

PRECISION, PEOPLE AND TECHNOLOGY

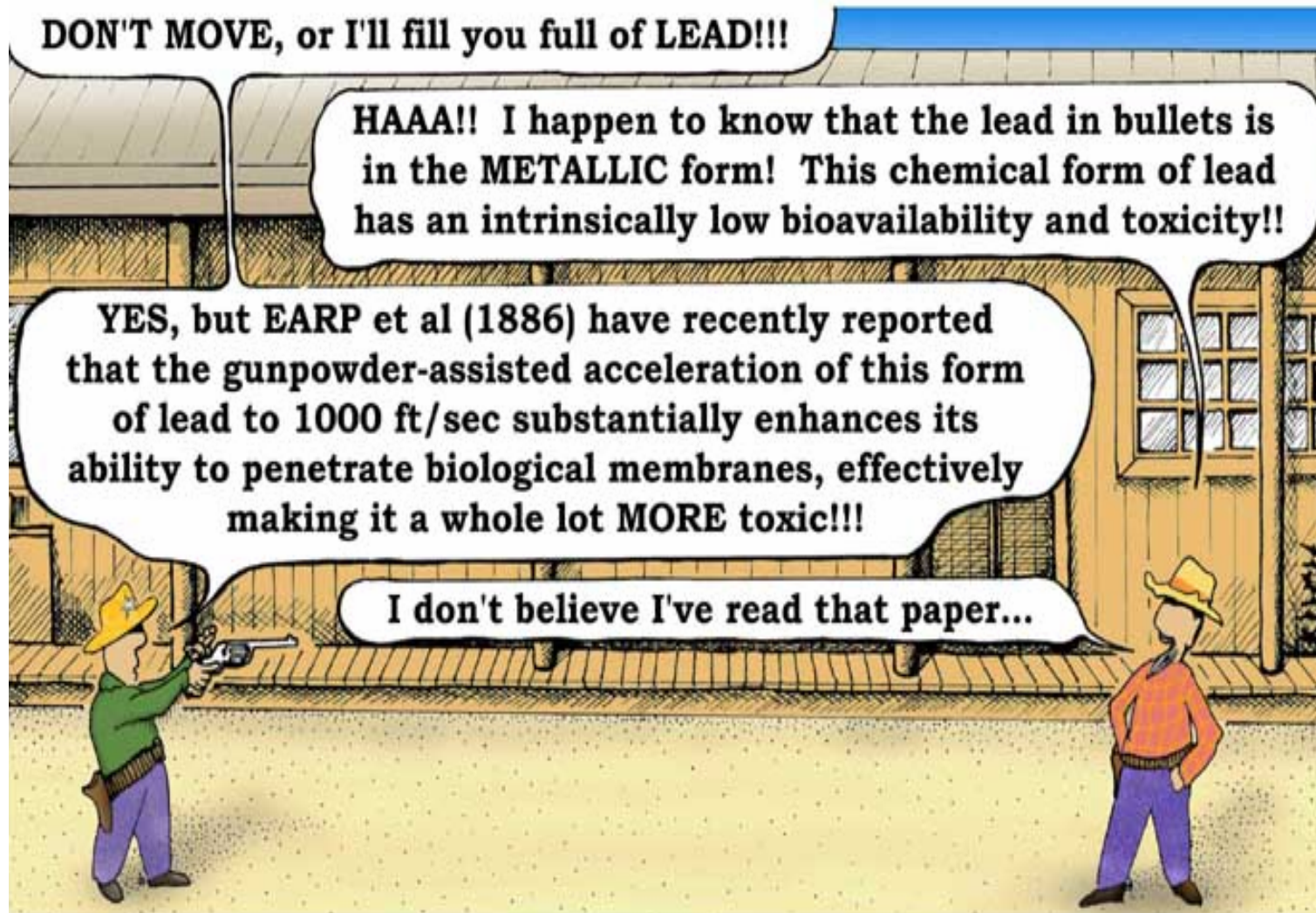


The Nammo Green Ammunition Experience

NDIA Joint Services Small Arms Systems Annual
Symposium, Exhibition and Firing Demonstration
May 15-18, 2006

