STANREC 4744
Risk Assessment of Non-Lethal Kinetic Energy Projectiles, Edition 5, 15 July 2021.

AEP-94	AEP-98	AEP-99	AEP-103
Skin Penetration Assessment of Non-Lethal Projectiles, Edition B, Version 1, July 2021.	Precision Assessment of Non-Lethal Kinetic Energy Weapons And Ammunition, Edition B, Version 1, July 2021.	Thorax Injury Risk Assessment of Non-Lethal Projectiles, Edition B, Version 1, July 2021.	Head Injuries Assessment of Non-lethal Projectiles, Edition B, Version 1, JULY 2021.

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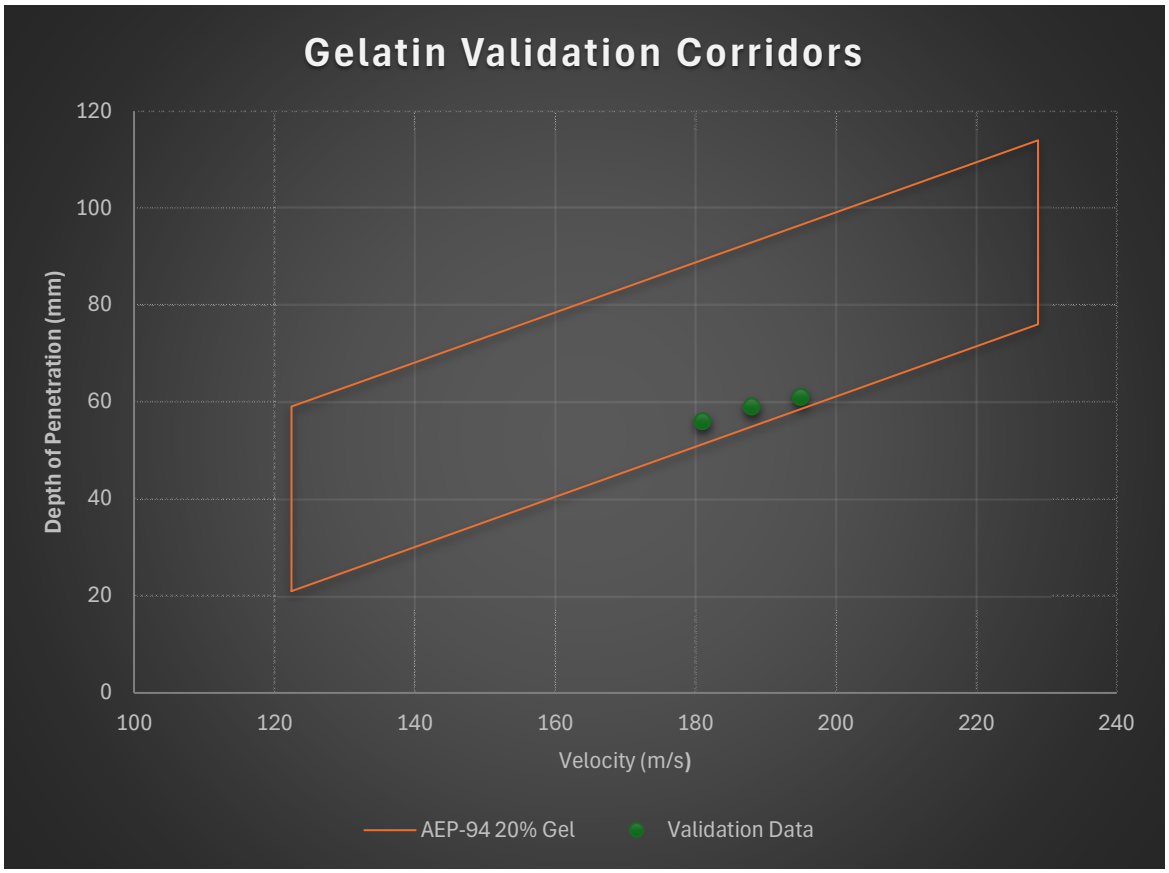
BALLISTIC GELATIN VALIDATION

Shot	Block ID	Concentration	Projectile	Date	Temperature °C	m/s	mm
1	1	20%	0.177BB	2025-12-12	19.9	195	61
2	1	20%	0.177BB	2025-12-12	19.9	188	59
3	1	20%	0.177BB	2025-12-12	19.9	181	56



AEP-94 SKIN PENETRATION ASSESSMENT

Method	AEP-94 - 10 shots at fixed velocity
Date	2025-12-12

Set-up	
Temp. (°C)	20
R.H. (%)	17

Launcher	Air Cannon
Obliquity	Normal
Range	#2, 37mm dia. steel barrel
Tech.	C Withnall

Projectile Details	
Manufacturer	DefSec Technologies
Description	Baton Munition
Model	Arwen AR-1
Type	Kinetic

Lot No.		n/a
Diameter (mm)		37
Nominal mass (g)		81.4
Velocity	(m/s)	75
	(feet/s)	245

Gelatin Details	
Gelatin	BDL Nato Ballistic Gel, 20%, 20x10x10
Foam layer	Darice 6mm white, cut to fit end face
Skin	Tufftane 400µm, 2 layers, 25 mm wrap around
Securement	Nite Ize 25 mm cam strap, 1.8 m, top and bottom

