria, it was no longer tested to avoid endangering the safety of R&D personnel and emergencies. The phrase "not OK" indicates that this substance did not meet the criterion. The "-" sign indicates that these parameters were no longer tested.

Table 9 Tested substitutes for explosives currently used in LTD.

	Substance A	Substance B	Substance C	Substance D
Complexity of synthesis	not OK	not OK	-	-
Initiating strenght	not OK	not OK	-	not OK
Thermal stability	not OK	not OK	-	not OK
Sensitivity to external stimuli	-	-	not OK	-
Changes in existing technology	-	not OK	-	not OK
Toxicity	not OK	not OK	-	-
Wastewater treatment	not OK	not OK	-	-

From the list of previously tested substitutes, it is clear that none of the groups of possible substitutes tested so far met the criteria required.

However, the LTD. continues to look for the possible substitutes for Pb compounds used in primary explosives and primary explosive charges within R&D.

6.2 The substitutes of Pb a Cr^{6+} compounds used in pyrotechnic charges

The primary feature of pyrotechnic charges is the **time step between the initiation and the effect of the system**. The time step is given by the length of the column of the pyrotechnic charge, its type (e.g., the length and milliseconds) and the number of press cycles.

Since pyrotechnic charges are mixtures of substances with different properties (oxidants, combustibles, binders, stabilizers, phlegmatists, etc.), Pb-based substitutes and Cr^{6+} compounds must meet a broader set of criteria in order to be a full replacement for the currently used Pb and Cr^{6+} compounds.

In general, the basic criteria for the selection of possible substitutes include:

- **a) shares of individual components,**
- **b) humidity,**
- **c) purity,**
- **d) particle size,**
- **e) specific surface,**
- **f) crystalline modification,**
- **g) reactivity.**

In addition to these properties, the technology of fabrication itself and the **technology of pretreatment of feedstocks play a significant role in selecting tested substitutes**.

6.2.1 Procedure for choosing the appropriate substitution for Pb and Cr^{6+} compounds in pyrotechnic charges

As with the choice of explosive substitutes, test substances are selected based on literary research, practical experience, and physico-chemical parameters. For example, if a replacement Substance is selected for the oxidant, the degree of oxidation is determined by calculation, in the case of combustion, the degree of reduction is calculated. After these basic calculations, the Substance is directly tested against the above criteria. The effect of an alternative substance (oxidant or flammable) on the stability of the existing system (whether it is fully compatible with existing Substances) and the fulfillment of the function for the given substance is also monitored. Thus, the time between the initiation and the effect of the system, the long-term compatibility and the stability of the system are monitored.

Technological cleanliness (production technology) of raw materials (each imported series) is determined on test files, which include:

- a) determination of the content of the basic substances,
- b) determination of the content of the active substance,
- c) determination of the content of salts soluble in water,
- d) determination of bulk density,
- e) determination of humidity,
- f) granulometry.

6.2.2 Testing of substitutes for Pb and Cr^{6+} compounds in pyrotechnic charges

On the basis of literary researches and initial tests of physicochemical parameters, the following compounds were selected as possible substitutes:

- a) oxides and peroxides (Substance A),

b) heavy metal compounds (Substance B),
c) inorganic nitrogen compounds (Substance C),
d) heavy metal salts (Substance D).

The following table (Table 10) lists the individual groups of substances and the basic criteria that must be fulfilled by the full substitution for Pb and Cr^{6+} compounds contained in pyrotechnic charges of explosive initiators manufactueed in LTD. If the tested Substance did not meet one of the Essential Criteria, it was no longer tested to avoid endangering the safety of R & D personnel and emergencies. The phrase "not OK" in the table indicates that this criterion was not met. The "OK" letters in the table indicate that Substance has met this criterion. The "-" sign indicates that these parameters were no longer tested.

Table 10 Tested substitutes for Pb a Cr^{6+} compounds in pyrotechnic charges used in LTD.

	Substance A	Substance B	Substance C	Substance D
Stability in mixtures	not OK	not OK	not OK	not OK
Physical-chemical properties	not OK	not OK	not OK	OK
High acquisition costs	not OK	-	-	-
Other use	-	-	-	OK

It can be seen from the above summary that, in the case of the Pb and Cr^{6+} compounds substitutes tested in pyrotechnic charges, only heavy metal salts (Substance D) have met the criteria for physicochemical properties. In further testing of substance D, it has been found that these substances can advantageously be used for their properties, for example as oxidants. However, Substance D but due to non-fulfillment of the criteria listed in Table 10 does not represent a full substitution for Pb and Cr^{6+} compounds.

However, the LTD. continues to look for possible substitutes for Pb and Cr^{6+} compounds used in the pyrotechnic charges within R&D.

The figure below schematically shows the procedure for the selection and testing of possible substitutions, which is repeated repeatedly due to inadequate results of substitutions testing. It can be seen from the above diagram that finding a full refund is a very complex process and is currently influenced by other legislative requirements (REACH, RoHS II, patent law, etc.).

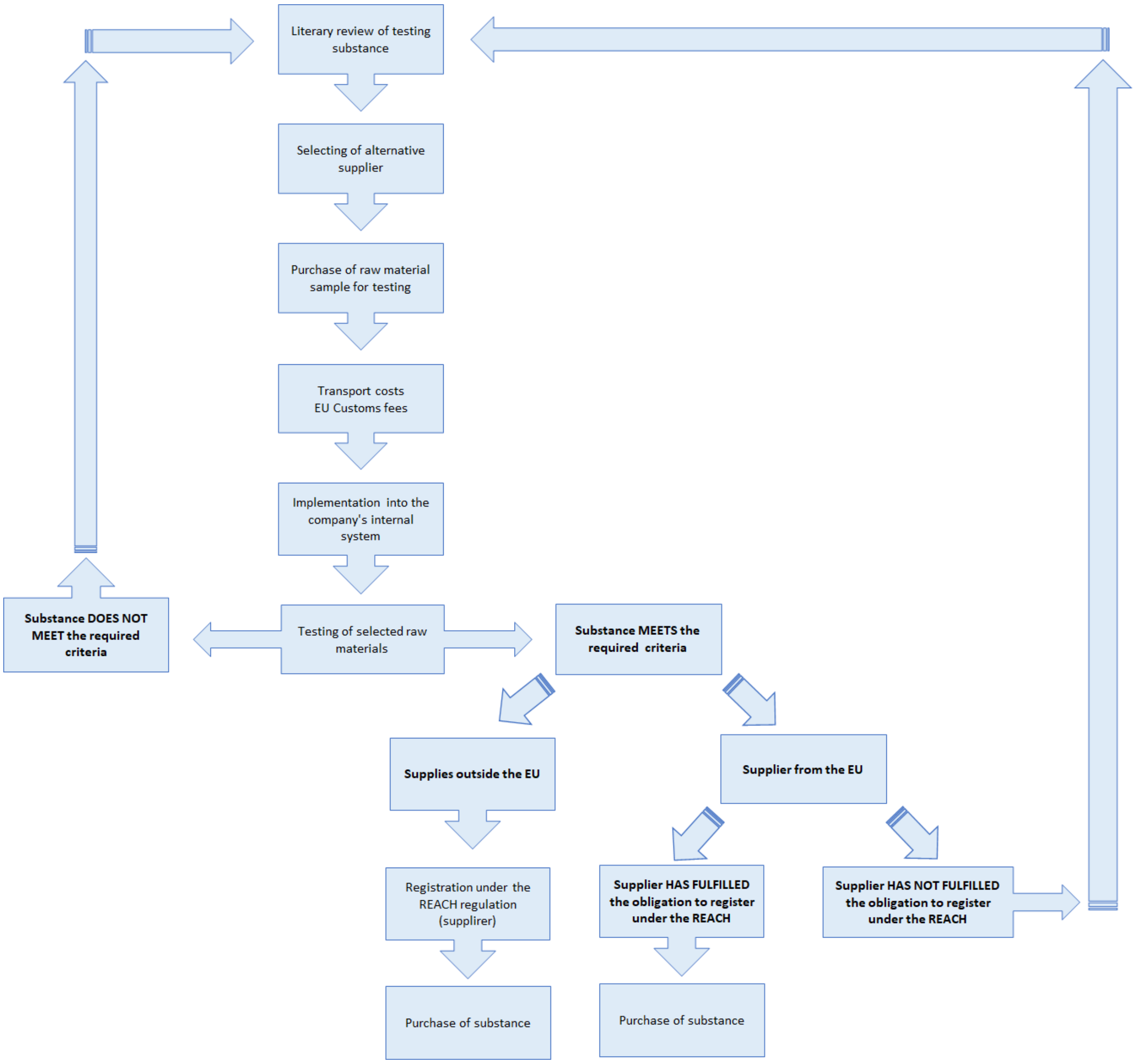


Figure 11 Procedure for selecting a new substitution or raw material for EEIs production.