Thomas Mauritzson, VP Product Development

Lead Ammo Toxicity Debate



2

General Objectives



- "Green" ammunition
- Environmental friendly
 - Groundwater
- Safe working environment
 - Non Toxic Primer
 - Non Toxic Projectile

- Transparent to users
 - Combat/Training ammo
 - Full military performance
- Same costs as lead core ammo
 - High-rate Production

TIMELINE

Nammo Non Toxic Ammo Program

1995	Swedish Requirement Established
1996	Swedish Specification Established
1995-1999	Design Trade Studies
1997-1999	Production Studies
1999	Initial Production to Sweden
1999-2002	Production Improvements
2001	Norway Adopts Nammo NT
2004	Finland Adopts Nammo NT
2004	NATO Qualification Approval

Specific “Green” Objectives

- External environment - Groundwater
 - No lead or heavy metals in the projectile
 - Outdoor range issue

- Safe working environment
 - Non toxic primer
(no toxic gas/particle emissions)
 - Non toxic projectile
(no toxic base oxidation emissions)
 - Indoor range issue



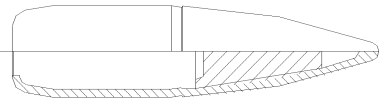
General Design Objectives

- Full Military (NATO) Performance:
 - Accuracy
 - Terminal Ballistics
 - Penetration
 - Wound Ballistics
 - Storage and Use Environments
 - -65°F to +125°F (-54°C to +52°C)
 - Function in all NATO weapons
 - Barrel erosion
 - Smoke, flash and fouling
 - Full training and combat interchangeability

- Cost Delta < 15% more than lead ammunition

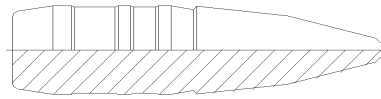
Evaluated Projectile Materials & Designs

Metal-
Polymer
Composite
Core & Steel
Tip
+
Gilding Metal
Jacket



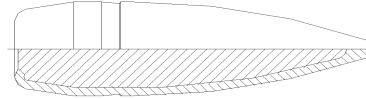
➤ **High Cost**

Solid Steel
and
Solid Brass



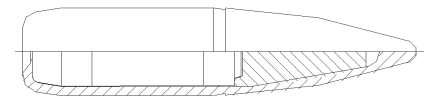
➤ **Penetration**
➤ **Barrel Erosion**
➤ **Copper Fouling**

Monolith
Steel Core
+
Gilding Metal
Jacket



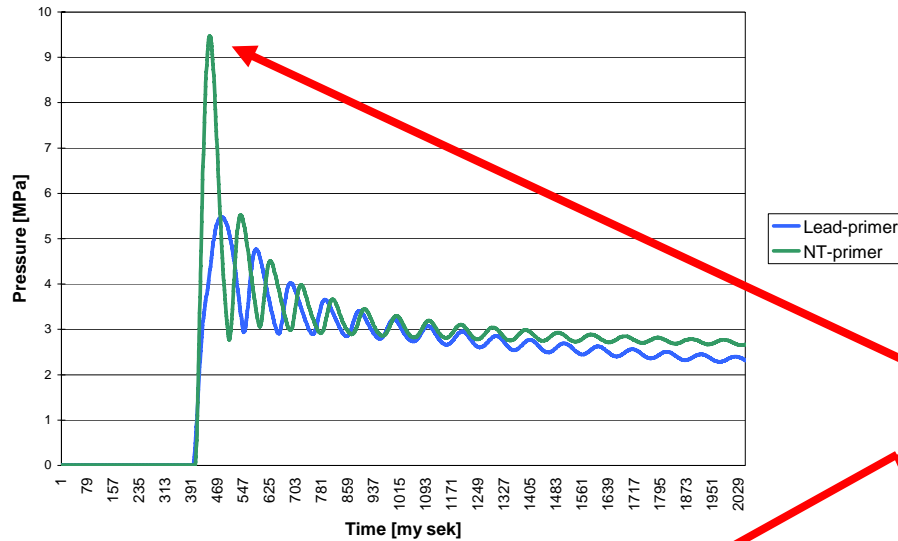
➤ **Penetration**
➤ **Barrel Erosion**

Green Design
Copper Core
& Steel Tip
or
Steel Core
& Steel Tip
+
Gilding Metal
Jacket



