



New Jersey Division of Criminal Justice

The Use of Non-Toxic Training Ammunition for New Jersey Law Enforcement

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The environmental issue regarding lead deposits and airborne lead from firearms training has caused several New Jersey governmental entities to require lead-free firearms training at their ranges. Monmouth County Police Academy's indoor range, is just one example of this growing trend.

Because of this issue law enforcement agencies have researched the available training ammunition market to obtain ammunition for training, which is not only environmentally friendly, but also meets the "equivalent load" language of the Attorney General's guidelines regarding firearms requalification. This language allows agencies to purchase and use "training" ammunition, which is similar in performance (size, weight, recoil and trajectory), to their "service" or duty ammunition for training and requalification. This option considerably reduces the cost of ammunition. For example a particular 9mm training round is half the cost (per 1,000 rounds) of its equivalent hollow point service round. Presently, ammunition technology has provided law enforcement several options in regards to non-toxic ammunition.

- Non-toxic environment at the shooting line, but not at the impact area using totally encapsulated lead core projectiles
- Totally non-toxic ammunition both at the shooting line and impact areas using frangible-metal projectiles
- Totally non-toxic ammunition both at the shooting line and impact areas using pulverized metal and nylon bonding agents to form the projectile

The last two options, which provide a totally lead-free environment, raises an "equivalent load" issue. In these cases tin, zinc and copper are used to form the projectile. In each case the quantity of metal used to form the projectile is of a lesser total weight than an equivalent lead projectile of the same caliber. Moreover, for each caliber these non-toxic projectiles are produced in only one projectile weight, effectively eliminating one element of the "equivalent load" standard. For example, 9mm service and training ammunition may be purchased in 115 gr., 124 gr. and 147 gr. projectiles. Totally lead free ammunition, however, is only available in 100 and 105 gr. projectiles, a significant difference if an agency is using a 147 gr. service projectile. This has caused many firearms instructors to question whether agency firearms training can be conducted at "lead-free" firearms ranges in accordance with the Attorney Generals guidelines.

Faced with this issue, major law enforcement ammunition distributors in the state were solicited and asked for samples of all available non-toxic ammunition be provided for testing purposes. Federal, Speer, Remington, and Winchester responded to the initial request.

The testing was structured to comply with the "spirit" of the "equivalent load" language, rather than the "letter" of this standard. Strict enforcement of the "letter" of the standard would have eliminated all totally non-toxic ammunition by simple comparison of projectile weights. It is the intention of the guideline to provide firearms training with ammunition, which is similar in performance to a trainee's service ammunition, so that accuracy and firing technique does not differ significantly from the training environment to the on-duty environment.

For the purposes of identification and categorization training ammunition is classified as follows:

- **Class 1 (TA1)** - Ammunition presently used and known as "training ammunition", which normally has a full metal jacketed projectile. And ammunition known as wadcutter or semi-wadcutter, or non-jacketed lead projectiles used for training ammunition in revolvers. This ammunition generally does not contain any non-toxic features. Projectile weights are available equal to projectile weights of service ammunition.
- **Class 2 (TA2)** - "*Firing line safe*" Ammunition which contains heavy metal free primers and totally encapsulated lead core projectiles. This ammunition keeps the firing line free of toxic airborne lead, barium and antimony, which is present in the primers of the Class 1 training ammunition. Lead is still used as the projectile core, but is totally encapsulated by a jacket. In the Class 1 ammunition the jacket covers only nose and sides of the projectile, leaving the bottom of the lead core exposed to the burning of the main propellant charge. Class 2 projectiles will leave lead deposits in the impact area. Projectile weights are available equal to projectile weights of service ammunition.
- **Class 3 (TA3)** - "*Total non-toxic environment*" Ammunition which has the same toxic free primers as Class 2 training ammunition and has a lead free projectile made of tin, zinc, copper, or a lead free metal composite, depending on the manufacturer. The manufacturing process of Class 3 projectiles enables the projectile to finely fragment upon impact with rigid surfaces, and is commonly referred to as "frangible". Projectile weights are significantly lighter than service ammunition projectile weights. While each manufacturer only offers one weight per caliber, the weights differ from one manufacturer to another.

