Exemption Request Form

Date of submission: October 17, 2024

1. Name and contact details

(A) Name and contact details of applicant:

Company:	Titanobel	Tel.:	+33 3 80 47 23 14
Name:	Emmanuel Martin	E-Mail:	emmanuel.martin@titanobel.com
Function:	Directeur Technique	Address:	Rte de Lamarche21270 Vonges, France

(B) Name and contact details of responsible person for this application (if different from above):

Company:	Dyno Nobel	Tel.:	860-408-1844
Name:	Richard Michna	E-Mail:	rich.michna@am.dynonobel.com
Function:	Research and Development Director	Address:	660 Hopmeadow St, Simsbury CT

2. Reason for application

Please indicate where relevant:

☐ Request for new exemption in:

☐ 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: Entry #45 in Annex III to Directive 2011/65/EU

Proposed or existing wording: See section 3 summary

Duration where applicable: Current exemption expires April 20, 2026

☐ **Other:** N/A

3. Summary of the exemption request / revocation request

Application to extend the existing exemption to authorize the use of Lead azide ($Pb(N_3)_2$), Lead dipicramate ($C_6H_3N_3O_7.½Pb$), and Lead Compounds in electric and electronic initiators (EEI's) of explosives for civil (professional) use.

This request is to extend the expiration date beyond April 20, 2026 for a period of 5 years.

4. Technical description of the exemption request / revocation request

(A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

   Name of applications or products:
   DIGISHOT®, DIGISHOT® PLUS, DRIFTSHOT®, and GEOSHOT® Electronic Detonator Assemblies

   a. List of relevant categories: (mark more than one where applicable)

      ☐ 1 ☐ 7
      ☐ 2 ☐ 8
      ☐ 3 ☐ 9
      ☐ 4 ☐ 10
      ☐ 5 ☒ 11
      ☐ 6

   b. Please specify if application is in use in other categories to which the exemption request does not refer: N/A

   c. Please specify for equipment of category 8 and 9:
      ☐ The requested exemption will be applied in
      ☐ monitoring and control instruments in industry
      ☐ in-vitro diagnostics
      ☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?
   (Indicate more than one where applicable)

   ☒ Pb ☐ Cd ☐ Hg ☐ Cr-VI ☐ PBB ☐ PDBE

3. Function of the substance:

   Lead azide - (CAS 13424-46-9)
   Lead azide is employed as an initiating explosive in the base charge within electronic detonator assemblies.

   Lead dipicramate – (CAS 6477-64-1)
   Lead dipicramate is used as a primary explosive in the fuse head within electronic detonators assemblies.

   Lead compounds – (CAS 7439-92-1)
   Lead compounds are utilized a solder within electronic detonators assemblies.

4. Content of substance in homogeneous material (%weight):

   Lead azide
   The element lead is present at 71 % by weight in the Dextrinated Lead Azide used as a primary charge in Dyno Nobel detonator assemblies.

   Lead dipicramate
   Lead dipicramate is present in the Fuse Head component of a Dyno Nobel Electronic detonator assembly at <20% by weight.

   Lead compounds (solder)
   Lead is present in the tin/lead solder used in Dyno Nobel electronic detonator at 40% by weight.

   Note that when considered on an overall basis Dyno Nobel DigiShot™ electronic detonator assemblies contain ≤0.1% lead in coil lengths of ≥16 ft (5 meters).

5. Amount of substance entering the EU market annually through application for which the exemption is requested:

   Electronic Detonator Assemblies
   XXXX

6. Name of material/component:

   Lead azide, Lead dipicramate, and Lead compounds

7. Environmental Assessment:

   LCA: ☐ Yes
   ☒ No

   The small amount of lead materials present in an electronic detonator assembly become very finely diluted during blasting. Detonator assemblies as-built do not enter waste streams.

(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?

Lead azide - (CAS 13424-46-9)
Lead azide is employed as an initiating explosive in the base charge within electronic detonator assemblies.

Lead dipicramate – (CAS 6477-64-1)
Lead dipicramate is used as a primary explosive in the fuse head within electronic detonators assemblies.

Lead compounds – (CAS 7439-92-1)
Lead compounds are utilized a solder within electronic detonators assemblies.

What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?

Lead azide is preferred as a primary explosive for several key reasons:

High Sensitivity: Lead azide is highly sensitive to shock, friction, and heat, which makes it effective for use in detonators and primers. It can reliably initiate secondary explosives like TNT or RDX.

Stable in Storage: Unlike many other primary explosives, lead azide is relatively stable under normal storage conditions. It does not degrade or lose effectiveness as quickly, making it safer and easier to store for extended periods.

Low Critical Mass: It can be used in very small quantities (milligrams) to initiate explosions, minimizing the amount needed while still being effective.