➤ **Steel Core
& Steel Tip
selected**
➤ **Lower cost**
➤ **Minimal
Copper
exposure**

Primer – Powder Optimization



Optimization of primer – powder system critical

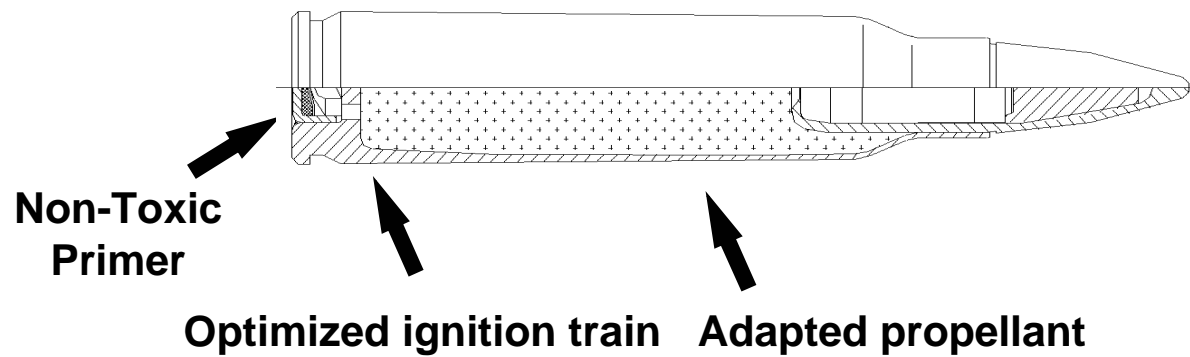
Green Primer design considerations;

- High peak pressure
- More hot gases than hot particles



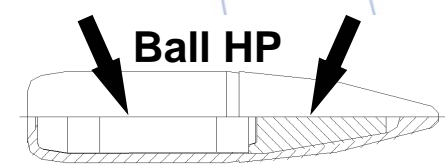
Nammo Green Ammunition Concept

5.56 mm & 7.62 mm NATO

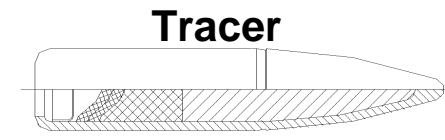


Optimized Soft-steel core

Hardened steel penetrator

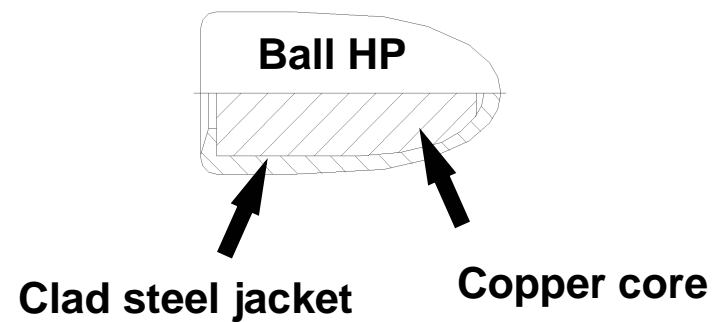
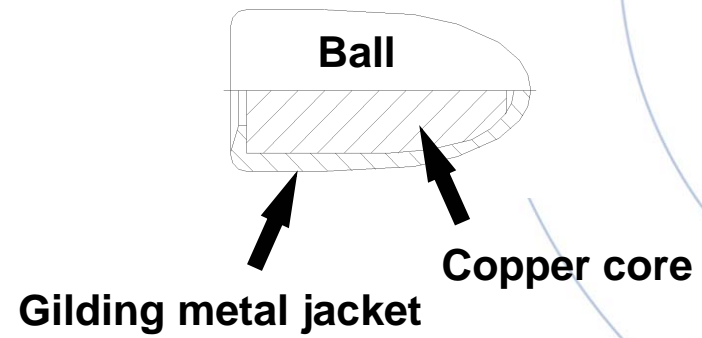
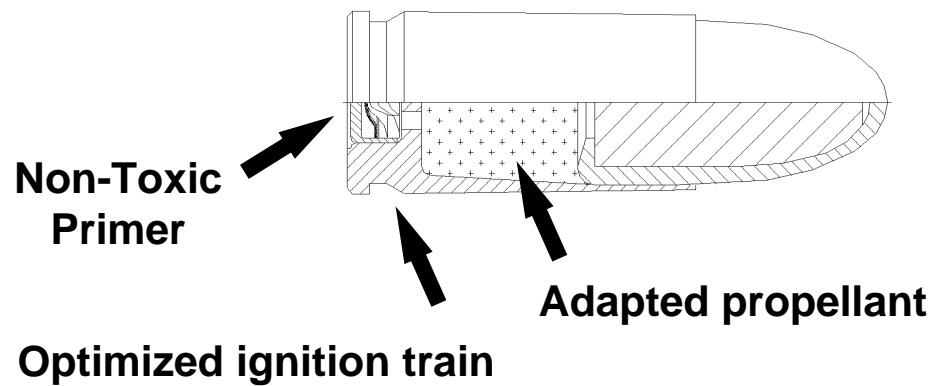


