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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BTTR calibration check

PROJECT NO.	40-69	**DATE**	2025-10-27
CLIENT	Kwesst	**TEMPERATURE (°C)**	22
PROJECTILE	41 mm nylon baton (with spacer strips)	**RELATIVE HUMIDITY (%)**	30
CONDITION	ambient , free flight	**TECHNICIAN**	CW
RANGE	air cannon (42.8 mm copper barrel)	**PROJECTILE MASS (g)**	140
REFERENCE SPEC.	n/a		

Shot No.	Location deg.	Location mm	Velocity m/s	Energy J	Cmax mm
1	0	0	9.7	6.6	13.0
2			20.0	28.1	27.0
3			30.7	65.8	38.7
4			40.1	112.6	49.2
5		180			
6					
7					
8					
9		-180			
10					
11					
12					

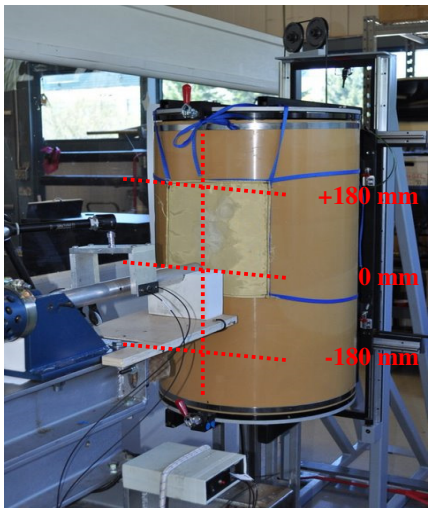
REMARKS

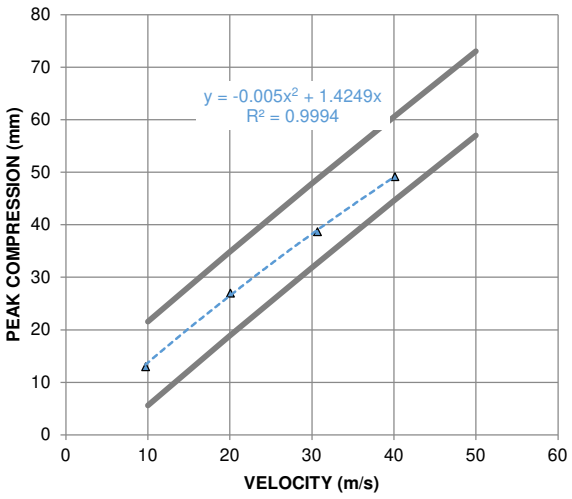
ANALYSIS

ROOT-MEAN-SQUARE DEVIATION			N/A	mm
VELOCITY	9.7	to	40.1	m/s
ENERGY	6.6	to	112.6	J
Cmax	13	to	49	mm

SETUP

Software	Biokinetics BTTRv503
TRANSDUCER	MEL (M7L/200-10B)
SAMPLING FREQUENCY	10 kHz
ANTI-ALIASING	n/a
FILTER	1 kHz low pass
CHEST DEPTH (mm)	236
VC SCALE	0.432
LASER CAL. (mm/V)	-10.099





Test Report: Arwen AR-1

Thorax Injury Risk Assessment of Non-Lethal Projectiles
Edition B, Version 1, July 2021.

Method	AEP-99 - VC_{max} assessment at single velocity
Test Date	2025-11-17

Set-up			
Temp. (°C)	22	Launcher:	Air Cannon
R.H. (%)	23	Obliquity:	Normal
Backing structure:	BTTR (see previous)	Range:	#2, 37mm dia. steel barrel
		Tech.	CW

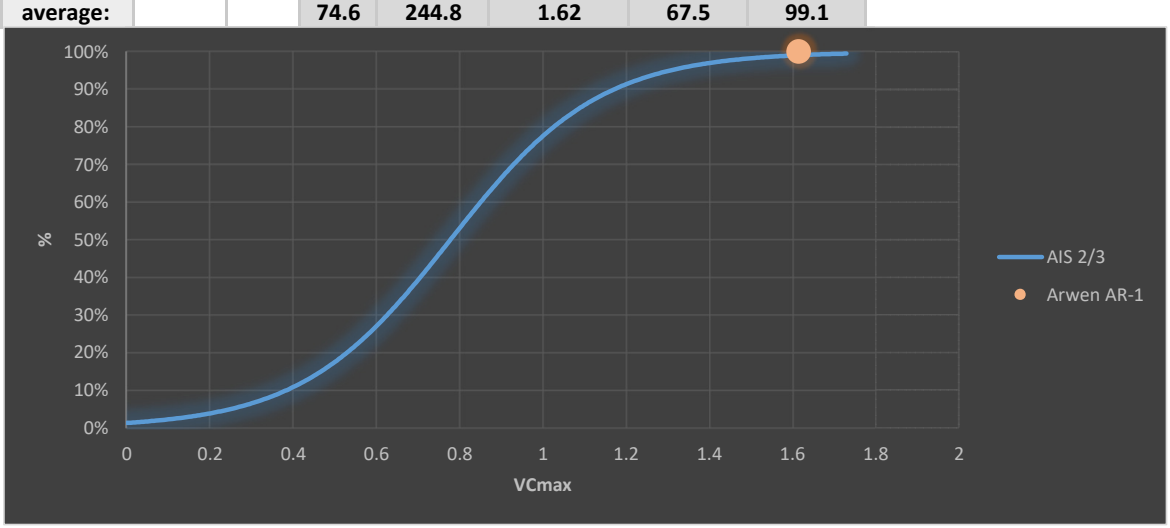
Projectile Details			
Manufacturer	DefSec Technologies	Lot No.	n/a
Description	Baton Munition	Diameter (mm)	37
Model	Arwen AR-1	Nominal mass (g)	81.4
Type	Kinetic	Velocity (m/s)	75
		Velocity (feet/s)	245