7 Proposed actions to develop possible substitutes

a) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.

Not applicable. See chapter 6.

b) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.

Not applicable. See chapter 6.

8 Justification according to Article 5(1)(a)

8.1 Links to REACH (substance + substitute)

The REACH issue is described in Reason 3 in Chapter 2 for all Pb and Cr^{6+} compounds used in EEI manufacturing in LTD.

☒ Authorisation

☒ SVHC

☒ Candidate list

☒ Proposal inclusion Annex XIV (Pb compound) - for more details see bellow

☐ Annex XIV

☐ Restriction

☐ Annex XVII

☐ Registry of intentions

☒ Registration[19]

To authorization according to Regulation REACH:

[redacted]

In the "background documentation", LAD[20] and SSD[21] terms were pre-defined as follows:

Latest application date (LAD)	Date of inclusion in Annex XIV plus **27 month**[22]
Sunset date (SSD)	18 months after LAD

Following the terms given in the background documentation for this substance and the uncertainty in the resulting regulation of the use of Pb compounds in the EEI by the REACH Regulation or in the case of Pb a and Cr^{6+} compounds by RoHS II, LTD. would have to meet the requirements of both legislative provisions. Furthermore, in the absence of an exemption under Article 5 (1) of the RoHS Directive, during the authorization process of Pb compounds under the REACH Regulation, LTD. would have to be put an end to the placing on the EU market of EEIs containing Pb and Cr^{6+} compounds. An interruption of EEI supplies to the EU market would create barriers to the secondary market, thus distorting competition, which would affect the EU's internal market. This situation is totally contrary to Article 114 of the Treaty on the Functioning of the

19 [redacted]

20 **LAD** – Latest application date

21 **SSD** – Sunset date

22 During public remarks LTD. submitted to ECHA a document with comments against the inclusion of [redacted] in Annex XIV of the REACH Regulation and against the standard LAD deadlines, taking into account a short timeframe for finding a suitable and full replacement for this substance. Based on the comments, the period for processing the dossier for the 27 months exemption request was extended.

European Union (TFEU)[23], which is the legal basis for RoHS II. The objective of Article 114 is to ensure the functioning of the internal market by approximating the laws, regultations and administrative provisions of the Member States concerning the functioning of the internal market. By prohibiting the placing on the EU market of EEIs containing Pb and Cr^{6+} compounds, the competitiveness of LTD. would be lost on this market, because after the deadline referred to in Article 2 (2) of the RoHS Directive II (July 22, 2019), LTD. it had to cease production of all EEIs placed on the EU market (section 8.5.1). (chapter 8.4.1).

[redacted]

[23] 2016 / C 202/01) - Treaty on European Union and the Treaty on the Functioning of the European Union. Available from: https://www.ecb.europa.eu/ecb/legal/pdf/oj_c_2016_202_full_en_txt.pdf

[redacted]

Figure 12 Steps to look for new substitutes with restriction by REACH Regulation and RoHS II Directive

From the above diagram (Figure 12), it is evident that even after 10 years of R&D activities in LTD. focusing on solution for Pb and Cr6+ substitutions used for explosive initiators manufacture, it is not possible in the case of selected and available substitution to speak as a substitute meeting the requirements of REACH and RoHS II due to changes of its status (In 2017, the substitute was recommended to inclusion in Annex XIV of REACH Regulation). LTD. has come into a complicated and uncertain situation due to changes to RoHS II Directive and the expected inclusion of [redacted] in

Annex XIV. It is evident from results in Chapter 6 that there is currently no full-fledged substitute. R&D activities in the search for reliable and full-fledged substitutes on this issue continue.

Given the above information, it is obvious that finding and testing new substitutes for Pb and Cr^{6+} compounds used for explosive initiators producing is very tedios proces, especially from the point of view of strict criteria (Chapter 6) and with an uncertain result. This process is also very time-consuming at the same time, due to the search for suitable substances for testing on the basis of the literature review, the procedure for fulfilling the basic criteria (Chapters 6.1 and 6.2) and requirements for registration under REACH Regulation, as shown in Figure 11.

8.2 Reliability of substitutes for Pb and Cr^{6+} compounds

See Reason 2 in Chapter 2

When handling Substances that are explosive (primary explosive, secondary explosive and pyrotechnic charges), strict safety requirements must be observed. These requirements aim at preventing or at least introducing measures against the risks arising from the handling of explosives that may endanger the health and life of employees. The most serious risks arising from the handling of explosives include:

1. **Sensitivity of the primary explosives**
   When testing new explosives, the high risk and probability of explosion is the highest due to the lack of historical and practical experience. Despite a thorough risk analysis, it is never possible to define and prevent all risks, as they are often hidden and undetectable. The consequences of the explosion of explosives are considerable due to this threat. In the case of long-term explosives used to produce initiators, these explosion risks are lower and precisely defined with regard to the knowledge of their properties and the long-term practical experience of handling them.
2. **Toxicity of the tested substitutes**
   Newly tested substances pose a high risk primarily due to the effects on human health, which are, in most cases, not yet known. These risks are described in detail in Chapter 6.1.2.
3. **Uncharted / hazardous properties of test substances**
   Dangerous properties of the tested substances (eg initiating strenght, sensitivity to external stimuli) are in most cases detected only when tested alone. Because the frequently mentioned properties do not correspond to the facts reported in the literature, the occurrence of accidents and injuries is minimized using a very small amount of explosive produced in grams in laboratory conditions. But even the use of such a small amount can cause moderate to severe injuries, most exposed to R & D personnel, laboratories and development workshops.
4. **Environmental hazards**
   Even though some substitutes for Pb and Cr^{6+} compounds have been found so far, it can not be unequivocally stated that these substitutes are environmentally friendly. These substitutes may entail other unknown environmental hazards.

From these risks, it is clear that the tested substitutes for Pb and Cr^{6+} compounds are **highly unreliable due to the lack of knowledge of the basic properties**. It can therefore be assumed that the testing of these substitutes could be affected by operational explosions, including workers' injuries. In the case of detecting dangerous properties of test substances that would meet the testing criteria in manufacturing practice, it would have fatal consequences (damage to property, health and human lives, stoppage of production, etc.). **Given the threat to the human life of workers in LTD. in the search for possible substitutes, the exclusion assessment should clearly be considered in paragraph 18 of the RoHS II Directive**:

"***Exemptions from the substitution requirement should be permitted if substitution is not possible from the scientific and technical point of view***, *taking specific account of the situation of SMEs or if* *the **negative environmental, health and consumer safety impacts** caused by substitution are likely to outweigh the environmental, health and consumer safety benefits of the substitution or the **reliability of substitutes is not ensured**. The decision on exemptions and on the duration of possible exemptions should take into account the availability of substitutes and the socioeconomic impact of substitution."*

In view of the above risks, it is necessary to carry out experiments in the field of production and use of EEIs and explosives with a very cautious approach and not to change existing processes and production technologies due to a direct threat to human life. Explosive industry and EEI users are therefore very conservative and have a negative view on any major changes in the field of existing EEI manufacturing and design, which could affect their own correct function.