Optimized gilding metal jacket



Nammo Green Ammunition Concept

9 mm NATO



Norwegian Groundwater Study

Laboratory Study: Relative change (%) in soaking of dissolved heavy metals when firing Nammo Green ammunition at Norwegian firing ranges in service

	Lead	Copper	Antimony	Zinc	Iron
Range A	-35%	5%	-37%	-24%	2800%
Range B (wetland)	-86%	17%	-93%	-75%	2100%
Range C	-17%	-31%	-75%	-13%	21%
Average	-46%	-3%	-68%	-37%	1636%

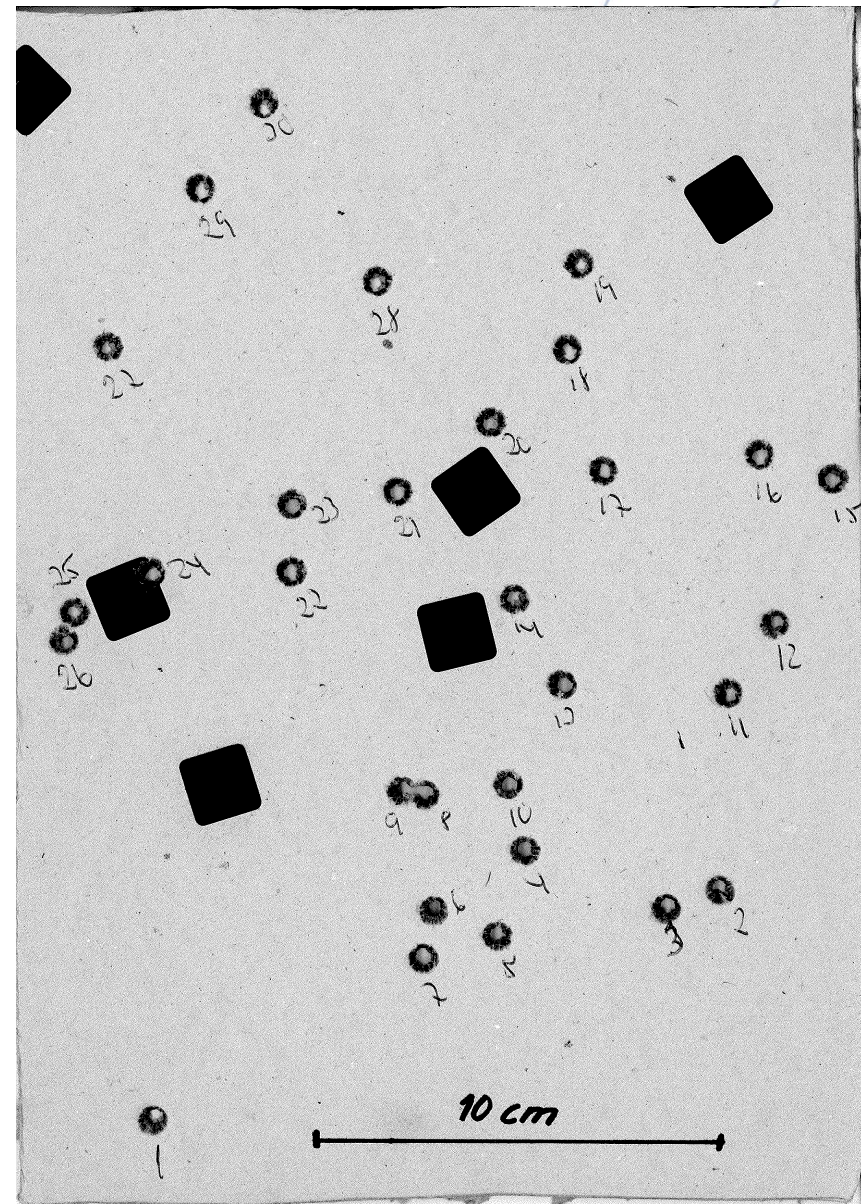
Green Accuracy

7.62 mm BNT 9 HP

Lot 01-CG-05 (5/12/05)
30 rounds @ 550 m

- Std. Dev. Hor. 5.5 cm
- Std. Dev. Vert. 6.2 cm
- NATO Req. Std Dev < 20 cm

- Mean Radius 7.6 cm
- US Req. MR < 6 " (15.2 cm)