- **Class 4 (TA4) -** The original "*Frangible*" ammunition. Ammunition designed for close quarters training using rigid targets or backstops. The projectiles of this ammunition are made of compressed copper or zinc mixed with a nylon bonding agent. The projectiles are usually dark brown in color and will pulverize when striking a rigid object. Not all major ammunition manufacturers produce this ammunition, however, there are several "speciality" manufacturers of this ammunition. While the projectile is lead free, not all manufacturers include lead-free primers. The projectiles of this ammunition are extremely light compared to service ammunition and generally produce a soft recoil. Each manufacturer produces one bullet weight per caliber. Class 4 ammunition is the most costly training ammunition option.
This ammunition is not recommended for use during in-service requalification or for trainee qualification at a New Jersey Police Training Commission approved police academy.

Summary

The following tables contain test results for Class 2 (firing line safe) and Class 3 (total non-toxic) training ammunition, which may be used for PTC approved police academy trainee qualification and in-service requalification. Class 3 ammunition may be used during qualification or requalification regardless of the projectile weight of service ammunition in each caliber. This testing is meant to serve as a guide for New Jersey firearms instructors and their agencies. The ultimate decision to use any Class 2 or Class 3 ammunition for requalification on the in-service level or qualification of trainees at a PTC approved police academy remains with the supervising firearms instructor or Range Master.

Recommended List of Non-Toxic Training Ammunition

9MM (recommended list)

Manufacturer	Type	Projectile Weight(s) (grs.)			
Firing Line Safe (Class 2)					
Federal	American Eagle	147			
Remington	UMC (leadless)	115			
Winchester	WinClean	115	124	147	
Total Non-Toxic (Class 3)					
Federal	CQT (Close Quarter Training)	100			
International	Greenline	100	75 +P		
Speer	Lawman RHT	100			
Winchester	SuperClean NT	105			

.40 Caliber (recommended list)

Manufacturer	Type	Projectile Weight(s) (grs.)			
Firing Line Safe (Class 2)					
Federal	American Eagle	180			
Remington	UMC (leadless)	180			
Winchester	WinClean	165	180		
Total Non-Toxic (Class 3)					
Bismuth	No-Tox	135			
Federal	CQT (Close Quarter Training)	135			
International	Greenline	125			
Remington	Disintegrator	145			

.45 Caliber (recommended list)

Manufacturer	Type	Projectile Weight(s) (grs.)			
Firing Line Safe (Class 2)					
Federal	American Eagle	230			
Remington	UMC (leadless)	230			
Total Non-Toxic (Class 3)					
Delta		195			
Federal	CQT (Close Quarter Training)	165			
International	Greenline	155			
Remington	Disintegrator	175			
Speer	Lawman RHT	155			

.223 Caliber (recommended list)

Total Non-Toxic (Class 3)					
Federal	CQT (Close Quarter Training)	42			
International	Greenline	42			
Winchester	SuperClean NT	55			

Shotgun (recommended list)

Total Non-Toxic (Class 3)					
Remington	Disintegrator	OO Buck	Sabot slug (7/8 oz)		

List of Not Recommended Non-Toxic Training Ammunition

9mm (not-recommended list)

Manufacturer	Type	Projectile Weight(s) (grs.)			
Firing Line Safe (Class 2)					
Federal	Ballistic Clean	100			
Total Non-Toxic (Class 3)					
Bismuth	No-Tox	115			
Delta		115			
Remington	Disintegrator	105			
Nylon Bonded Frangible (Class 4)					
All Class 4 Ammunition					
<u>.40 Caliber</u> (not-recommended list)					
Total Non-Toxic (Class 3)					
Delta		155			
Speer	Lawman RHT	125			
Winchester	SuperClean NT	140			
Nylon Bonded Frangible (Class 4)					
All Class 4 Ammunition					
<u>.45 Caliber</u> (not-recommended list)					
Firing Line Safe (Class 2)					
Winchester	WinClean	185	230		
Total Non-Toxic (Class 3)					
Winchester	SuperClean	170			
Nylon Bonded Frangible (Class 4)					
All Class 4 ammunition					

Test Data and Information

Testing Protocol

- All ammunition was fired by each of the three participating shooters
- The same firearm was used for each respective caliber
- Three rounds were fired to attain muzzle velocity
- Accuracy and trajectory stability was tested by firing three rounds at 25 yards and three rounds at 50 yards
- Accuracy was judged on a FBI "Q" type target
- Felt recoil was judged throughout all firing; mixed ammunition magazine rapid fire and a double tap drill
- Malfunctions would be recorded as they occurred
- Temperatures ranged from 81 - 89 degrees; all ammunition was exposed to the sun throughout the five hour test period
- Speer Gold Dot Hollow Point was used as a standard as service ammunition
- Initial testing was conducted at Fort Dix Range #71 on August 2 , 14, & October 11, 2001. Additional testing will be conducted as new products become available or when necessary.