8.3 Description of environmental assessment of Pb and Cr^{6+} compounds and possible substitutes

Given that there is currently no full replacement for Pb and Cr^{6+} compounds that are part of EEI (chapter 6), it is not possible to evaluate the environmental and health impacts of alternative substances. The evaluation of these impacts (Chapters 8.3.1 and 8.3.2) is made for the existing Pb and Cr^{6+} compounds used to make initiators in LTD.

8.3.1 Environmental impacts of Pb and Cr^{6+} compounds

LTD. acts to continually reduce the environmental risks resulting from the properties of Pb and Cr^{6+}. These measures are primarily based on regular monitoring of soil, surface and groundwater pollution in the premises and surrounding areas of LTD.which are based on national legislative requirements. Based on these regular monitoring carried out since the establishment of LTD. no contamination with Pb and Cr^{6+} was observed. Similarly, the under-limit concentrations of Pb and Cr^{6+} in waste water are discharged into public sewerage after neutralization. The main reason for these lower values is the use of BAT technology for waste water treatment from the production of explosives (EEI and non EEI). This fact points to a very effective system of environmental protection.

8.3.1.1 Environmental risk assessment of Pb and Cr^{6+} compounds

The **EUSES v.2.1 model tool**, which is recommended by ECHA for environmental risk assessment, is used to assess environmental risks in the case of:

a) registration of dangerous substances manufactured or imported into the EU in quantities of ≥ 10 tonnes / year (Article 14 (4) of the REACH Regulation).
b) when submitting an application for authorization under Article 62 of the REACH Regulation, based on the inclusion of substances in Annex XIV to this Regulation.

The evaluation principles used in this tool are based on the EU Technical Guidance Documents document (TGD, EC TGD, 2003).

The environmental risk assessment was performed only for Pb exposures. Risk assessment for Cr^{6+} was not necessary because Cr^{6+} used in LTD. in the production of EEI and non EEI does not exhibit hazardous properties for environmental compartments.

Exposure to Pb is considered to be the worst-case scenario with respect to the amount of Pb (10.6 t) used in the EEI production compared to the amount of Cr^{6+} (0.74 t) used. For these reasons, it can be assumed that the environmental risk assessment resulting from exposure to Pb is absolutely sufficient for this documentation.

Modeling of Pb exposures was carried out for a **municipal sewage treatment plant to which sewage from the LTD. was discharged** and the following **environmental compartments**:

- water (river),
- sediment,
- soil.

Environmental exposure was expressed using **Predicted Exposure Concentration (PEC)**[24]. Together with the environmental exposure assessment, an exposure assessment was carried out for the population, who may be **exposed to secondary environmental components** (eg via crops grown on contaminated soil near LTD.). The exposure of these inhabitants is expressed by the total daily dose (mg.kg body weight 1 1.d 1). The table (Table 11) below lists the results of the exposure assessment using the EUSES v.2.1 tool.

Table 11 Results of exposure assessment using EUSES v.2.1 ..

Environmental exposure assessment of Pb				
PEC in STP ($mg.l^{-1}$)	**PEC for local freshwater ($mg.l^{-1}$)**	**PEC for local freshwater sediment ($mg.kg_{dwt}^{-1}$)**	**PEC for local soil ($mg.kg_{dwt}^{-1}$)**	**Total daily intake man via the environment regional ($mg.kg_{dw}^{-1}.d^{-1}$)**
5,98E-08	6,93E-09	3,29E-07	5,84E-08	4,19E-10

For the assessment of environmental risks, it was necessary to compare the obtained results of the model exposure with the **Predicted No-Effect Concentration[25] (PNEC)** values established for Pb based on current knowledge of the hazardous properties of this substance. The following table (Table 12) lists the PNEC limit values set for each environmental compartment.

Table 12 PNEC limit values for individual environmental compartments

PNEC of Pb	
Microorganisms in STP	1,00E-01 $mg.l^{-1}$
Freshwater aquatic	3,10E-03 $mg.l^{-1}$
Freshwater sediment	1,74E+02 $mg\ kg_{dwt}^{-1}$
Soil	2,12E+02 $mg\ kg_{dwt}^{-1}$
Man via the environment (total daily intake)	5,00E-06 $mg\ kg_{bw}^{-1}\ d^{-1}$

The resulting environmental hazards were calculated as the fraction of predicted PEC[24] exposure concentrations with PNEC[25] limit values. The table below (Table 13) lists the resulting risks expressed by the so-called **Risk Characterization Ratio (RCR)[26]**. For the risk to be considered acceptable, the ratio of the RCR values must be **<1**.

Table 13 The resulting risks expressed through the risk characterization ratio

RCR of Pb				
RCR in STP		**RCR for local freshwater sediment**	**RCR for local soil**	**RCR for humans via the environment regional**
5,98E-07	2,24E-06	1,89E-09	2,76E-10	8,39E-05

From the results of the risk characterization it is evident that the ratios of the PECs[24] and PNECs[25] compared to the individual components of the environment are less than 1 (RCR <1). **The expected exposure concentrations (PEC[24]) of the components of life are very low and do not exceed the PNEC[25] limit values. Based on these results, it can be concluded that environmental risks from Pb exposure are negligible and sufficiently controlled.** Using Pb in LTD. therefore does not cause an increase in the environmental burden. Similarly, no undesirable impact on the health of the population exposed over the environmental compartments is expected.

[24] **PEC (Predicted Exposure Concentration** is the predicted exposure concentration of the substance in the medium

[25] **PNEC (Predicted no-effect concentration)** means the predicted concentration at which the harmful effects of the substance are not expected

[26] **RCR (Risk characterisation ration)** – the ration of the risk characterisation

8.3.2 Health impacts of Pb and Cr^{6+} compounds and substitutes

LTD. is aware of the dangerous potential of Pb and Cr^{6+} compounds used in initiator production and is therefore one of the main goals of the LTD. is maximum protection of workers exposed to these dangerous substances.

Based on increased caution about human health, LTD. performs regular Pb and Cr^{6+} measurements in the work environment. Measurement is carried out using a personal exposure meter located in the exposed zone of the exposed worker. From the measured data, the **time-weighted average concentration of the chemical**, together with the **short-term maximum concentration of the chemical**, is then calculated. Through this approach, risks are regularly monitored, and measurement results used in follow-up decision-making procedures leading to effective health risk management.

Based on the results of the Pb and Cr^{6+} concentration measurements in the working environment, the work is classified into categories according to Decree No. 432/2003 Coll.[27] Based on this **categorization**, the public health authorities in the Czech Republic determine the content and frequency of preventive inspections provided by the medical service. This is an important element of primary prevention of exposed workers. Preventive examinations include, among others, **biological exposure tests** that point to a group exposure of Pb workers.

As already mentioned, the goal of LTD. is to continually reduce the exposure concentration values. This is a long-term intention of LTD., Which can be implemented by introducing preventive measures. These include, for example:

- **technological measures** (e.g. efficient source extraction, process automation),
- **organizational measures** (e.g. reduction of exposure time, prohibition of pregnant women to work on exposure to Pb, reduction of exposure in women of reproductive age, etc.)

In places where exposure concentration values can not be effectively reduced, it is necessary to protect workers using **personal protective equipment (PPE)** that effectively prevents the chemical from entering the body.

It is also necessary to mention that **since the beginning of LTD. no occupational disease or death due to long-term exposure to Pb and Cr^{6+} compounds have been reported.**

Within the professional use of initiators, users are not exposed to because the initiators are hermetically sealed. Even when using EEI, professional users must always follow the safety rules that determine their safe distance from the source of the explosion, as well as the safe time for entering the area after the explosion.

