# ECHA Workshop : Call for evidence on possible restriction of lead in gunshot, bullets and fishing sinkers

## A Viewpoint From Competitive Target Shooting

ELEY®

# Introduction

- ELEY manufactures high specification, precision target shooting ammunition in 0.22LR, 0.17 Air and 38 Super calibres.
- Our products are used worldwide by competitive target shooters and hunters from international Olympic athletes to enthusiastic amateurs.
- We are committed to the continued, sustainable development of a sport which is truly
  - gender neutral,
  - non-elitist and
  - para-sport friendly

# Target Shooting Sports

- Target shooting is a diverse collection of sporting disciplines
  - Each different discipline has a specified format
    - Shooting Range
      - Defined area designed to contain all projectiles discharged
      - Construction and layout
      - Range distance
      - Target specification
    - Firearm type
      - Calibre
      - Barrel length
      - Loading action
      - Stock format
    - Ammunition type
      - Calibre
      - Ballistic specification
        - Projectile mass
        - Projectile velocity

# Target Shooting Disciplines

- Examples include

| Air | Smallbore | Fullbore | Shotgun |
|---|---|---|---|
| Target Air Rifle | Target Rifle | Target Rifle | Trap |
| Target Air Pistol | Target Pistol | Target Pistol | Double Trap |
| Target Sprint | Rapid Fire Pistol | Practical Pistol | Skeet |
| Running Target | Biathlon | Practical Rifle | |
| | Benchrest | | |
| | Practical Pistol | | |
| | Mini Rifle | | |
| | Running Target | | |

# Target Shooting Ammunition

- To achieve the necessary level of precision within the ballistic specification of the discipline, many different types and calibres of ammunition have been developed.
- Popular examples for rifle and pistol target shooting disciplines include

| Air | Smallbore | Fullbore |
|---|---|---|
| 0.17 AIR 4.49mm | 0.22LR Precision Rifle | 7.62 / 308 |
| 0.17 AIR 4.50mm | 0.22LR Precision Pistol | 6mm BR |
| 0.17 AIR 4.51mm | 0.22LR Rifle | 6mm XC |
| 0.22 AIR | 0.22LR Pistol | 6.5 x 55 |
| | 0.22LR Biathlon | 7.5 x 55 |
| | 0.22LR High Velocity | 6mm x 47 |
| | 0.22LR Heavy Weight | 9mm |
| | | 38 Super |
| | | 45 ACP |
| | | 10 mm |
| | | 40 CAL |
| | | 223 Rifle |

# Competitive Standards

- **Case Study 1: Para R3–mixed 10m air rifle prone SH1**
- https://paralympics.org.uk/articles/skelhon-crowned-world-champion-as-ritchie-takes-bronze-in-sy
- https://eley.co.uk/paralympian-matt-skelhon-puts-a-perfect-performance-at-the-world-championships/
- *13 October 2019 : Skelhon crowned world champion as Ritchie takes bronze in Sydney*
- *Matt Skelhon held his nerve when it mattered most as he claimed the 10m air rifle prone mixed SH1 title at the World Shooting Para Sport Championships in Sydney.*
- *The Beijing 2008 Paralympic gold medallist scored a total of **253.2** points in the final to top the podium, finishing just **0.3** ahead of Australia's Anton Zappelli*


*Figure 1 : Matt Skelhon crowned world champion*

# Competitive Standards

- **Requirements of the Discipline**
- The ISSF 10m Air Rifle target has a white central dot which is the 10 ring, with a radius 0.25mm. The surrounding 9 ring has a 2.75mm radius.
- The maximum score per shot of 10.9 is reduced by 0.1 for every 0.25mm between the target centre and the centre of the shot impact.
- In the final competition round, Matt Skelhon shot twenty-four 0.17 Air calibre pellets at the ISSF air rifle target from a distance of 10m achieving a score of 253.2 from a possible 24 x 10.9 = 261.6. Matt Skelhon's gold medal was won by an aggregate difference of only (0.3 x 0.25 / 0.1) = 0.75mm across the 24 shots, or an average deviation of 0.031mm per shot at the target.