Results

Sample ID	Serial	m/s	ft/s	CP/PP	Gel ID
25-9-25-15	1	71.91393	235.9	PP	1.00
25-9-25-16	2	72.45757	237.7	PP	1.00
25-9-25-17	3	73.94469	242.5	CP	1.00
25-9-25-18	4	74.46497	244.2	CP	1.00
25-9-25-19	5	74.76085	245.2	CP	1.00
25-9-25-20	6	74.62906	244.8	CP	1.00
25-9-25-21	7	74.1173	243.1	CP	1.00
25-9-25-22	8	75.10349	246.3	CP	1.00
25-9-25-23	9	74.37775	244.0	CP	1.00
25-9-25-24	10	75.90019	249.0	CP	1.00

Analysis

Min.	71.9	m/s
Max.	75.9	m/s
Average	74.2	m/s

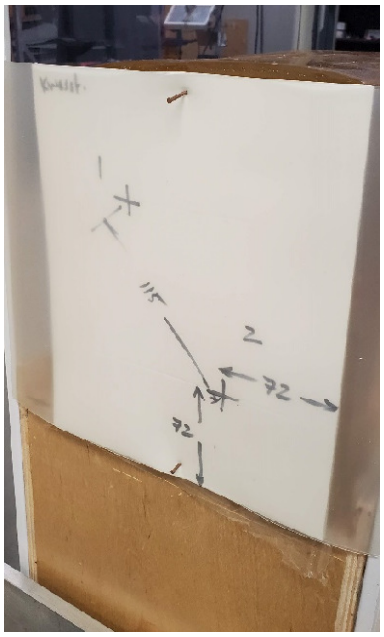
Note: AEP-94 defines CP as follows: "Visible damage is defined as cracks or penetration of the projectile into the gelatine with or without perforation of the layers". In this report, assessment of damage was limited to the gelatin. Damage to the Darice foam did not constitute CP.

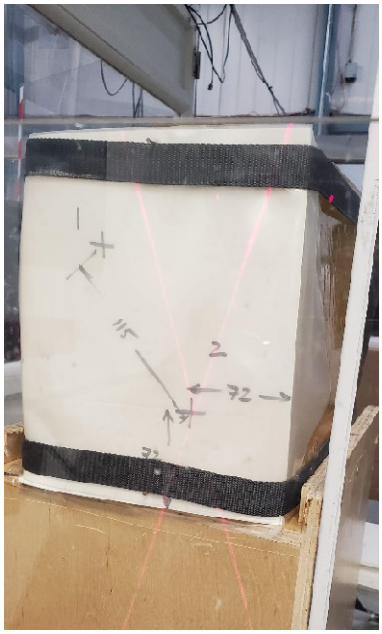
AEP-94 SKIN PENETRATION ASSESSMENT

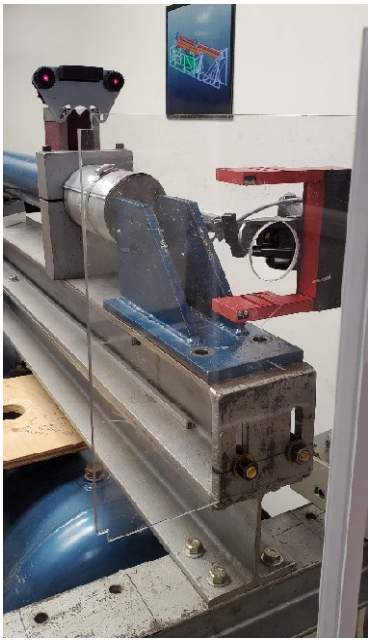
Method	AEP-94 - 10 shots at fixed velocity
Date	2025-12-12

Shot spacing

Projectile diameter	37 mm
2 shots per face	72 mm from edges
	115 mm between shots
	25 mm strap secured top and bottom







Examples of PP (left) and CP (right)

Acceptance Criteria for Penetration Resistance

A kinetic energy munition is considered to have acceptable penetration resistance if no penetrations occur in any tests. If a penetration occurs during the test sequence, the remaining rounds are still tested, and all results are recorded. This criterion is focused solely on penetration, not other potential injuries like blunt trauma nor accuracy. This acceptance criterion was established as part of the AEP-94 Skin Penetration standard, which aims to define minimum performance requirements and test methods for less-lethal munitions. The standard recognises that the threat posed by a non-penetrating projectile depends on its physical characteristics and impact velocity.

Several factors influence the likelihood of skin penetration:
Projectile Characteristics: Projectile composition, shape, dimensions, mass, and velocity all play a role in determining the risk of penetration. Any alterations in design (composition, shape, dimensions, mass) or impact velocity necessitate re-testing. Researchers have noted that impactor shape and loading area affects penetration likelihood.
Anatomical Location: The body region impacted significantly influences the risk of penetration. Energy density requirements for penetration vary across different areas due to factors like underlying bone, fat, and muscle. For example, impacts over bone exhibit a lower probability of penetration compared to areas without underlying bone.
Skin Thickness: Skin thickness is a critical factor influencing penetration risk. Thinner skin generally leads to a higher risk of penetration.

Non-lethality is not a fixed property of a weapon, but rather a function of many factors, such as the type, size, shape, velocity, and angle of the projectile, the distance and location of the impact, the physical characteristics and health status of the target, and the availability and quality of medical care. Therefore, testing and evaluation of NLKEPs should consider all these factors and uncertainties, and provide clear and reliable data and recommendations for their responsible use. Users of NATO STANREC 4744 should be aware of its assumptions, limitations, and uncertainties, and should apply it with due diligence and professional expertise.