Based on the above, it can be stated that worker health protection is set at a high level and the incidence of a disease is not expected despite the significant hazardous properties of Pb and Cr^{6+}. The exposure of professional workers and end-users does not occur at all.

8.3.3 Consumer safety impacts

Non applicable.

[27] Decree No. 432/2003 Coll., which stipulates the conditions for classifying works, the limit values of biological exposure test pointers, the conditions for the collection of biological material for carrying out biological exposure tests and the need to report work on asbestos and biological agents.

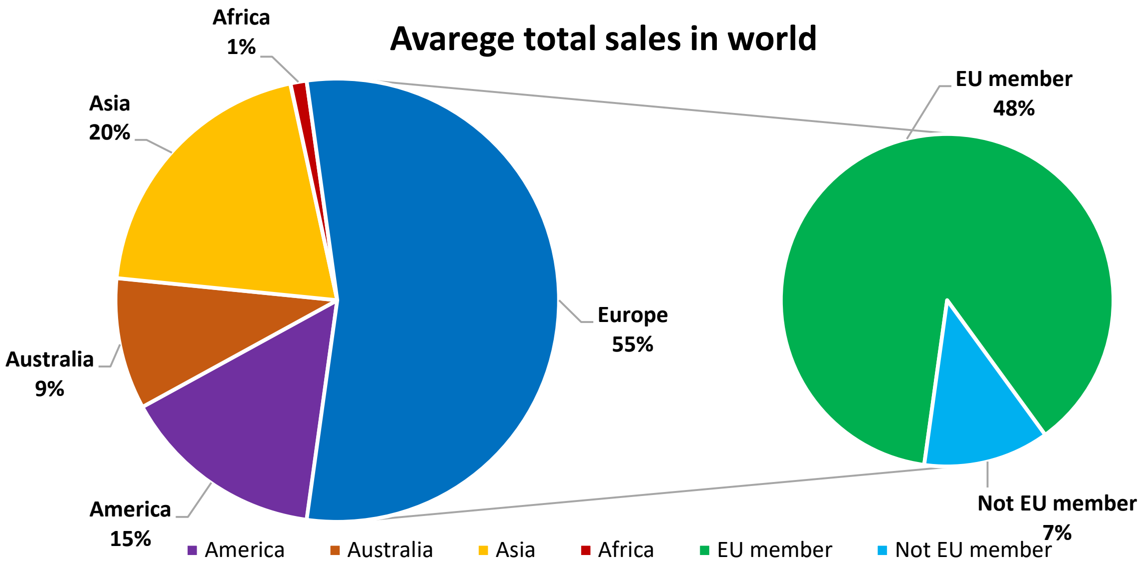
8.4 Socio-economic impacts

8.4.1 Economic impacts

For the purposes of this documentation, the economic impacts primarily present the termination of sale of the EEIs on EU market, at the same time preserving the fixed costs associated with the EEI manufacturing. Except for manufacturing the EEIs, LTD. manufactures also non EEIs, which do not fall under the scope of RoHS II Directive, because they do not meet the definiton of EEI (Article 3 (1) of the RoHS II Directive). Despite this fact, non EEIs are part of this chapter, and only for the purpose of expressing economic impacts related to the whole range of LTD.

8.4.1.1 Development of total sales of LTD.

The following chart (Scheme 3) shows the total sales of LTD. in the years 2012-2016 with regard to the distribution of sales in individual continents of the world. Values were determined by the arithmetic mean for this period and are reported in EUR million.



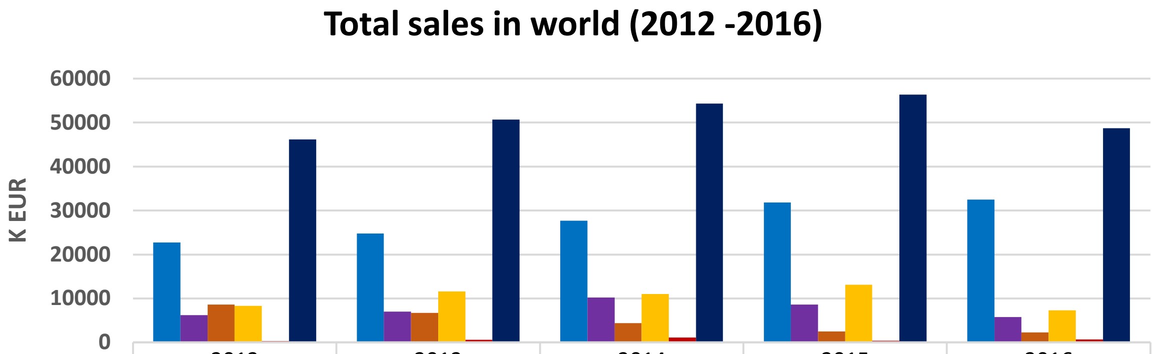
Scheme 3 Average sales of all EEI and non EEI sales in individual continents (average for 2012-2016)

The total revenue in 2012–2016 was €[28] 256,300 K. It is clear from Scheme 3 that the largest share of worldwide sales is generated by sales on the European market (55%). Over the past five years, LTD has added. to Europe products (EEI and non EEI) worth EUR 139,500. In addition, most European customers are based in the EU Member States. **From these values it can be stated that the European market is key for LTD.**

In case the exemption under Article 5 (1) (a) RoHS II is not granted to LTD. and a real ban on the placing of Pb and Cr^{6+} EEI on the EU market due to the current absence of potential substitutes would be LTD. forced to redirect its entire business plan to a non-European market. This change would represent an increase in EEI export costs and a loss of competitiveness in the EU EEI market. Pointing that LTD. is one of the most important EEI producers in Europe, this prohibition would have a huge impact on the EU market, or on the whole of the explosive industry and the industries using the basic minerals extracted from the industrial disintegration of the rock by explosion (see Chapter 4.2). At the same time, this prohibition would weaken secondary market operations, which is contrary to Article 114 of the Treaty on the Functioning of the European Union (SFEU20) (see Chapter 8.1).

[28] The transfer was calculated based on the exchange rate (1 EUR = 25,555 CZK) as of 1 January 2017, Source: Czech National Bank

The following figure shows the sales growth of sales of all products (EEI and non EEI) in individual continents of the world over the last 5 years (2012-2016). **The total sales in these years amounted to approximately 256.300 EUR[28], with the average annual sales of LTD. represented almost 51.300 EUR[28].** Values are rounded to hundreds of euros.

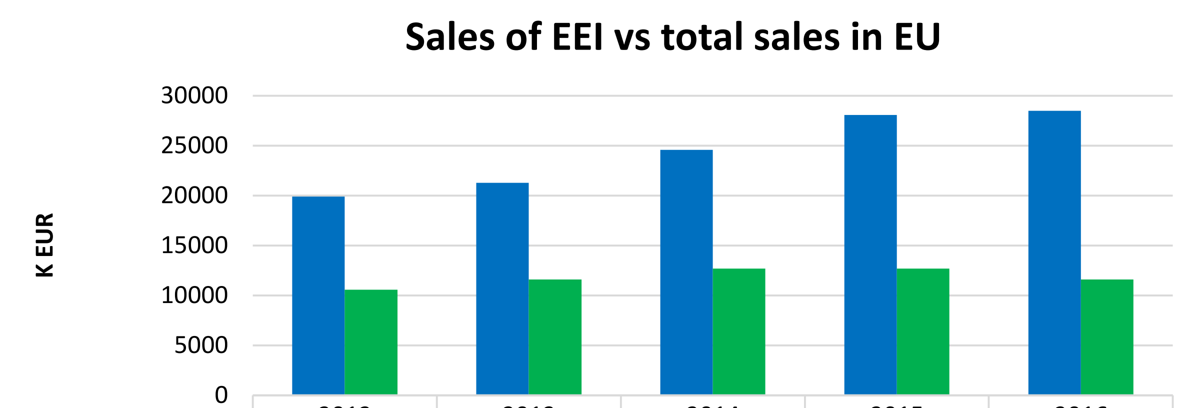


	2012	2013	2014	2015	2016
Europe	22700	24800	27700	31800	32500
America	6200	7000	10200	8600	5800
Australia	8600	6700	4400	2500	2300
Asia	8300	11600	11000	13100	7300
Africa	300	600	1100	400	700
TOTAL	46200	50700	54300	56400	48700

Scheme 4 Developments in actual sales of all products (EEI and non EEI) for the period 2012-2016

As can be seen from the chart above, in 2016 there was a decline in sales of all products (EEI and non EEI). This decline was mainly due to the end of the use of the initiators used in Asia. The decline in revenues for 2016 is significantly affected by the fall in fossil fuel prices. At present, and also in the long run, an increasing trend of sales is anticipated due to the positive development of fossil fuel prices and the launch of projects requiring the use of EEI (predominantly in northern Europe).