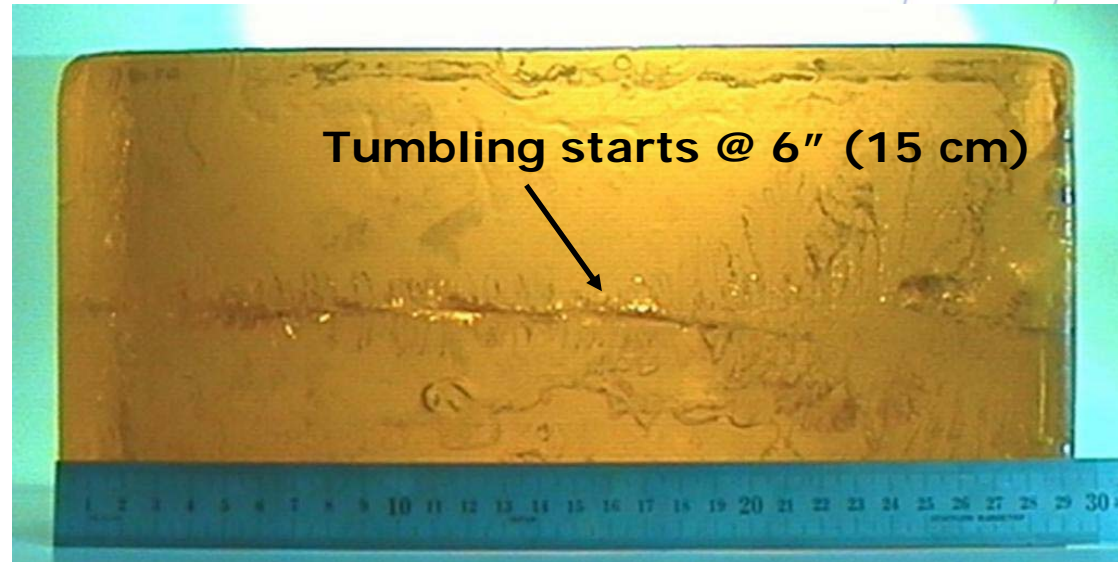


NATO Test Target - Penetration

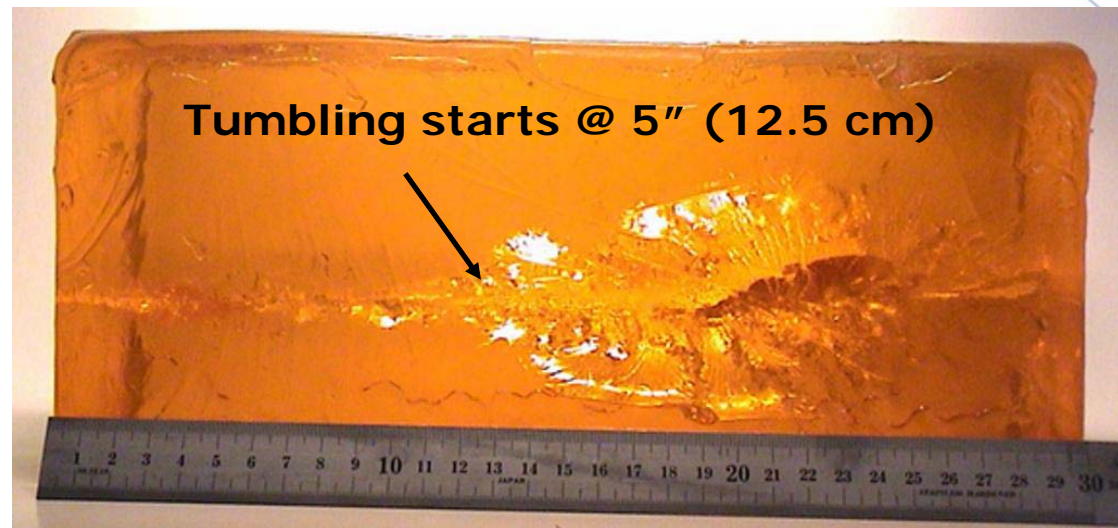
Nammo Cartridge	Nammo BNT-HP Penetration	Standard Ball Penetration
5.56 mm BNT 4 High Performance	3.5 mm NATO plate @ 620 m @ 0° obliquity	3.5 mm NATO plate @ 550-600 m @ 0° obliquity
7.62 mm BNT 9 High Performance	3.5 mm NATO plate @ 950 m @ 0° obliquity	3.5 mm NATO plate @ 550-600 m @ 0° obliquity
9 mm BNT 7 High Performance	3 mm mild steel @ 70 m @ 0° obliquity	3 mm mild steel @ 5-10 m @ 0° obliquity