Fast Detonation Speed: Lead azide has a rapid transition from deflagration (burning) to detonation, which ensures a quick and efficient transmission of energy to secondary explosives.

Ease of Manufacturing: It can be synthesized relatively easily and with consistent quality, which makes it a practical choice for large-scale production.

Lead dipicramate is used as a material in fuse head compositions

High Sensitivity: The high sensitivity of Lead dipicramate is the key characteristic for use in fuse head compositions. This creates a highly reliable fuse head that minimizes the amount of energy needed as a trigger.

Lead compounds (solder) join the electrical components to the circuit board.

Lead has traditionally been used in solder for several important reasons:

Low Melting Point: Lead has a relatively low melting point (327.5°C), and when combined with tin, it forms a eutectic alloy (typically 60% tin and 40% lead) that melts at around 183°C. This low melting temperature allows for soldering at relatively low heat, which reduces the risk of damaging sensitive electronic components.

Good Wetting and Flow Properties: Lead-tin solder alloys exhibit excellent wetting characteristics, meaning they flow well and spread evenly across surfaces, creating strong, reliable joints. This ensures good electrical and mechanical connections, which is crucial in electronics.

Ductility: Lead is ductile, meaning it can absorb mechanical stresses and resist cracking or becoming brittle. This flexibility is especially important in solder joints, as it allows the connections to withstand thermal expansion and contraction without breaking.

Cost-Effectiveness: Lead is relatively inexpensive compared to other metals that can be used in soldering. This, combined with its favorable properties, has made lead-based solders an economical choice for many years in various industries, especially electronics.

Oxidation Resistance: Lead helps prevent the formation of oxides that could interfere with the soldering process. In lead-based solders, the lead helps protect the solder joint from oxidation, ensuring better conductivity and a longer-lasting connection.

Reliable Electrical Conductivity: Lead provides good electrical conductivity, ensuring reliable electrical connections in circuits. The combination of tin and lead in solder creates a joint with low electrical resistance, which is essential in electrical and electronic applications.

5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

(A) Please indicate if a closed loop system exists for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)

When used EEI's are consumed completely in the blasting process. A closed loop system is not possible.

(B) Please indicate where relevant:

☐ Article is collected and sent without dismantling for recycling
☐ Article is collected and completely refurbished for reuse
☐ Article is collected and dismantled:
  ☐ The following parts are refurbished for use as spare parts:_____
  ☐ The following parts are subsequently recycled:______________
☐ Article cannot be recycled and is therefore:
  ☐ Sent for energy return
  ☐ Landfilled

(C) Please provide information concerning the amount (weight) of RoHS substance present in EEE waste accumulates per annum:

☐ In articles which are refurbished ________
☐ In articles which are recycled ________
☐ In articles which are sent for energy return ________
☐ In articles which are landfilled ________

6. Analysis of possible alternative substances

(A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken

Lead Based Solder – There is lead free solder that may be possible to use to affix the electronic components, and for attachment of the fuse head and downline wires. Validating and converting to these materials will require extensive testing and development by DetNet & Dyno Nobel.

Lead Azide – Diazo dinitrophenol (DDNP) is an has been used as a primary charge in a detonator design based on rigid elements in our former Port Ewen NY facility. Both DDNP synthesis, and the rigid element technology needed to use it were discontinued at Dyno Nobel in favor of a Lead Azide based design.

Lead dipicramate – We will have to work with our suppliers DetNet and XXXX, our fuse head supplier, to identify what options there are. This change may affect cost and/or the product performance envelope of the Electronic Initiator Unit (EIU).

(B) **Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application**

DDNP is used successfully as a primary explosive in the manufacture of detonators. This requires a substantially different detonator design then the current Dyno Nobel lead azide based system.

As mentioned above, changing the fuse head construction to eliminate the lead dipicramate will require the involvement of Dyno Nobel suppliers DetNet and XXXX. It can be assumed that there is a suitable substitute, but that may have cost and performance implications. Validation of the safety and performance of the overall system is pending.

Lead free solders are available but will likely require adjustments to the manufacturing processes. Validation of the safety and performance of the system with lead free solder is pending.

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.**

To-date the action taken has been to review the historical detonator assembly designs that did not utilize a lead azide primary charge, and to investigate the competitors' offerings. There is clearly more work required to develop a full path forward.

The implementation of lead-free solder into the fabrication of EIUs resulted in reduced manufacturing reliability and additionally resulted in a reduction of operational performance during the application of the product.

An in-depth investigation was conducted into the material properties of the lead-free and lead-based solder at various points of the manufacturing process as well as those exposed to environmental stress.

More work is required to introduce a lead-free solder into the manufacturing process while ensuring product parity additionally, a full validation of the proposed change is required to ensure reliability and specifically safety as poor solder joint leading to a misfire is a safety risk.