The following figure (Scheme 5) shows the share of actual EEI sales in the EU from total sales of all products (EEI and non EEI).



	2012	2013	2014	2015	2016
Total sales in EU	19900	21300	24600	28100	28500
Sales EEI in EU	10600	11600	12700	12700	11600

Scheme 5 EEI revenue share in the EU compared to total sales of LTD.

Total EEI sales on the EU market amounted to an average of 11.840 EUR[28], which represents almost half of total EU sales. EEI therefore belongs to a significant part of the LTD. range marketed in the EU. In the case of a ban on the marketing of EEI, LTD. will lose almost half of the revenue from this significant market. Also the customers of the LTD. dependent on regular EEI supplies will be affected (Chapter 4.2). In order to outline possible impacts on follow-up sectors, this chapter is a schema showing the dependence of the industry on the basic raw materials (fossil fuels, minerals) obtained by using EEI (Figure 13).

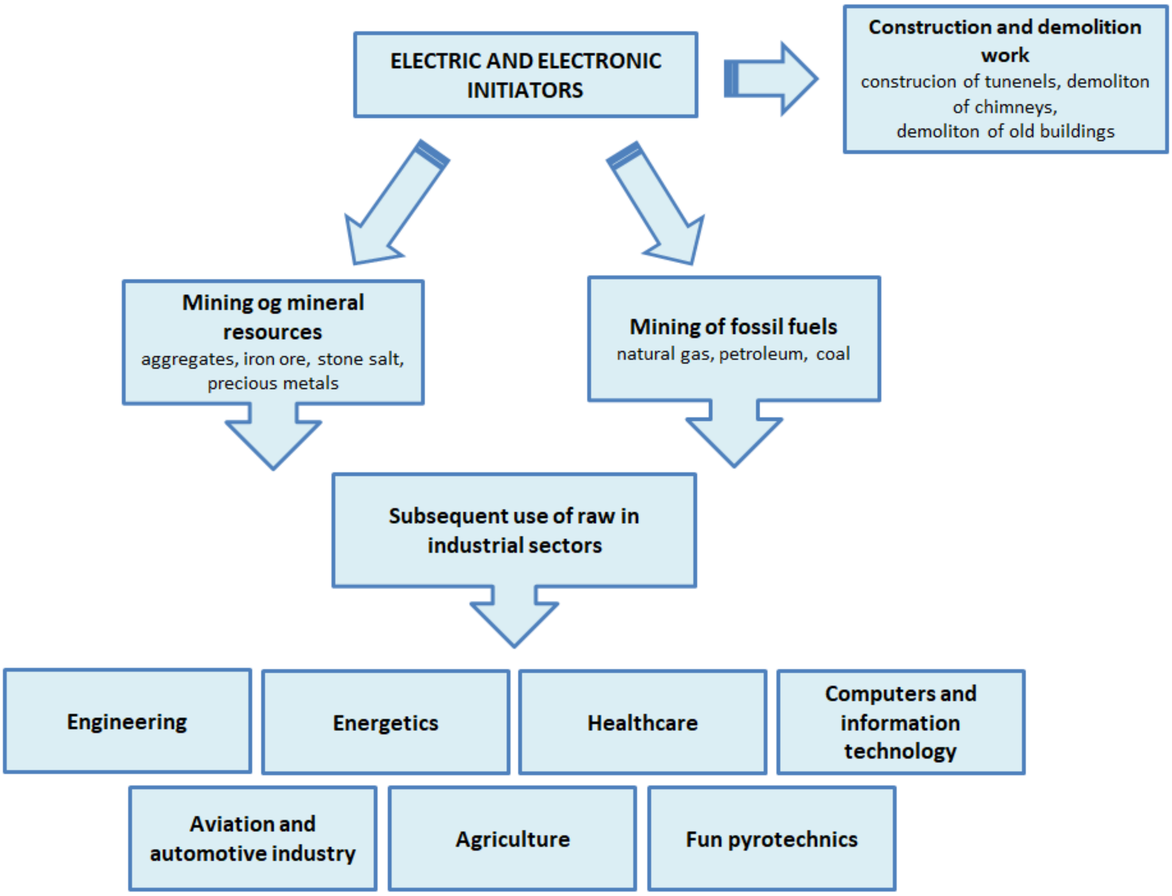


Figure 13 Dependence of industries on basicraw materials (fossil fuels, mineral sources) obtained by using EEI

It should also be noted that in case of not granting an exemption under Article 5 (1) of the RoHS Directive II for EEI applications mentioned in Chapter 4.2, this negative impact will be reflected in the initial phase of the LTD itself, and then on the professional EEI users. From a global perspective, the EEI outages (on the EU market) would mean an overall weakening of the EU's fossil fuel and mineral wealth market. In addition, a gradual depletion of EU mineral resource stocks could be expected, which would lead to an increase in demand for these raw materials from non-EU countries. In the case of raw materials thus supplied, a drop in EEI on the EU market would have been the price increase in the industries listed in Figure 13 and, consequently, of each product / raw material etc. used in everyday life.

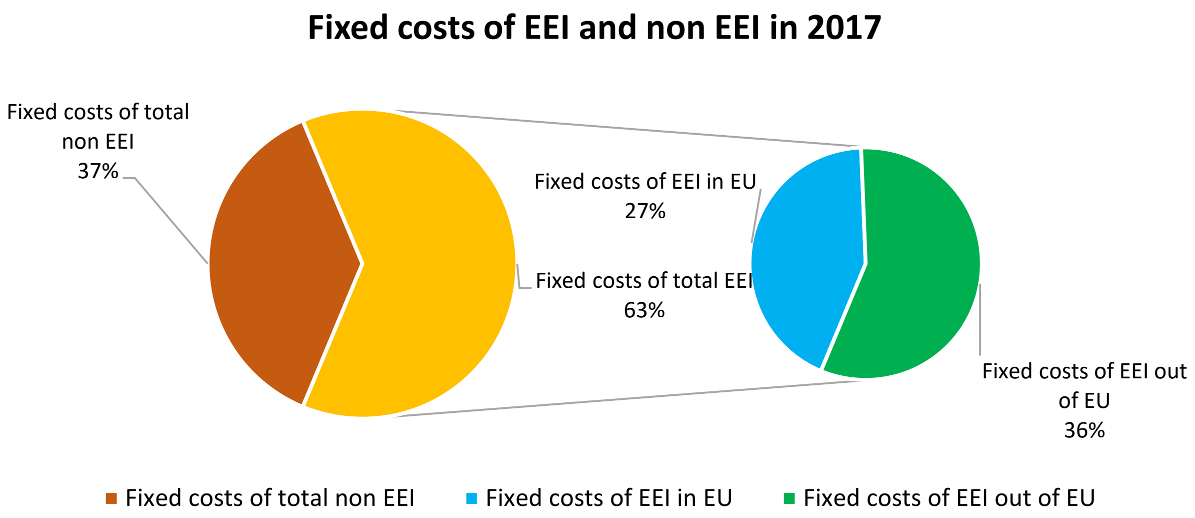
Given the fact that the LTD. is one of the largest producers of EEI in the EU, the ban on the placing of these EEI with Pb and Cr^{6+} compounds would mean an outage in the entire EU explosive indutstry. This situation would create a business opportunity for EEI suppliers from outside the EU. Ultimately, these suppliers would also have to meet the requriements of the RoHS II Directive for placing the EEE the resctricted substances on the EU market. **It should be noted tahtevent tehese suppliers would not have to meet the requirements of the RoHS II Directive on Pb and Cr^{6+} in EEIs. Even in this case, due to the non-compliance with the RoHS II requirements, these EEIs could not be marketed in the EU, which would case the same supply outage of EEIs from non-EU countries as in the case of European suppliers.**

8.4.1.2 Expenses of the LTD.

8.4.1.2.1 Fixed expenses

Fixed expenses are in the short and medium term independent of changes in production. Based on this, it can be assumed that fixed costs will remain at the same level if the EEI production is reduced. There is a phenomenon called cost remanence. The purpose of this chapter is to highlight the costs associated with the production of EEIs marketed in the European Union which, despite the limitations of the ROHS Regulation, would have to be spent. These costs represent one of the significant economic impacts on the overall economy of LTD.