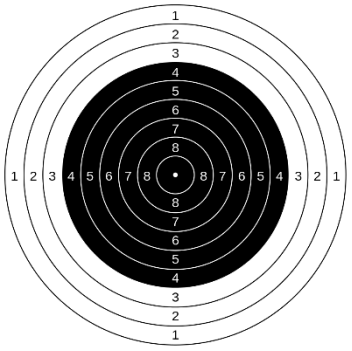


*Figure 2 : ISSF 10m Air Rifle Target*

# Competitive Standards

- **Product Performance Capability**
- ELEY Tenex Air pellets (0.17 calibre lead pellets) tested on the Eley Customer Test Range from a clamped air rifle at 10m, produced the results in Figure 3. Ten lead pellets from each of 3 ELEY Tenex Air batches are shown. The score (out of a possible 109.0) for the 10 shots is shown upper left, while the enclosing circle diameter (mm) is shown lower right. No other materials are available to provide the necessary combination of properties which deliver this level of accuracy performance.
- Tin pellets are available in limited quantities. The physical and mechanical properties of tin prevent the formation of pellets with the necessary profile, mechanical properties and specifications required to consistently achieve this level of performance. At 10m typically 10 tin pellets can produce an enclosing group circle of 15 to 20 mm, potentially reducing the score in a 24 shot ISSF final by up to 12 points.

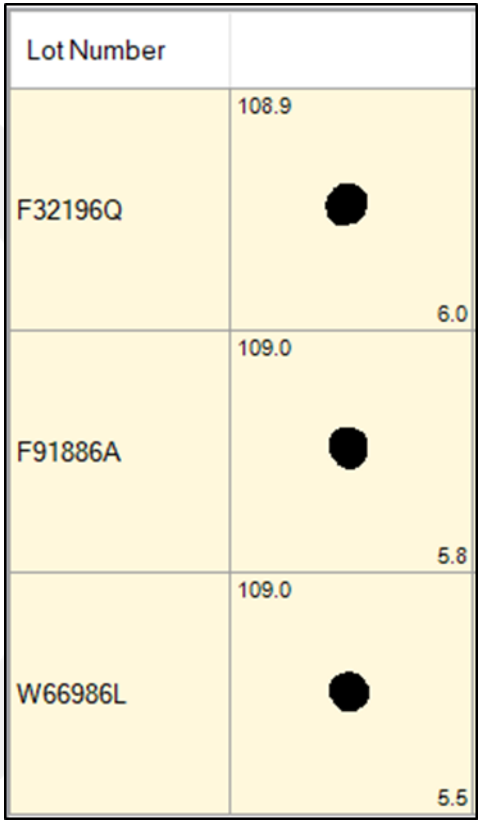



*Figure 3: Performance of Tenex Air 0.17 Lead Air Pellets at 10m*

# Competitive Standards

- **Case Study 2: 50m Rifle 3 Positions Men FR3X40**
- Ref: https://www.issf-sports.org/news.ashx?personissfid=SHCHNM2202199601&newsid=3053
- *25 May 2018 : Yang Haoran pockets his first 3 Positions gold, sets a new World Record*
- *ISSF World Cup Rifle / Pistol · Munich, GER*
- *The Chinese 22-year-old shooter — who counts seven international gold medals in the Air Rifle event — climbed atop the podium in Munich, prevailing over Russian Federation's Sergey Kamenskiy and Italy's Marco De Nicolo, who respectively took silver and bronze.*
- *Along the decisive elimination phase, Yang fired three times in the 10th ring, successfully defending the top position and pocketing the brightest medal with the score of 465.3 points: a new World Record in this event. His 30-year-old Russian rival, instead, closed with 463.4 points placing 2nd and winning his fourth World Cup medal in this event.*

*Figure 4 : Yang Haoran pockets his first 3 Positions gold*

# Competitive Standards

- **Requirements of the Discipline**
- The ISSF 50m Rifle Target has a central 10 ring, with a radius 5.2mm. The surrounding 9 ring has a 13.2mm radius.
- The maximum score per shot of 10.9 is reduced by 0.1 for every 0.8mm between the target centre and the centre of the shot impact.
- In the final competition round, Yang Haoran set a new world record score of 465.3 shooting forty-five 0.22LR calibre bullets at the ISSF 50m Rifle Target. His winning margin of 1.9 points represents an average difference of only 0.42mm per shot at a distance of 50m.

