

# AMMUNITION SAFETY



**TNO** innovation  
for life

The product team Ammunition Safety (PT AS) is a team within TNO consisting of experts from multiple departments who work together on life cycle analysis, testing and modelling of ammunition characteristics, as well as consultancy on safety aspects related to purchasing, storing and demilitarizing of ammunition. This team has all the necessary resources and qualifications to assist governments, defense organizations and industrial partners. The high-quality results will enable your organization to maximize the safety and utility of your ammunition while minimizing the burden on health and environment.

The facilities accessible to the PT AS experts include a wide range of test machines, laboratories and bunkers for (gas) explosions. These facilities are designed for the synthesis, chemical, physical and thermal analysis and handling of energetic materials. In the decades of experience working with explosive materials such as pyrotechnics, organic peroxides, ammonium nitrate fertilizers, self-reactive and self-heating substances and flammable gases, solids and liquids, the team has built a considerable expertise while maintaining a safe track record. The PT AS global customer base, ranging from SMEs to multinationals and governments, values the rapid response, independent and objective character and effort to go that extra mile. After every project you will receive the results and findings in a report, including a thorough interpretation and analysis with always the main question in mind:

what does this actually mean for your business?

## **LIFE CYCLE ANALYSIS OF AMMUNITION**

To be able to predict the safe remaining life of ammunition for storage, transport and use, the AS team performs life cycle analyses of various types of ammunition including gun powder containing articles and guided missiles. This means that the explosive materials are tested under a variety of realistic mechanical and environmental loadings, for example: shock and vibration to simulate off-road transport or ammunition drops, and storage at extreme and fluctuating temperatures. Vulnerability tests, such as bullet and fragment impact tests, can also be performed at the PT AS facilities. Finally, periodically rocket motors are mechanically, chemically and thermally tested to create a reference point for the

aging behaviour and service life of high-end ammunition. These tests allow the experts at PT AS to predict the service life of ammunition and advise clients on their storage, deployment and demilitarization activities.

Case study: Samples of each single lot of gun powder from the ammunition that the Dutch Ministry of Defence has in stock, are stored and tested periodically. This allows the AS team to advise the Dutch Ministry of Defence on lifetime of the propellant regarding safe storage, transport and use of the ammunition.

**COMPLYING TO NEW STANDARDS**

By using its exclusive and state-of-the-art facilities for the qualification of energetic materials, the experts from the PT AS are able to support governments and ministries of Defence in setting up realistic (national/international) safety standards. The AS team also contributes to the updating and development of NATO standards.

Case study: The implementation of amongst others the REACH legislation in the EU, has increased the awareness with respect to the effect of materials on human health and the environment. The REACH legislation aims to improve the protection of human health and the environment against the risks associated with chemicals, including those used in ammunition. The PT AS experts are equipped to perform measurements regarding the emission products produced when using ammunition by advising or providing the right measurement setup and to perform a toxicity evaluation on the obtained results by using available (inter)national guidelines or threshold values. Due to the lack of international guidelines for ammunition, PT AS experts are involved in the development of these guidelines together with other NATO-countries.

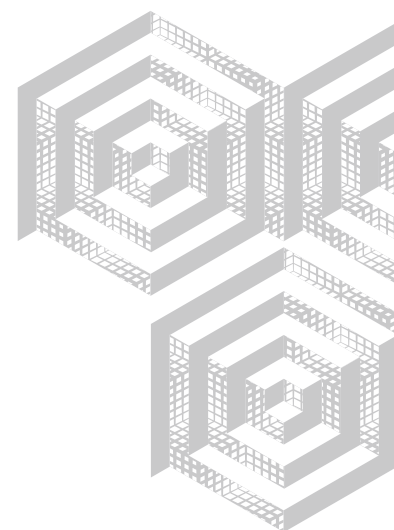
Apart from emissions, also noise may affect the environment. Within the PT AS, experts investigate the propagation of noise produced by the firing of ammunition, its effect on the target and the impact of this noise on the environment. Based on these results, the experts provide advice on noise reduction measures.

**SAFE DISPOSAL**

The final part of the ammunition lifecycle is demilitarisation, so when a batch of

ammunition reaches its end of lifetime, the PT AS experts provide advice on how to handle its disposal. The experts base these decisions on in-house models for ammunition degradation and test data. The batch of ammunition may be used for training purposes or needs to be disposed of. Also advice in the clearing of unexploded ordnance from, for example, World War II can be provided.

Case study: In a field in the south of the Netherlands, the remains of an unexploded old German V1 missile were discovered. It was decided by the Dutch Explosive Ordinance Disposal (EOD) that these remains were to be cleared by detonation of the explosive charge of the V1 missile. The PT AS experts used their calculation models to advise the EOD to set up a protective cover on and around the point of detonation. This model included environmental factors such as a nearby farm and greenhouses, and by following the AS experts' recommendations the cover allowed for a controlled explosion while preventing any damage to the surrounding constructions.



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**DEFENCE, SAFETY AND SECURITY**

The independent Netherlands Organisation for applied scientific research (TNO) supports the Dutch comprehensive protection model. Our work in Defence, Safety & Security focuses on technological and behavioural innovations.

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