The following figure (Scheme 6) shows the share of fixed costs spent on EEI subsequently marketed in the EU to total fixed costs in LTD.



Scheme 6 Fixed costs incurred on non EEI in LTD. and EEI divided by LTD. into fixed costs in the EU and outside the EU

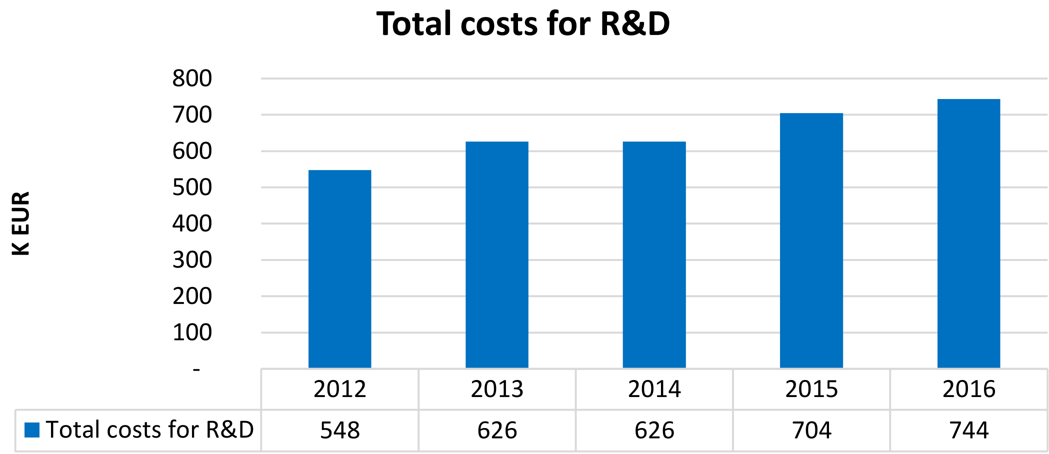
Total fixed expenses in 2017 were estimated at 9 000 K EUR[28] in 2017. Fixed EEI costs account for 63% of total fixed costs. The fixed costs of EEI marketed in the EU were estimated to be almost 2 400 K EUR[28] this year.

Under this assumption LTD. would have to spend fixed costs of 2 400 K EUR[28], representing 27% of the fixed costs of EEIs placed in the European Union, even in the case of a ban on the marketing of EEI on that market.

8.4.1.2.2 R&D costs

LTD. has spent more than 20 years searching for substitutes for Pb and Cr^{6+} compounds and disposes of its own department of R&D. However, looking for new, safe and environmentally friendly alternatives is very demanding in terms of time and financial costs, simply because the EEI itself is very dangerous and the raw materials used must meet very strict technological and safety criteria. Continuously with finding of new substitutes the R&D workees are also involved in the testing and verification of currently used substances in the production of explosive initiators, primarily because of the safety of the use of individual products.

The following chart (Scheme 7) shows the total cost of R&D activities for the period 2012-2016.



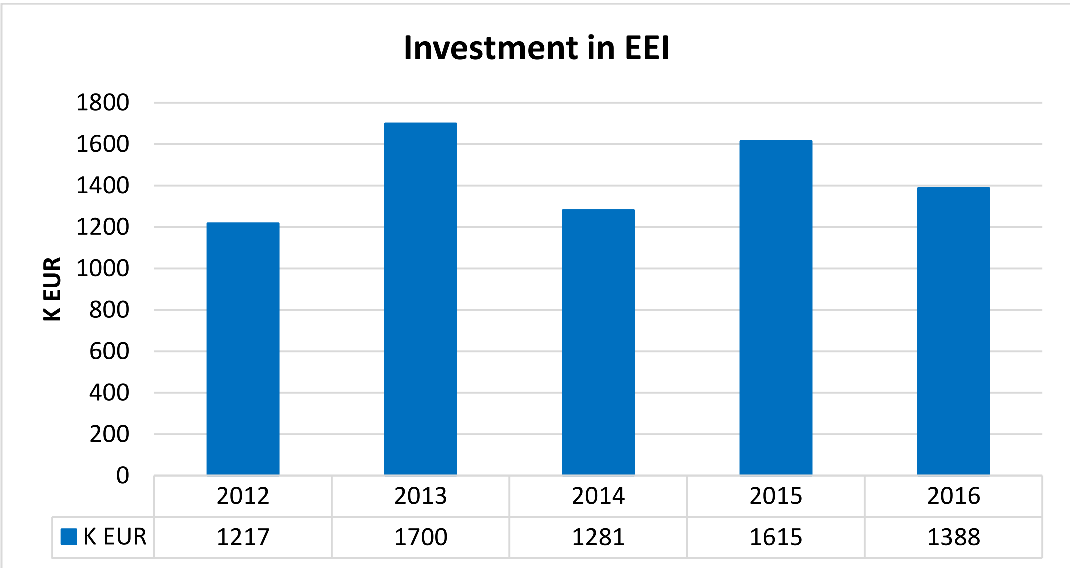
Scheme 7 Total R&D costs for 2012-2016

All of these costs were spent on finding alternatives and eliminating hazardous substances in the EEI. **R&D costs have increased by 26 % over the last 5 years.** This increase is due to the increasing number of development projects related to REACH and RoHS II, and the resulting increase in staff numbers, wage costs, material consumption and other costs for research institute services.

8.4.1.2.3 Investment

LTD. spends considerable money on constantly improving working conditions and reducing the undesirable effects of production on workers' health. At the same time LTD. invests in new technologies to improve safety and hygiene. Among the major investments of LTD. an investment can be allocated to the R&D explosion chamber[29], amounting in total to 567,000 EUR[28] in 2015, and a new laundry room investment amounting to 157,000 EUR[28].

Regular annual volume of investments of the LTD. is not negligible, and between 2012 and 2016 the average amount of 4 970 K EUR[28] was close to fifty percent of the net profit. Scheme 8 shows the EEI investments in the period 2012-2016. **The annual EEI investment amounts to an average of 1 440 K EUR[28], representing approximately 30% of the total investments of EEI.**



Scheme 8 Developments in EEI investments for 2012-2016

[29] **Explosion chamber** – R&D facilities used in LTD. to develop the safe and environmentally friendly destruction of inappropriate explosives or non-conforming products.