Results

Sample ID	Serial	Fair	m/s	ft/s	$(VC)_{max}$	C_{max} (mm)	AIS 2/3
25-9-25-5	1	Y	74.8	245.4	1.59	67.4	99.0
25-9-25-6	2	Y	74.4	244.1	1.62	65.9	99.1
25-9-25-7	3	Y	74.5	244.5	1.63	68	99.2
25-9-25-8	4	Y	74.2	243.3	1.62	68	99.1
25-9-25-9	5	Y	75.1	246.4	1.60	67.4	99.0
25-9-25-10	6	Y	74.7	245.0	1.59	68.2	99.0
25-9-25-11	7	Y	74.9	245.6	1.62	67.3	99.1
25-9-25-12	8	Y	74.3	243.7	1.63	67.4	99.2
25-9-25-13	9	Y	75.1	246.3	1.61	68.6	99.1
25-9-25-14	10	Y	74.4	244.2	1.64	66.9	99.2
average:			**74.6**	**244.8**	**1.62**	**67.5**	**99.1**

Analysis

n	*10*
s	*0.02*
k	*3.98*
Mean $(VC)_{max}$	1.62
UTL $(VC)_{max}$	1.68
KE (J)	227
ED (J/cm^2)	21
AIS Code	3
AIS 2/3 Risk	99%



The average VC_{max} of 1.62 was measured at 75m/s (245 ft/s) and represents a 99 % risk of AIS 2/3 injury.

Term	Definition
Obliquity	Normal to a surface refers to the direction that is perpendicular to the surface being targeted.
Fair	Velocity and projectile orientation are with parameters
m/s	Velocity in meters per second
$(VC)_{max}$	Maximum Viscous Criterion value
C_{max} (mm)	Maximum compression of membrane
AIS	Estimated Abbreviated Injury Scale Code
AIS 2/3	Percentage risk of an AIS 2-3 injury
Mean $(VC)_{max}$	Average of the (VC)max
UTL $(VC)_{max}$	Upper Tolerance Limit of the (VC)max with a 95% CI
KE (J)	Kinetic Energy in Joules
ED J/cm^2	Energy Density- Energy per unit area

Abbreviated Injury Scale	Prob of Death (%)
AIS 1 – Minor	.1 - 1
AIS 2 – Moderate	1 - 2
AIS 3 – Serious	2 - 16
AIS 4 – Severe	16 - 30
AIS 5 – Critical	30 - 99
AIS 6 – Lethal	100

NATO STANREC 4744 should not be considered as a definitive or prescriptive standard for the use of NLKEPs, but rather as a reference tool for informing decision-making and risk management. The STANREC outlines the criteria and thresholds for each level of injury, as well as the methods for calculating the probability of injury given a specific NLKEP and impact scenario. However, NATO STANREC 4744 also acknowledges that there are inherent uncertainties and limitations in the data and models used, and that the results should be interpreted with caution and professional judgment. We are offering two levels of reporting to facilitate the interpretation of data. This “test lab report” provides all information required for a knowledgeable third party to review and evaluate the data for the purpose of decision-making and risk management. Our “formal report” is intended to provide some basis of the test methodologies used in the assessment of injuries from less-lethal ammunition. It contains references to published information from the standards groups and the scientific literature and provides the scientific bases for decisions, interpretations, and implementation of the methodologies for the given product being evaluated. This guidance may be helpful because not all injury mechanisms/modes, severities, threat types/velocities and anatomical/age/sex differences have been studied fully. For this reason, test methods often describe the conditions under which they were created to help with interpretation of the results. For example, the AEP-99 standard for thoracic blunt trauma is based on several different blunt projectiles and biomechanical test conditions. However, some newly developed KENLW ammunition might fall outside the studied threat velocities. The scientific experts will therefore note these limitations to make the reader aware of these when interpreting their data. It also helps to identify areas of future research that are required to complete our understanding of injury outcomes.

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 ethical and responsible use. Users of NATO STANREC 4744 should consider its assumptions, limitations and uncertainties and interpret results with due diligence and professional expertise.