Test Results

The object of this test was to assure non-toxic type ammunition performance in accordance with the Attorney General's guidelines for the "equivalent load" language for Police Training Commission approved academy trainees and in-service requalification. The ammunition had to pass:

- **"Felt Recoil"** testing, which consisted of double tap drills and a mixed magazine test. The latter test consisted of a magazine filled with all ammunition of the respective caliber. A rapid fire sequence was fired to evaluate felt recoil.
- **Accuracy** at 25 yards and 50 yards. All ammunition tested had to provide a satisfactory three round group within a FBI "Q" target.
- **Trajectory Stabilization** All ammunition impact marks on the cardboard "Q" target was checked for indications of "keyholing" during the accuracy tests.
- **Malfunctions** Any malfunctions were to be noted during the entire testing period

All ammunition tested passed the stabilization and accuracy tests. Handgun ammunition tested without a single malfunction. Two trigger reset failures and one failure to lock-back on the last round occurred with .223 Class 3 ammunition. This may indicate that recoil energy was

not sufficient to push the bolt totally to the rear during the firing cycle. This may be firearm specific.

While the majority of the ammunition tested provided sufficient recoil energy to meet the "equivalent load" standard, some did not.

The following ammunition failed to provide sufficient recoil to meet the "equivalent load" standard and are not recommended to be used for qualification of PTC academy trainees or in-service requalification.

Class 2 ammunition (Firing Line safe)

9mm Federal Ballistic Clean 100 gr.

.45 caliber Winchester WinClean 185 gr. and 230 gr.

Class 3 ammunition (Totally Non-Toxic)

9mm Remington Disintegrator 105 gr.

9mm Delta Frangible 115 gr.

.40 caliber Delta Frangible 155 gr.

.40 caliber Speer Lawman 125 gr.

.40 caliber Winchester SuperClean NT 140 gr.

.45 caliber Winchester SuperClean NT 170 gr.

Class 4 ammunition (Nylon Bonded Frangible)

All calibers Winchester Ranger

Costs

Generally, *Class 1* training ammunition is approximately half the cost of service ammunition.

The cost to change from *Class 1* training ammunition to *Class 2* (firing line safe) is an additional \$2 to \$20 per ,1000 rounds depending on caliber and manufacturer.

The change from *Class 1* to *Class 3* (total non-toxic) ammunition is more costly. Administrators will find this ammunition \$30 to \$40 more than service ammunition per 1,000 rounds.

Class 4 ammunition is the most costly, adding a little over \$100 to the cost of service ammunition per 1,000 round for 9mm. .40 & .45 caliber is a slightly higher increase over service ammunition. For example Winchester Range (Class 4) ammunition is \$428 per 1,000 rounds.

The following tables (by caliber) provide specific information, including muzzle velocities, for each round tested.

9MM (Glock 19)

Manufacturer	Type	Weight grs.	Muzzle Vel. (fps)			M/V Avg.	Acc/ Stab	Felt Recoil
Service Ammunition								
Speer	Gold Dot	115	1162	1166	1162	1163	N/A	N/A
Speer	Gold Dot	124	1123	1112	1112	1116	N/A	N/A
Speer	Gold Dot	124+P	1214	1233	1207	1218	N/A	N/A
Speer	Gold Dot	147	1013	1019	1019	1017	N/A	N/A
Training Ammunition (Class 1)								
Winchester	FMJ	147	923	956	929	936	N/A	N/A
Firing Line Safe (Class 2)								
Federal	Ballistic Clean	100	1228	1202	1211	1214	pass	<u>failed</u>
Federal	American Eagle	147	984	953	940	959	pass	pass
Remington	UMC (leadless)	115	1143	1136	1136	1138	pass	pass
Winchester	WinClean	115	1063	1063	1066	1064	pass	pass
Winchester	WinClean	124	1050	1068	1068	1062	pass	pass
Winchester	WinClean	147	935	934	940	936	pass	pass
Total Non-Toxic (Class 3)								
Bismuth	No-Tox	115	1145	1144	1161	1150	<u>failed</u>	pass
Delta		115	1108	1119	1107	1111	pass	<u>failed</u>
Federal	CQT (Close Quarter Train'g)	100	1125	1132	1150	1136	pass	pass
International	Greenline	75 +P	1707	1681	1700	1696	pass	pass
International	Greenline	100	1268	1269	1263	1266	pass	pass
Remington	Disintegrator	105	1110	1164	1189	1154	pass	<u>failed</u>
Speer	Lawman RHT	100	1177	1142	1186	1168	pass	pass
Winchester	SuperClean NT	105	1157	1134	1153	1148	pass	pass
Nylon Bonded Frangible (Class 4)								
Winchester	Ranger	85	1474	1393	1427	1431	pass	<u>failed</u>