One of the priorities of LTD. is to increase the protection of workers during manipulation with hazardous chemicals (Pb and Cr^{6+} compounds, testing of alternative substances etc.). Therefore LTD. spends considerable money on the health and safety of workers (PPE, medical examinations). **The total cost of reducing the risks of explosive initiators production (see Chapter 8.3.2) is on average 313,200 EUR[28] per year.**

8.4.1.3 Summary of economic impacts

Based on the above, we can assume that LTD. faces a variety of macro and microeconomic threats, one of which could be a ban on placing EEIs on the EU market after 22 July 2019. At present time, EEI users within EU account for almost half of all sales of LTD. and the ban on placing EEI on the EU market without the available substitutes would lead, first of all, to a change in the orientation of EEI sales to non-EU countries. From the point of view of LTD. it would be a loss of gross profits from the sale of EEIs put on the EU market which, in the worst case scenario, could reach EUR 39 000 000 by 2022. This loss is calculated as the sum of the lost gross profit from EEI production in LTD. and the value of fixed costs of EEI production marketed in the EU. These economic impacts would then also affect the social situation in the company due to the necessary dismissal of employees.

In reality, however, the assumed loss of gross profits would be much worse given that LTD would fail to meet the overall demand for the initiators of explosives on the European market, as part of the EEI would be subject to the RoHS II bans because of the lack of adequate substitution found so far. This change would, of course, bring a whole host of new threats and costs that LTD would have to face. If the implications of the restrictions imposed by REACH on the use of Pb and Cr^{6+} compounds in industry would be taken into account, LTD. would threaten its total decline. The overall situation would then be negatively affected primarily by downstream users whose activity depends primarily on the use of EEI (but also non EEI) for professional use (Table 4).

8.4.2 Social impacts

8.4.2.1 Impacts on the Consumer Market and LTD.

Thanks to its long tradition and long-term high quality of their products, LTD. hold a major position in the European and world market for initiators of explosives used for civil (industrial) blasting. Currently LTD. covers up to 20 % of the European market and supplies its products to 35 countries around the world. Among the most important EEI users are companies focusing on primary mining and processing of minerals, construction work, destruction and special civilian work (Table 4). The following map (Figure 14) lists the states in the EU to which LTD. supplies EEI.

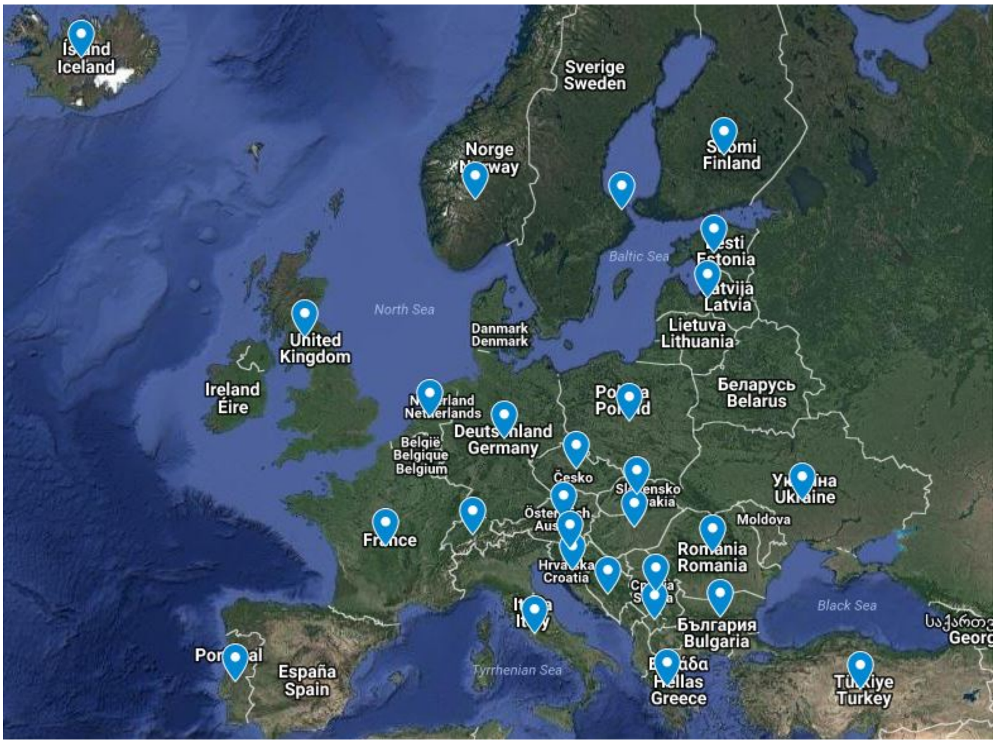


Figure 14 Customer Map – A View of Europe

8.4.2.2 Impact on end-users of products made from primary raw materials

In order to outline the relationship between the use of EEI and the production of finished products obtained from primary raw materials, this document includes illustrative examples. From these examples (Figure 15, Figure 16), it is more than obvious that explosive initiators play a very important and indispensable role in everyday life.

The first diagram (Figure 15) expresses the connection between **the use of explosive initiators and the acquisition of raw materials in the production of bread.**

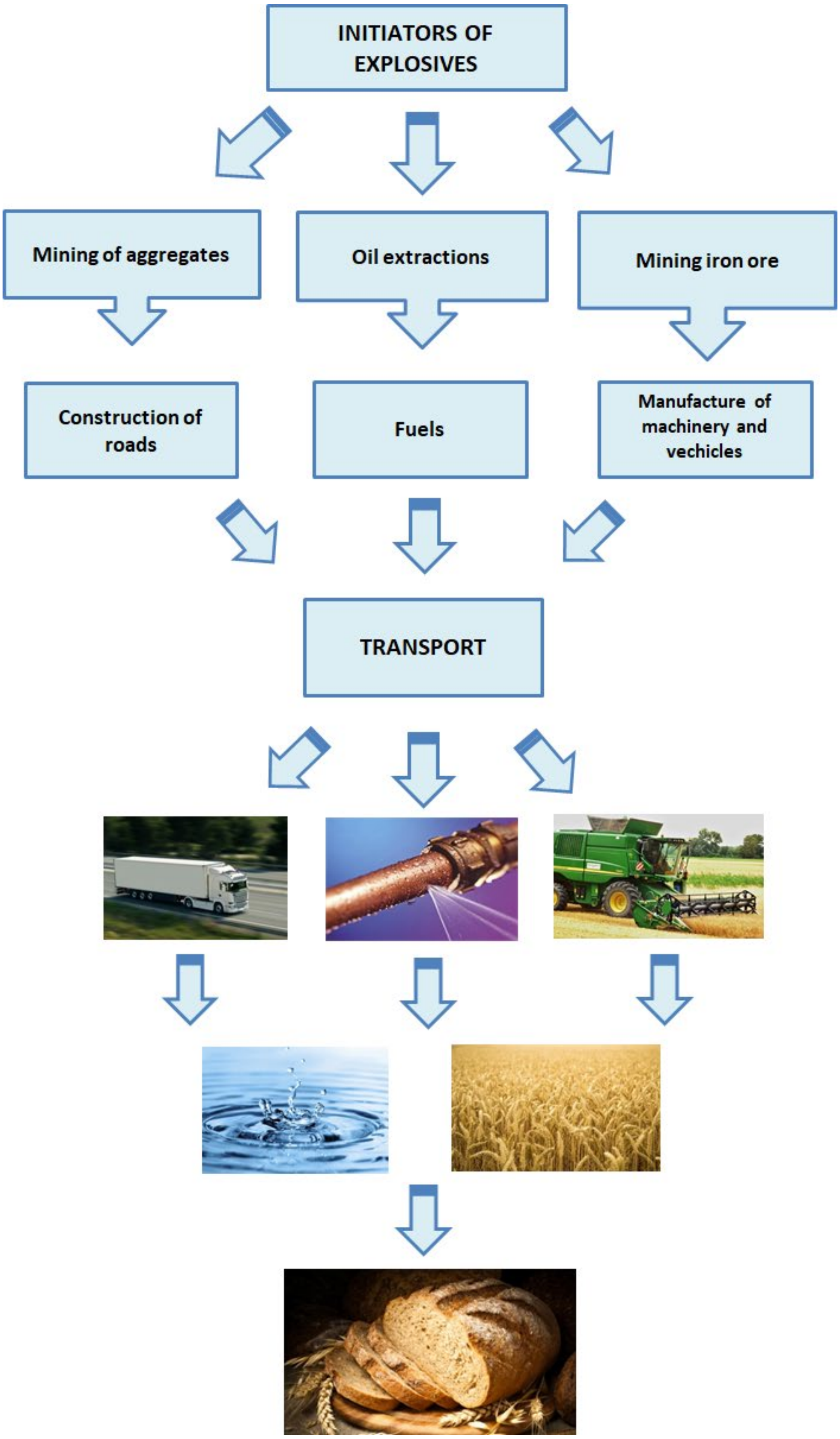


Figure 15 The use of explosive initiators and the acquisition of raw materials in the production of bread.

