

2.5.2021

The European Chemicals Agency

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## Field test of FMJ and .22 LR bullets used small game hunting in Finland

The Finnish Hunters' Association have been asked by the European Chemicals Agency ("ECHA") to participate in a third party consultation regarding lead in all ammunition.

More specifically, ECHA have asked about the accuracy and suitability of the currently available lead free ammunition in .22 LR provide information and provide information on the use of Full Metal Jacket (FMJ) bullets in hunting.

1:

*Hunting*

*Alternatives to lead for rim calibres: As indicated in the Annex XV report, there is contradictory information on the accuracy of lead-free ammunition for rim calibres (such as .17 HMR, .22 LR, etc) for hunting. In some studies, lead-free ammunition for these calibres is claimed to be sufficiently accurate while in other studies it is disputed. Please provide information on the accuracy of lead-free ammunition for these calibres in the form of tests, field reports, or similar, as well as information on the development of lead-free alternatives for this type of ammunition in the future.*

2:

*Alternatives to lead for certain types of hunting: The Annex XV report indicates that the suitability of lead-free ammunition for small game hunting with Full Metal Jacket bullets and for the population management of seals (where this is allowed) should be further explored in the consultation.*

- a. *For **small game hunting with Full Metal Jacket bullets** (e.g. Nordic bird hunting), please provide information on (i) whether, and under what circumstances, the use of Full Metal Jacket bullets is permitted in the EEA and (ii) whether lead-free alternatives are available and their technical performance/suitability for this type of hunting.*

*For the **population management of seals**, please provide information that helps ECHA's Committees to better understand in how many EEA countries this takes place and whether lead-free alternatives are available and their technical performance/suitability for this type of hunting. (the text is from the EHCA form: [Comments for Annex XV restriction report](#))*

The Finnish Hunters' Association conducted a field test, in which nine different Full Metal Jacket (FMJ), Open Tip Match (OTM) and .22 LR Solid Lead Round Nose bullets were test fired at the gamebird (pheasant). The pheasant (*phasianus colchicus*) is a medium sized gamebird and can be compared to typical gamebird hunted in the Nordic countries, such as capercaillie, black grouse, hazel grouse or willow grouse. In addition, according to the Finnish Hunting Act, rifle bullets of the FMJ and OTM types may be used in the hunting of small mammals (e.g. fox, raccoon dog). Nordic hunting culture involves utilizing their furs in the winter, and the bullet types mentioned above do not break their skin/fur like bullets expanding from a impact do. These bullet types are also very accurate and are suitable for hunting timid game species over longer distances.

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## Accuracy required

Below are listed the ethical kill zones of some small game:

- Hazel grouse (*Tetrastes bonasia*), willow grouse (*Lagopus lagopus*), ptarmigan (*Lagopus muta*) and wood pigeon (*Columba palumbus*). Ethical kill zone approximately 20 mm (mostly hunt with rimfire .22 LR) shooting distance 50-80 meter.
- Black grouse (*Lyrurus tetrix*). Ethical kill zone approximately 30 mm (centerfire and rimfire .17 HMR, **NOTE .22 LR not allowed**). Shooting distance in hunting with rifle between 100-250 meter
- Capercaillie (*Tetrao urogallus*). Ethical kill zone approximately 40 mm (centerfire and rimfire .17 HMR, **NOTE .22 LR not allowed**). Shooting distance in hunting with rifle between 100-300 meter
- Raccoon dog (*Nyctereutes procyonoides*) and fox (*Vulpes vulpes*), ethical kill zone approximately 50-60 mm (centerfire and rimfire .17 HMR, **NOTE .22 LR not allowed**). Shooting distance in hunting with rifle between 100-300 meter.

As shown above, high accuracy is an absolute demand for continued hunting of these species. As can be seen from the table 1. (page 3) in the attached table, the annual load of these bullet types on the environment in Finland is only 1675 kg. The seal hunting increases the value by 8.8 kg. The numbers also includes missed shots that sometimes occur during hunting.

Pic 1. Bullet velocities were measured with a magnetospeed V3 ballistic chronograph.



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Table 1. shows the amount of FMJ, OTM and .22 LR bullets used in hunting in Finland in kilograms. The table also shows the bullets used in the seal hunting.

