



# Health Protection in Sports Shooting

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## 1. Why hearing and lead protection matter

Two health hazards often underestimated in sports shooting are **extreme noise exposure** and the **uptake of lead particles** from the ammunition.

Both can cause long-term health damage with repeated exposure. Especially in indoor facilities, the exposure is many times greater than when shooting outdoors. However, these risks can be reduced very effectively with some simple protective measures.

## 2. Noise exposure during shooting

A single gunshot can reach peak sound pressure levels of **140–170 dB**. Inner ear structures may already be damaged from about **120 dB**. Particularly high sound levels are produced by rifle ammunition and/or when using muzzle brakes.

Typical consequences include:

- Permanent **hearing loss**
- **Chronic ringing in the ears (tinnitus)**
- Increased sensitivity to sound

Sound reaches the inner ear through two pathways:

### Air conduction

- Sound waves travel through the ear canal and eardrum into the inner ear
- This is the most important transmission pathway during a gunshot

### Bone conduction

- The pressure wave is transmitted through the skull bones, particularly the bones behind the ear, directly to the sound receptors in the inner ear
- This component **cannot be completely blocked** by earplugs only

Therefore it is important to **reduce** both the generation and transmission of sound **as much as possible** to decrease the overall load on the inner ear.

## 3. Appropriate hearing protection

### Very good protection

- Combination of **earplugs + earmuffs (“double protection”)**
- Especially important for **rifles with muzzle brakes** and in indoor ranges
- Electronic earmuffs are practical because they allow speech but block impulse noise. Some manufacturers now offer a 'double protect' mode. It amplifies speech even when earplugs are worn under the earmuffs

**Good protection**

- Earmuffs with high attenuation (SNR > 30 dB) that cover the bone structures behind the ear
- Protective or normal glasses with flat frame bars for proper sealing between earmuff and head
- Well-sealing and soft earmuff cushions over the glasses, silicone cushions are particularly suitable



**3M Earmuffs Bulls Eye**

Beveled cup shaped specifically to avoid any interference with the rifle butt

Source: 3M



**3M Earmuffs SportTac**

With electronic, sound-level-dependent control

Source: 3M



**3M Silicone Cushions and Inserts**

Regular replacement is recommended

Source: 3M

**Less suitable, especially in indoor ranges**

- Simple, small earplugs, especially if they are **not applied correctly**
- Thin earmuffs with low attenuation
- Electronic earplug protection only with low noise reduction



**3M Earplugs EEP-100**  
With electronic control  
*Source: 3M*



**3M Earplugs 1271**  
Simple, reusable plugs  
*Source: 3M*

**Important:** Hearing protection only works properly if it **fits tightly** and is **worn before and during every shot**. Foam and silicone components should also be replaced every few years according to the manufacturer's recommendations.

## 4. Lead exposure during shooting

When shooting with lead-containing ammunition, **fine lead particles and lead dust** are generated, both when firing and upon impact with the bullet trap. The main sources are the primer and the bullet. The pollutants are present in the air but also settle on the floor and on all other surfaces in the shooting range.

The pollutants can be:

- Inhaled
- Ingested via hands and mouth, especially when contaminated hands are used for eating without using cutlery

With frequent exposure, **blood lead levels may increase**.

During dynamic shooting, the shooter often moves in different directions, for example, also moving forward immediately after firing. Even with optimal ventilation, inhaling harmful substances may not be avoidable under certain circumstances.

## 5. Simple protective measures against lead

- Wash hands, hair and beard thoroughly after shooting
- Do not eat or drink on the range
- A filter mask can significantly decrease respiratory uptake during frequent indoor exposure
- Use lead-free or low-lead ammunition or reloading components (e.g. primers), NONTOX if possible
- Ensure good indoor range ventilation for example with a modern piston ventilation
- When using suppressors, NONTOX ammunition is particularly important due to gas backflow towards the shooter
- Change clothing after intensive training
- Regular and thorough cleaning of the range to control harmful dust



### **3M Particulate Respirator FFP2 8822**

Affordable, effective, disposable mask  
Source: 3M



### **S&B NonTox 9x19mm 124gr**

Ammunition largely free of toxic substances  
Source: Sellier & Bellot

## 6. Example blood lead levels and possible symptoms

Blood Lead ( $\mu\text{g/L}$ )	Blood Lead ( $\mu\text{mol/L}$ )	Meaning / Possible Symptoms
< 50	< 0.24	Normal range of the general population
50 – 100	0.24 – 0.48	Elevated exposure, usually still asymptomatic
100 – 200	0.48 – 0.97	Possible neurocognitive effects, fatigue
200 – 300	0.97 – 1.45	Headaches, irritability, reduced performance
300	1.45	Occupational medicine threshold (SUVA BAT)
300 – 400	1.45 – 1.93	Significant chronic exposure
400 – 600	1.93 – 2.90	Abdominal colic, neuropathy, anemia
> 600	> 2.90	Possible severe lead poisoning

**The half-life of lead in blood is about 30 days, but in bone it is several years.**

## 7. Conclusion

Sport shooting is a safe sport from a health perspective if **good hearing protection is used consistently** and **lead exposure is minimized**.

Particularly important protection measures are:

- **High-quality hearing protection, ideally double protection**
- **Usage of protective masks for dynamic shooting in indoor ranges**
- **Hygiene measures during and after shooting**
- **Low-lead ammunition and good ventilation in indoor ranges**

These simple measures can reduce health risks very effectively.

Best regards and good shooting,

Marc

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