Test Target – 10 % Gelatin

7.62 mm Ball M80



7.62 mm BNT 9 HP



Real Target - Building



Test Target - Concrete

125 mm (5")
1999 Vintage
Concrete Block



7.62 mm Ball M80
23 rounds
Two bursts



7.62 mm BNT 9 HP
10 rounds
One bursts

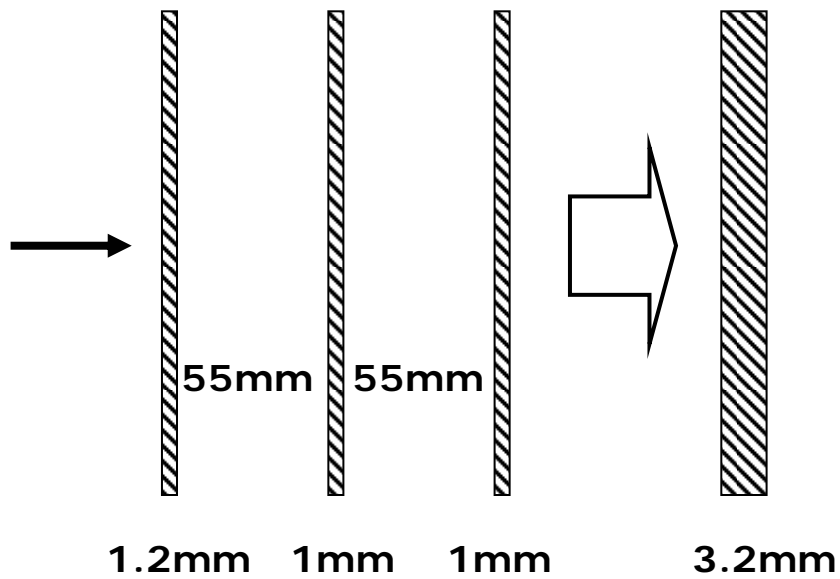


Real Targets - Trucks

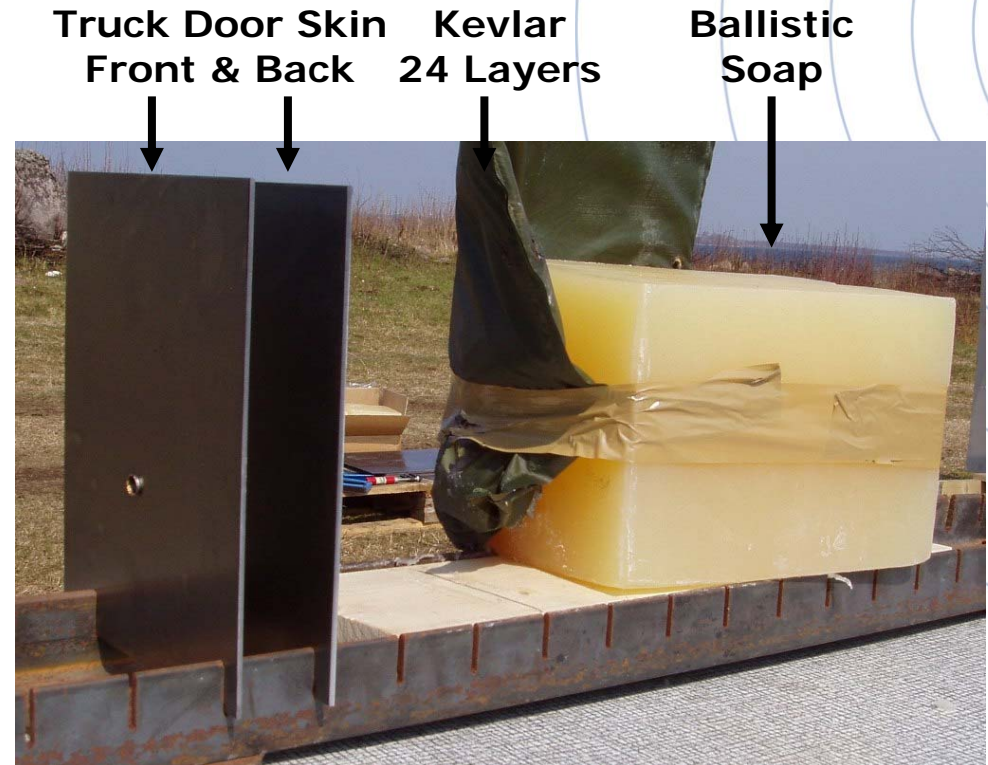


Test Target – Medium Truck

NATO Medium Truck
STANAG 4498

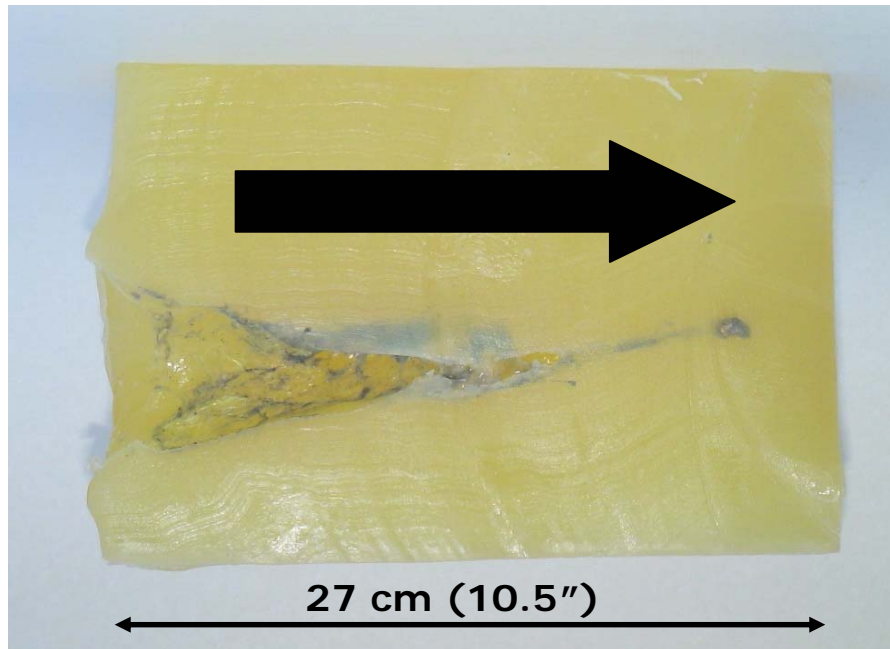


Material: Mild steel

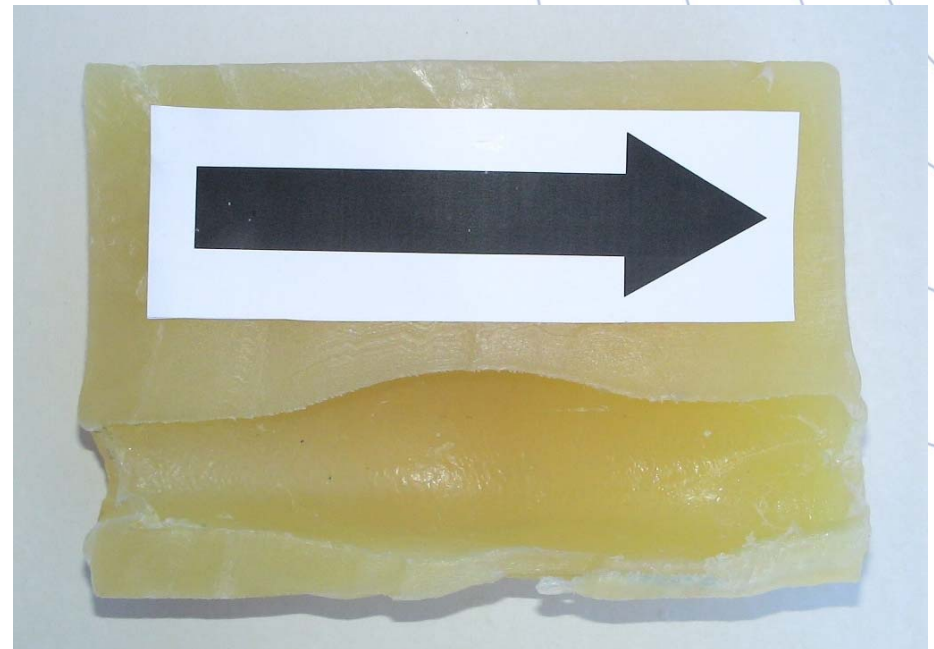