Game shot with FMJ bullets in Finland (2018)							
Species	Game bag 2018	Non-eatable game bag with FMJ	Eatable game bag with FMJ	In hunting Shots fired (inc. missed)	Bullet weight average (kg)	Total amount of lead (kg)	Bullet shots to the eatable game (kg)
Beavers	6200		3720	2	0,008	59,52	29,76
Capercaillie	35900		7180	3	0,005	107,7	35,9
Black grouse	88000		17600	3	0,005	264	88
Red fox	47800	5000		2	0,005	50	0
Raccoon dog	180600	36120		2	0,005	361,2	0
Badger	15300	1530		2	0,005	15,3	0
<b>Total</b>		<b>42650</b>	<b>28500</b>			<b>857,72</b>	<b>153,66</b>
Notes: There are other game animals that can be hunted with FMJ bullets (e.g. lynx), but then we are talking about individual animals whose numbers are irrelevant.							
Game shot with rimfire .22 LR bullets in Finland (2018)							
Species	Game bag 2018	Non-eatable game bag with .22 LR	Eatable game bag with .22 LR	In hunting Shots fired (inc. missed)	Bullet weight average (kg)	Total amount of lead (kg)	Bullet shots to the eatable game in kg
Squirrel	5100	1000		1	0,0026	2,6	0
Stoat (also trapping)	1500	500		1	0,0026	1,3	0
American mink (also trapping)	48900	20000		1	0,0026	52	0
Pine marten	29000	5000		1	0,0026	13	0
Hazel grouse	39900		7980	2	0,0026	41,496	20,748
Willow grouse	20300		2030	2	0,0026	10,556	5,278
Partridge	5600		112	2	0,0026	0,5824	0,2912
Pheasant	28300		2830	2	0,0026	14,716	7,358
Wood pigeon	263600		52720	2	0,0026	274,144	137,072
Crow	140600	14060		1	0,0026	36,556	0
Magpie	74000	37000		1	0,0026	96,2	0
Gulls	15200	3040		1	0,0026	7,904	0
Fox (only trapping)	47800	4780		1	0,0026	12,428	0
Raccoon dog (only trapping)	180600	90300		1	0,0026	234,78	0
Badger (only trapping)	15300	7530		1	0,0026	19,578	0
<b>Total</b>		<b>183210</b>	<b>65672</b>			<b>817,8404</b>	<b>170,7472</b>
Notes: .22 LR rimfire is used for hunting the smallest game species and when shooting small predators caught in cage traps. Some other species can also be shoot with a .22 LR caliber, but numbers are irrelevant.							
Seal hunting with rifle bullets in Finland (2019)							
Species	Game bag 2019	Non-eatable game bag	Eatable game bag with bullets	In hunting Shots fired (inc. missed)	Bullet weight average	Total amount of lead (kg)	Bullet shots to the eatable game in kg
Baltic gray seal	285		285	2	0,008	4,56	2,28
Baltic ringed seal	266		266	2	0,008	4,256	2,128
<b>Total</b>			<b>551</b>			<b>8,816</b>	<b>4,408</b>
Notes: Headshot only in sealhunting, otherwise the seal may be lost to the sea.							

## Test methods

Field tests were fired with three typical Nordic small game hunting caliber (.308 Win, .223 Rem and .22 LR). In the test were fired nine different cartridges loaded with FMJ, OTM and a typical solid round nose lead bullet used in a .22 LR Rimfire caliber.

### Bullet types:

FMJ (Full Metal Jacket) type target bullets, where lead is covered by copper jacket and the bullet is not designed to expand or fragment.

OTM (Open Tip Match) type target bullets, where lead is covered by copper jacket and the bullet is not designed to expand or fragment.

.22 LR Solid round nose lead bullet is typically used in hunting, hunting practicing and sport shooting.



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**Rifles used in the test:**

SAKO TRG 22, .308 Win, 26 inch barrel, Silencer Ase-utra SL 5 i  
Tikka T3 X Varmint stainless, .223 Rem, 20 inch barrel, Silencer Ase-utra SL 5 i  
SAKO Quad Range, .22 LR, 23,6 inch barrel, Silencer SAKO Optisup

In the test, dead male pheasants (breeding birds that were killed) were shot at a typical shooting distance (centerfire 150 meter and rimfire 50 meter). The distance may be longer or shorter in hunting, but the test distances were chosen to represent the average shooting distance in hunting.