*Figure 5 : ISSF 50m Rifle Target*

# Competitive Standards

- **Product Performance Capability**
- ELEY Tenex 0.22LR lead ammunition tested on the Eley Customer Test Range in Fellbach, Germany from a clamped firearm at 50m, produced the results in Figure 6. Four groups of 10 shots from ELEY Tenex 0.22LR ammunition lot 1019-06259 shown. The enclosing circle diameter (mm) is shown lower right for each group.

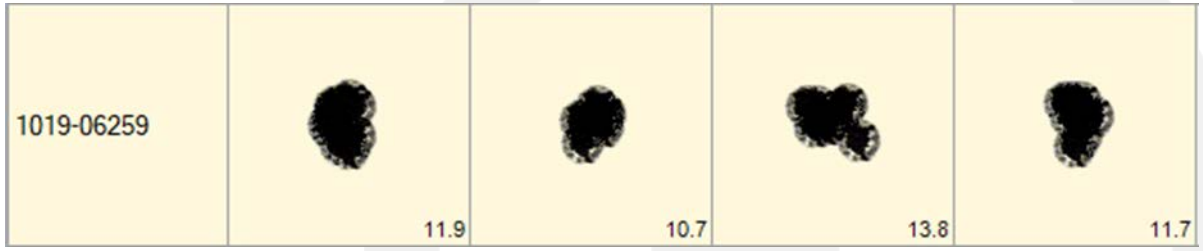



*Figure 6 : Performance of Tenex 0.22LR at 50m*

- On an ISSF 50m target these 40 shots would score 427.7 out of a possible 436.0 (Figure 7). No other materials are available to provide the necessary combination of properties which will deliver this level of accuracy performance.
- Very limited quantities of 0.22LR ammunition loaded with copper projectiles are available. Independent testing with this copper ammunition shows the enclosing circle diameters for only 5 shots at 45.7m (50 yards) to on average 35.6mm. This would not be considered acceptable for even entry level target shooting.
- Ref: https://www.americanrifleman.org/articles/2016/11/10/tested-cci-copper-22-ammunition

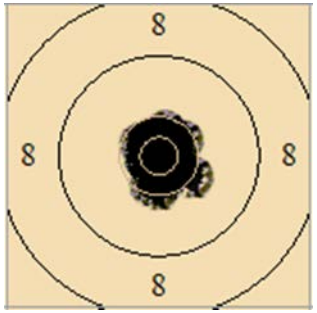


*Figure 7: 40 shots of Tenex 0.22LR ammunition lot 1019-06259 on an ISSF 50m Rifle Target*

# Achieving Performance Standards

- The accuracy standards demonstrated in the illustrated Case Studies are the result of long term development and investment in product design and manufacturing processes.
- European ammunition and firearms manufacturers currently produce the most accurate 0.22LR and 0.17 AIR target shooting ammunition and equipment in the world, with almost exclusive usage at the highest levels of the sport for nearly 20 years.
- These standards are achieved by a close interaction between three elements of a precision system;
  - Athlete
  - Firearm
  - Ammunition

# Achieving Accuracy Performance Standards

- **Athlete**
- Target shooting athletes spend hundreds of hours developing their shooting technique, with the goal of ensuring the firearm to becomes a natural extension of their body. They will develop an intimate familiarity with their firearm and an acute sense of the reactive forces produced when shooting a particular ammunition lot.

*Figure 8: Target shooting athletes (www.scottishtargetshooting.co.uk)*

# Achieving Performance Standards

- **Firearms**
- Target shooting firearms are sophisticated pieces of equipment, developed over many years to interface with both the athlete and the ammunition to enable the necessary precision at the target distance. Target shooting rifles and pistols of 0.22LR and 0.17AIR have been engineered to launch a lead projectile. The barrel of the firearm must,
  - safely contain the pressure developed by the gases used to drive the projectile,
  - appropriately form and guide the projectile to an accurate and consistent release,
  - provide enough rotational spin to the projectile to stabilise it during its trajectory to the target.
- A change of projectile material will require redesign and development of all aspects of the firearm.

*Figure 9: Target Shooting Firearms*

# Achieving Performance Standards

- **Ammunition**
- The 0.22LR calibre has minimal recoil and produces relatively low noise in subsonic form, making it ideal for target shooting sports.
- The 0.22LR calibre requires a “heeled” projectile. The main section of the projectile has the same diameter as the brass cartridge case to which it must be attached. Therefore, a narrower diameter “heel” on the projectile is necessary to enable it to be fitted to the brass cartridge case.
- For precision performance, each projectile of an ammunition lot must be capable of undergoing the launch process in a controlled and predictable manner.