Target Effect – Medium Truck

7.62 mm Ball M80



7.62 mm BNT 9 HP



Nammo Green Ammunition NATO Qualification Status

Nammo Cartridge	Specification	NATO QA Status
5.56 mm BNT 4 High Performance	STANAG 4172	AC/225-128A (2004)
5.56 mm TNT 4	STANAG 4172	In progress
7.62 mm BNT 9 High Performance	STANAG 2310	AC/116-32A (2004)
7.62 mm Tracer Non Toxic 9	STANAG 2310	AC/116-37A (2005)
9 mm BNT 7 High Performance	STANAG 4090	In progress

Nammo Green Ammunition Family



In Production:

- 5.56 mm Ball Non Toxic 4 High Performance
- 5.56 mm Tracer Non Toxic 4
- 5.56 mm Ball Non Toxic 3 Short Range
- 7.62 mm Ball Non Toxic 9 High Performance
- 7.62 mm Tracer Non Toxic 9
- 7.62 mm Ball Non Toxic 6 Short Range
- 9 mm Ball Non Toxic 7 High Performance
- 9 mm Ball Non Toxic 7

Under development:

- 5.56 mm Dim Tracer Non Toxic 4
- 7.62 mm Dim Tracer Non Toxic 9

... and Finally



... and Finally

**..so far 300 tons less
lead polluting the
environment and
creating health
hazards**

**Thank you for your
attention!**

Any questions?