The test was performed during one day (April 30, 2021) by shooting the killed pheasants. The dead pheasant was attached to a rack and shot from a side profile. The bullets were captured after hitting the pheasant to the paper tissue boxes (also used by ballistic laboratories and in forensic examinations). The bullets were excavated from paper and photographed and weighed. Pheasants were cataloged, vacuum-packed, and frozen for possible later x-ray examination.

Initially, reference bullets were fired. Reference bullets were fired only to the paper tissue boxes so that we could see how the bullet would form when shot on plain paper and to see if they lose any weight in the barrel or in the tissue box. The residual weights of the reference bullets can be seen in the table. The actual test shots were then fired at the birds.

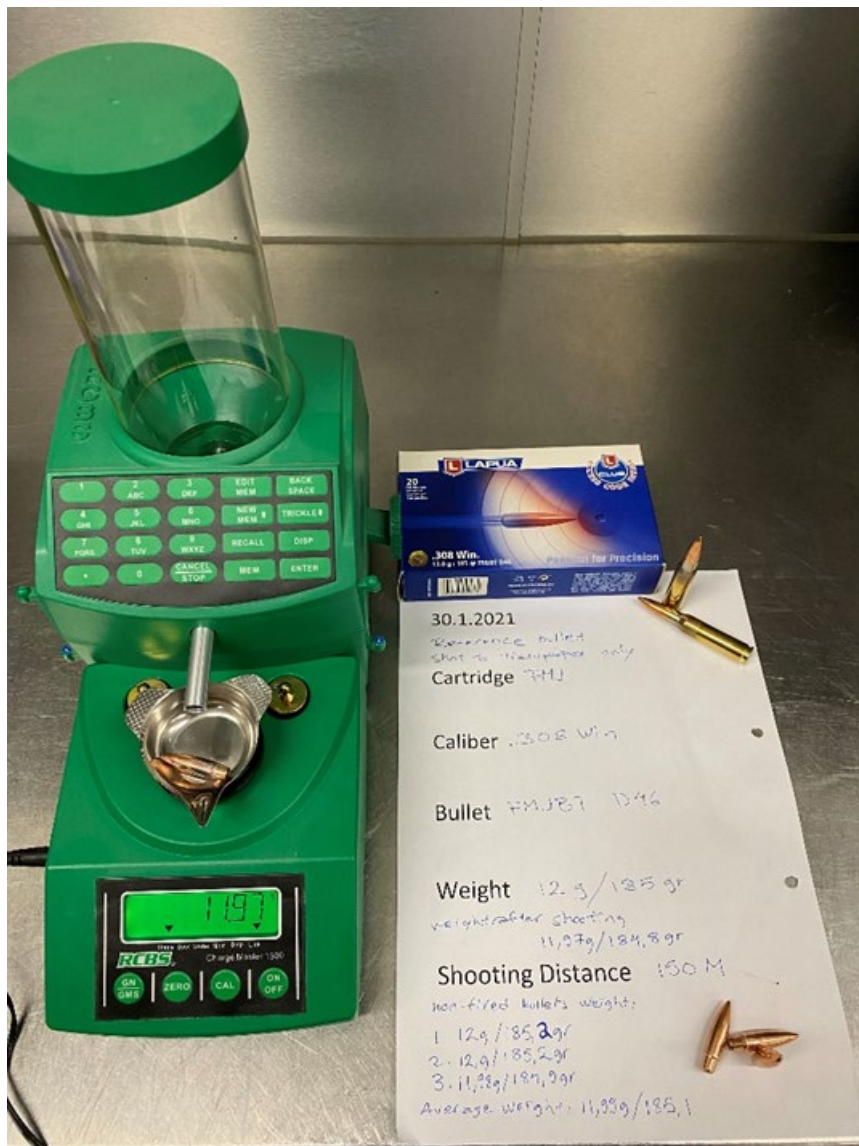
All shots were documented, the velocity was measured, and the cartridges to be tested were dismantled and the average weights of their bullets were measured as reference readings, because although the tolerances are very small in factory production of bullets. Bullets can have differences of one hundredth of a gram.

*Pic 2. Behind the pheasant you can see the soft tissue paper boxes from which the bullet was dug after the impact.*



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Pic 3. All bullets were weighed accurately with an RCBC Charge master 1500 scale.