.40 Caliber (H&K USP Compact)

Manufacturer	Type	Weight grs.	Muzzle Vel. (fps)			M/V Avg.	Acc/ Stab	Felt Recoil
Service Ammunition								
Speer	Gold Dot	165	1071	1064	1044	1060	N/A	N/A
Speer	Gold Dot	180	953	951	942	949	N/A	N/A
Training Ammunition (Class 1)								
Speer	FMJ	180	952	933	929	949	N/A	N/A
Firing Line Safe (Class 2)								
Federal	American Eagle	180	952	944	956	951	pass	pass
Remington	UMC (leadless)	180	959	960	964	961	pass	pass
Winchester	WinClean	165	1110	1050	1030	1063	pass	pass
Winchester	WinClean	180	940	929	939	936	pass	pass
Total Non-Toxic (Class 3)								
Bismuth	No-Tox	135	1038	1088	1081	1069	pass	pass
Delta		155	878	864	891	877	pass	<u>failed</u>
Federal	CQT (Close Quarter Train'g)	135	1132	1130	1142	1135	pass	pass
International	Greenline	125	1103	1076	1087	1088	pass	pass
Remington	Disintegrator	145	1014	1024	984	1007	pass	pass
Speer	Lawman RHT	125	1048	1044	1028	1040	pass	<u>failed</u>
Winchester	SuperClean NT	140	964	977	921	954	pass	<u>failed</u>
Nylon Bonded Frangible (Class 4)								
Winchester	Ranger	105	1112	1076	1089	1092	pass	<u>failed</u>

.45 Caliber (Colt Combat Commander)

Manufacturer	Type	Weight grs.	Muzzle Vel. (fps)			M/V Avg.	Acc Stab	Felt Recoil
Service Ammunition								
Speer	Gold Dot	185	968	971	1012	984	N/A	N/A
Speer	Gold Dot	200+P	1030	1040	1044	1038	N/A	N/A
Speer	Gold Dot	230	848	871	855	858	N/A	N/A
Training Ammunition (Class 1)								
Federal	American Eagle FMJ	230	793	782	779	785	N/A	N/A
Firing Line Safe (Class 2)								
Federal	American Eagle	230	827	824	828	826	pass	pass
Remington	UMC (leadless)	230	799	785	800	794	pass	pass
Winchester	WinClean	185	880	894	866	880	pass	<u>failed</u>
Winchester	WinClean	230	707	721	730	719	pass	<u>failed</u>
Total Non-Toxic (Class 3)								
Delta		195	843	894	894	877	pass	pass
Federal	CQT (Close Quarter Train'g)	165	1029	1053	1053	1045	pass	pass
International	Greenline	155	1146	1175	1175	1165	pass	pass
Remington	Disintegrator	175	942	907	933	927	pass	pass
Speer	Lawman RHT	155	1086	1085	1106	1092	pass	pass
Winchester	SuperClean NT	170	938	909	994	947	pass	<u>failed</u>
Nylon Bonded Frangible (Class 4)								
Winchester	Ranger	125	1085	1106	1120	1104	pass	<u>failed</u>

.223 Caliber (H&K SL8)

Manufacturer	Type	Weight grs.	Muzzle Vel. (fps)			M/V Avg.	Acc Stab	Felt Recoil
Training Ammunition (Class 1)								
Federal	American Eagle FMJ	55	3129	3009	3030	3056	N/A	N/A
Total Non-Toxic (Class 3)								
Federal	CQT (Close Quarter Train'g)	42	3086	3072	3037	3065	pass	pass
International	Greenline	42	2715	2754	2699	2723	pass	pass
Winchester	SuperClean NT	55	2930	2892	2943	2922	pass	pass

Shotgun (Remington 870)

Manufacturer	Type	Weight grs.	Muzzle Vel. (fps)			M/V Avg.	Acc Stab	Felt Recoil
Total Non-Toxic (Class 3)								
Remington	Disintegrator	OO Buck	1474	1450	1415	1446	pass	pass
Remington	Disintegrator	Sabot slug (7/8 oz.)	1086	1084	1102	1091	pass	pass

* Note: the sabot slug round did not fully cycle a Benelli semi-auto Super 90