# Achieving Performance Standards

- **Launching the 0.22LR Precision Projectile**
- The projectile must provide consistent resistance to the initial gas pressure rise produced in the firearm.
- The outer diameter of the projectile must be suitably engraved by the grooved internal surfaces of the firearm barrel and maintain alignment of its axis with that of the firearm barrel.
- The rear surface of the projectile must uniformly expand to provide a seal, preventing leakage of the expanding drive gases as the projectile travels along the firearm barrel.
- During its travel down the firearm barrel, the projectile must engage with the twisted grooves of the firearm barrel to ensure a controlled stabilising spin is applied, and not create excessive wear or damage to the barrel.
- On exit from the barrel, the release of the driving gases around the projectile must be even, controlled and repeatable. This can only be achieved if the rear surface has expanded in a uniform manner.
- During its travel to the target, the projectile must have sufficient mass to maintain both forward and rotational momentum.
- On impact, the projectile must deform to rapidly dissipate its kinetic energy, minimising the potential for ricochet. Figures 10 to 12 show the form of a Tenex 0.22LR lead projectile through these stages.
- The mechanical and physical properties of the projectile material must be homogenous and to achieve the necessary performance must have a high density, low hardness and exhibit high ductility with a low tensile strength.

# Achieving Accuracy Performance Standards

- **ELEY Tenex 0.22LR Lead Projectile**
- Figures 10 to 12 show the form of a Tenex 0.22LR lead projectile through these stages.

*Figure 10 : Original form of Tenex 0.22LR lead projectile*

*Figure 11 : Tenex 0.22LR lead projectile after travelling through target rifle firearm*

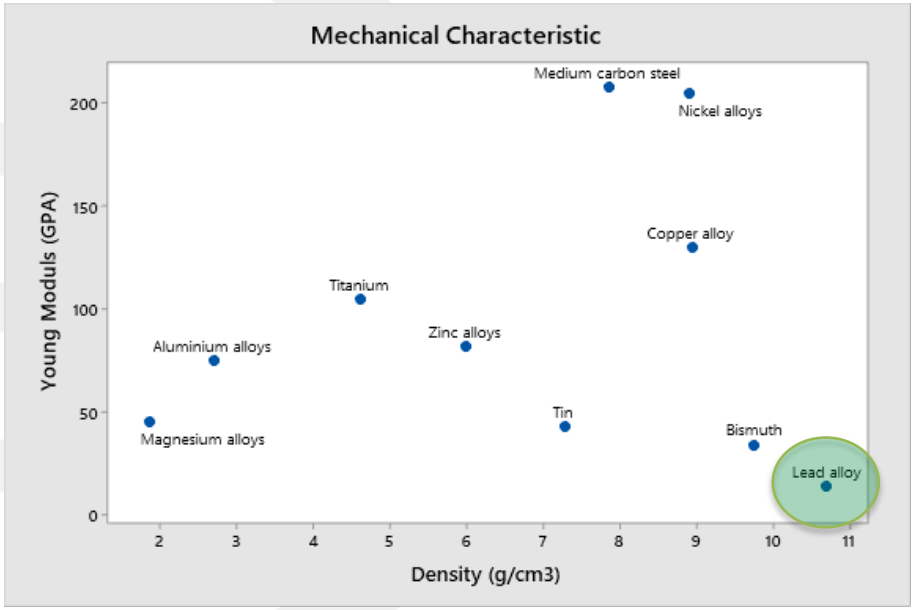
*Figure 12 : Tenex 0.22LR lead projectile after capture in projectile catcher*

# Alternative Materials

- Current status
  - Precision target shooting with 0.22LR and 0.17 Air calibres is undertaken entirely with lead projectiles. Alternative materials, such as copper, tin and tungsten impregnated polymers are not used and are unavailable in formats that meet the performance standards demanded by even entry level athletes and competitors.
  - The current levels of performance achieved in competitive target shooting have been achieved as result of the long-term continuous development of the interacting relationships between athlete, firearm and ammunition. No current alternative materials have successfully demonstrated the necessary combination of physical and mechanical properties required by these interactions. Their deficiencies include
    - lower densities which produce supersonic projectiles with significantly higher noise levels for competitors and spectators,
    - higher hardness which restricts the deformation of the projectile within the firearm barrel, reducing the effectiveness of the seal to the pressurized gases which drive it, and also increases the risk of ricochet and splinter requiring redesign and modification of projectile capture and management on existing shooting ranges,
    - lower ductility which also restricts deformation of the projectile within the firearm barrel and increases the potential for projectile cracking and splinter.