The second scheme (Figure 16) then expresses the connection between **the use of explosive initiators and the manufacture of a mobile phone.**

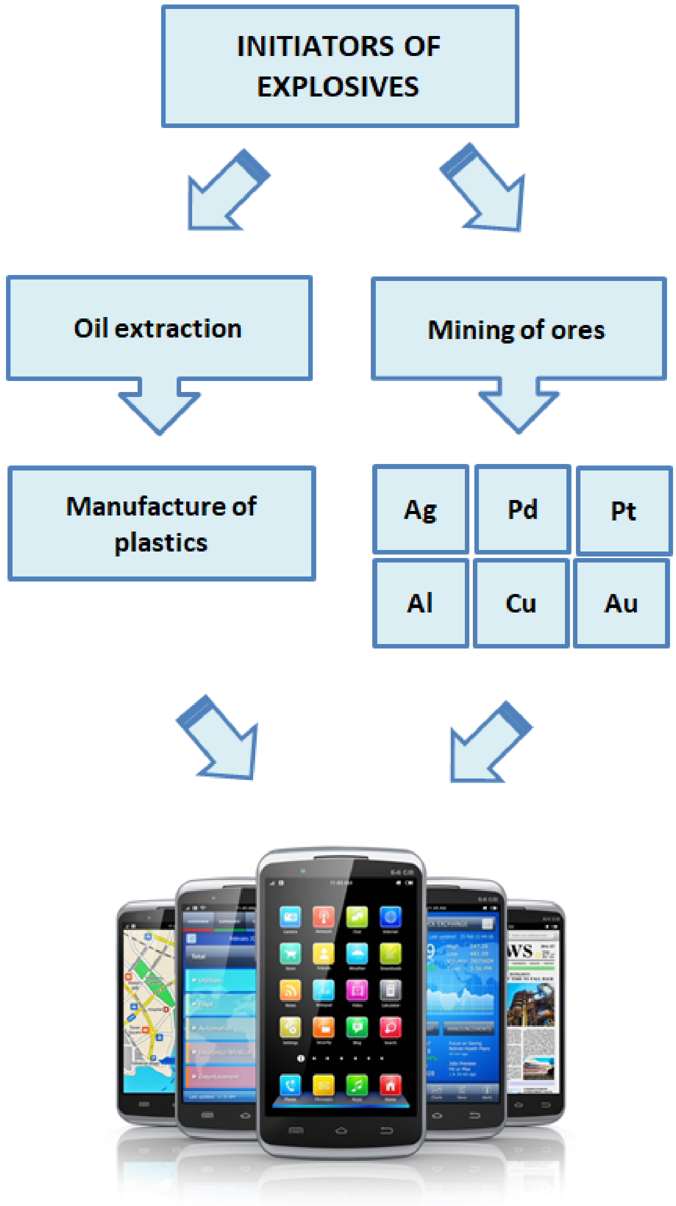


Figure 16 The use of explosive initiators and the manufacture of a mobile phone.

8.5 Availability of substitutes

a) **Describe supply sources for substitutes:** Not relevant

b) **Have you encountered problems with the availability?** Describe: Nor relevant

c) **Do you consider the price of the substitute to be a problem for the availability?** Not relevant

d) **What conditions need to be fulfilled to ensure the availability?** No relevant

9 Other relevant information

All relevant information has been provided in this application.

10 Information that should be regarded as proprietary

Applicant considers the below information as proprietary and request that this information is kept confidential as the information is commercially and technical sensitive where publication will result in loss of market share and competitive disadvantage.

Table 1 The list of substances used in the LTD. and their regulation by REACH

The following part of Reason for exemption no. 3 (Chapter 2, page 7):

[redacted]

Table 3 Percentual content of Pb and Cr6+ in pure chemicals used to produce explosive substances and mixtures in EEI

The following part of Chapter 8.1 (page 32):

[redacted]

Note number 19 (page 32):

[redacted]

[redacted]

The following part of Chapter 8.1 (page 33):

[redacted]

Figure 12 Steps to look for new substitutes with restriction by REACH Regulation and RoHS II Directive

11 Annexes

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÈQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

CERTIFICATE

No.: 1160708

Product: Components for the production of electronic detonators (without the presence of chemical substances, mixtures and explosives)

Type: -

Rating: -

Ordering firm: Austin Detonator s.r.o.
Jasenice 712, 755 01 Vsetín, Czech Republic

Manufacturer: Austin Detonator s.r.o.
Jasenice 712, 755 01 Vsetín, Czech Republic

Trade mark:

The test results are stated in the test-report No.: 603700-01/01 of: 12.09.2016

A sample of the product was found to be in conformity with:
Directive-RoHS- 2011/65 / EU as amended, and Government Regulation no. 481/2012 Sb.
ZP 344/02- Methodology for the determination of elements Pb, Cd, Cr, Hg, Br (see also EN 62321: 2009, Art. 6, EN 62321-1:2013 and IEC 62321-2:2013)

Other data:

The validity of the certificate is limited to: 30.09.2019

20.09.2016

Prague

Mgr. Miroslav Sedláček
Head of Certification Body

elektrotechnický zkušební ústav
ezú
-1-
Pod Lisem 129, 171 02 Praha 8 - Troja

Stamp

* C E R / 1 1 6 0 7 0 8 *

603700-01

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRÜFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÉQUE
ЭЛЕКТРОТЕХНИЧЕСКИЙ ИСПЫТАТЕЛЬНЫЙ ИНСТИТУТ - ЧЕШСКАЯ РЕСПУБЛИКА

Pod Lisem 129, 171 02 Praha 8 - Troja

CERTIFICATE

No.: 1160779

Product: Components for production of electric detonators
(without the presence of chemical substances, mixtures and explosives)

Type: -

Rating: -

Ordering firm: Austin Detonator s.r.o.
Jasenice 712, 755 01 Vsetín, Czech Republic

Manufacturer: Austin Detonator s.r.o.
Jasenice 712, 755 01 Vsetín, Czech Republic

Trade mark: -

The test results are stated in the test-report No.: 603095-01/01 of: 13.10.2016, 603095-01/03 of: 18.10.2016

A sample of the product was found to be in conformity with:
Directive RoHS 2011/65/EU as amended and Government Regulation no. 481/2012,
ZP 344/02 Methodology for the determination of elements Pb, Cd, Cr, Hg, Br (see also EN 62321:2009, Art. 6., EN 62321-1:2013 and IEC 62321-2:2013)

Other data:

The validity of the certificate is limited to: 31.10.2019

20.10.2016

Prague

RNDr. Milan Press
Deputy Head of Certification Body

elektrotechnický zkušební ústav
ezú
-1-
Pod Lisem 129, 171 02 Praha 8 - Troja

Stamp

* C E R / 1 1 6 0 7 7 9 *

603095-01

ELEKTROTECHNICKÝ ZKUŠEBNÍ ÚSTAV

ELECTROTECHNICAL TESTING INSTITUTE - CZECH REPUBLIC
ELEKTROTECHNISCHE PRŮFANSTALT - TSCHECHISCHE REPUBLIK
INSTITUT ELECTROTECHNIQUE D'ESSAIS - RÉPUBLIQUE TCHÉQUE
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603095-01