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

<u>**High Level Schedule Bullet Points**</u>

- Identify potential suppliers of a lead-free base charged shell and use them to assemble electronic detonator assemblies
  ~8 Months to identify / validate (If available).

- Develop a lead free EIU including Fusehead and downline solder joint
  ~36 to 48 months to identify / validate
  (Note: Fuse head to have equivalent output characteristics to the current design)

- Develop an internal process for manufacturing lead free base charges in-house. Possibilities include:

  - DDNP based design either rigid element style or inverted cup concept
    ~36 to 48 months to design / validate

- Dextrinated Silver Azide direct Lead Azide Substitute
  ~24 months to design / validate

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

(A) Links to REACH: (substance + substitute)

1. Do any of the following provisions apply to the application described under (A) and (C)?
   ☒ Authorization
   - ☒ SVHC
   - ☒ Candidate list
   - ☐ Proposal inclusion Annex XIV
   - ☐ Annex XIV

   ☐ Restriction
   - ☐ Annex XVII
   - ☐ Registry of intentions

   ☒ Registration
   lead diazide (lead azide) – Registration Number 01-2119475503-38-0001

2. Provide REACH-relevant information received through the supply chain.
   Name of document: Information is included in our MSDS (section 3)

(B) Elimination/substitution:

1. Can the substance named under 4.(A)1 be eliminated?
   ☐ Yes. Consequences?
   ☒ No. Justification: See section 7.A and 7.B above.

   - The EEI design hermetically encapsulates all chemical substances placed in the article. During normal use of the article, there is no contact with these chemical substances, which are the subject of this exemption request.

   - During operation, the EEE is completely destroyed. This is because lead is a component of the primary explosive or pyrotechnic composition, which will be completely consumed during detonation operation. This means that there is no waste that can be reused, recycled or processed.

2. Can the substance named under 4.(A)1 be substituted?

   ☐ Yes.

   ☐ Design changes:

   ☐ Other materials:

   ☒ Other substance: There may be potential substitutes (pending testing).

   ☒ No.

   Justification:

   The research and testing of new substitutes for the lead compounds used in the production of explosives initiators is a very tedious process, particularly from the point of view of strict criteria, and some of the results, despite many years of study and testing, are still uncertain. The fields of use of the explosives and pyrotechnic products concerned require, in some cases, technical qualification of products using EEIs, particularly for sensitive applications. Modifying components such as EEE therefore requires a new application for qualification, which takes several years. In addition, for professional industrial use, it is necessary to obtain a level of performance both in terms of the item's explosive properties and safety guarantees.

3. Give details on the reliability of substitutes (technical data + information):

   See section 7.A and 7.B above.

4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to

   a) Environmental impacts:

      Candidates will need to be thoroughly evaluated in this regard.

   b) Health impacts:

      Candidates will need to be thoroughly evaluated in this regard.

   c) Consumer safety impacts:

      EEI's are used in specific mining and construction applications by highly trained blasters, not by general consumers. As part of any alternate material investigation extensive safety evaluations will be completed.

   Do impacts of substitution outweigh benefits thereof?
   Please provide third-party verified assessment on this:

   Until a thorough investigation of alternatives has been completed this remains unanswered.

(C) Availability of substitutes:

1. Describe supply sources for substitutes:

   Potential material and sub-assembly substitutes may be available within the companies manufacturing EEI's and components. These options will be pursued.

2. Have you encountered problems with the availability? Describe:

   This work is pending.

3. Do you consider the price of the substitute to be a problem for the availability?

   ☐ Yes ☒ No

4. What conditions need to be fulfilled to ensure the availability?

   Any potential alternate material will have to undergo extensive testing to ensure reliability, safety during manufacture, and safety during end use. There will also need to be commercial arrangements for the material sourcing, or internal manufacturing established.

(D) Socio-economic Impact of substitution:

1. What kind of economic effects do you consider related to substitution?

   ☒ Increase in direct production costs
   ☒ Increase in fixed costs
   ☐ Increase in overhead
   ☐ Possible social impacts within the EU
   ☐ Possible social impacts external to the EU
   ☐ Other:

   Provide sufficient evidence (third-party verified) to support your statement:

   Both increased production costs and fixed costs may be impacted by a material or sub-component substitution. Evidence to support this is pending.

9. Other relevant information

Please provide additional relevant information to further establish the necessity of your request:

10. Information that should be regarded as proprietary

Please state clearly whether any of the above information should be regarded to as proprietary information. If so, please provide verifiable justification:

- References to fuse head supplier Astotech.
  See highlighted sections 6.A and 6.B

- Specific weights of materials used in Dyno Nobel EEI's.
  See highlighted section 4.A.5

- Forecast sales figures of Dyno Nobel EEI's.
  See highlighted section 4.A.5