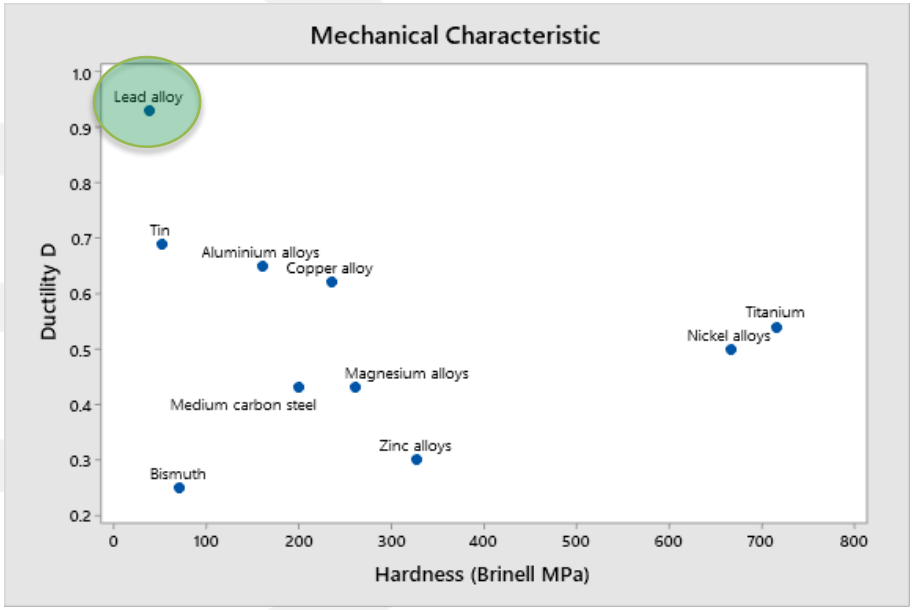
# Alternatives

- High density materials are required to ensure the small precision 0.22LR and 0.17AIR projectiles used for target shooting have sufficient mass to stabilise at subsonic velocities, minimizing noise levels for competitors and spectators.
- Lower density alternatives such as copper result in lower mass projectiles which require supersonic velocities for stability. This increases noise and recoil levels and requires greater pressures within the firearm.



# Alternatives Materials

- Soft metals are required to ensure the projectile deforms sufficiently within the firearm barrel to provide an effective seal to the pressurized gases which drive it, and to reduce the risk of ricochet by absorbing the projectile terminal energy during deformation on impact. Harder materials such tungsten and steel do not sufficiently deform.
- Poor ductility in metals such as bismuth prevent efficient manufacture of precision projectiles in volume and increase the potential for fracturing of the projectile in manufacture and use.



# Competitive Impacts

- Without a clear alternative to the use of lead projectiles in target shooting ammunition
  - EU countries unable to host international target shooting events.
    - Olympics (Summer and Winter)
    - ISSF (Sports Shooting)
    - IBU (Biathlon)
    - IPSC (Practical Shooting)
    - WBSF (Benchrest Shooting)
  - EU target shooters unable to train with lead projectiles and would be forced to compete at a significant disadvantage

# Derogation

- **Request for a derogation for sports shooting**
- Following the California regulation on lead-containing rifle ammunition for hunting, target shooting with lead projectiles continues. In the months Jan 2019 to Dec 2019 there have been 86 official American Rimfire Association (ARA) benchrest target shooting matches within the US state of California. (www.americanrimfire.com).
- A derogation from the scope of any proposed restriction is specifically requested for ammunition used in target sports shooting, as a ban would ultimately result in the non-participation of EU competitors in international shooting events (such as the Olympics and qualifying events). As shooting ranges are controlled areas, there are no significant risks to man via the ingestion of game shot with lead ammunition, nor to birds in wetlands. The spent lead can also be collected and recycled.
- It is proposed that a harmonization of best practices for shooting range environmental management across the EU could ensure that lead is appropriately captured and recycled, and run-off of leached lead ions to ground water is prevented. This would be a proportionate risk management measure.