## Results

It can be seen from the table 2. (page 7) that the bullets remained intact. Picture 4. (page 6) is showing that some of the bullets did not deform at all and some again flattened slightly, but in practice remained intact. Lead from the bullets remained in the pheasant in practically very negligible and within the measuring limits, if at all. In general, the changes were in the order of one hundredth of a gram. In some of the bullets, the residual weight could have increased slightly and this was due to the OTM bullet hole filling with muscle tissue.

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*Pic 4. Pictures of bullets shot through a pheasant.*



**Sample nr. 3308 shot through pheasant (.308 Win, FMJ 120A, 8g)**

The bullet is formed slightly from the tail. The residual weight is 0.02 g less compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 5308 shot through pheasant (.308 Win, Sierra HPBT, 10.9g)**

The body of the bullet is slightly bent. The residual weight is 0.01 g less compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 8308 shot through pheasant (.308 Win, OTM GB 432, 12g)**

The body of the bullet is slightly flattened. The residual weight is same compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 11308 shot through pheasant (.308 Win, FMJBT D46, 12g)**

The body of the bullet is slightly flattened. The residual weight has increased 0.04 g than a bullet that has been shot to the tissue paper only.

**Sample nr. 13223 shot through pheasant (.223 Rem, FMJ 105 G, 3.2g)**

The bullet is formed slightly from the tail. The residual weight is same compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 18223 shot through pheasant (.223 Rem, OTM GB 544, 4.5g)**

The bullet is slightly deformed at its tip. The residual weight is 0.02 g less compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 19223 shot through pheasant (.223 Rem, FMJ S538, 3.2g)**

The bullet is formed slightly from the tail. The residual weight has increased 0.02 g than a bullet that has been shot to the tissue paper only.

**Sample nr. 2222 shot through pheasant (.22 LR solid lead round nose, 2.6g)**

The bullet is deformed at its tip. The residual weight is same compared to a bullet that has been shot to the tissue paper only.

**Sample nr. 2722 shot through pheasant (.22 LR solid lead round nose, 2.6g)**

The bullet is deformed at its tip and tail. The residual weight has increased 0.01 g than a bullet that has been shot to the tissue paper only.

*Table 2. shows the details of all shot cartridges and bullets. One reference was shot from each cartridge on paper tissue and three on pheasants.*

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Sample nr.	Cartridge	Bullet type	Bullet nr.	Caliber	Velocity V0 (m/s)	Shooting distance (M)	Non-fired bullet weight measured average (g)	Bullet weight after impact
Reference*	SAKO Range	FMJ	FMJ 120A	.308 Win	no	150	8	7,99
1308	SAKO Range	FMJ	FMJ 120A	.308 Win	916	150	8	7,97
2308	SAKO Range	FMJ	FMJ 120A	.308 Win	893	150	8	7,96
3308	SAKO Range	FMJ	FMJ 120A	.308 Win	916	150	8	7,98
Reference*	SAKO Racehead	OTM	Sierra HPBT	.308 Win	no	150	10,88	10,91
4308	SAKO Racehead	OTM	Sierra HPBT	.308 Win	825	150	10,88	10,92
5308	SAKO Racehead	OTM	Sierra HPBT	.308 Win	820	150	10,88	10,9
6308	SAKO Racehead	OTM	Sierra HPBT	.308 Win	835	150	10,88	10,88
Reference*	Lapua OTM Scenar	OTM	GB 432	.308 Win	no	150	12,01	12,02
7308	Lapua OTM Scenar	OTM	GB 432	.308 Win	748	150	12,01	12,03
8308	Lapua OTM Scenar	OTM	GB 432	.308 Win	750	150	12,01	12,02
9308	Lapua OTM Scenar	OTM	GB 432	.308 Win	no	150	12,01	12,03
Reference*	Lapua FMJ	FMJ	FMJBT D46	.308 Win	no	150	11,99	11,97
10308	Lapua FMJ	FMJ	FMJBT D46	.308 Win	749	150	11,99	11,99
11308	Lapua FMJ	FMJ	FMJBT D46	.308 Win	742	150	11,99	12,01
12308	Lapua FMJ	FMJ	FMJBT D46	.308 Win	746	150	11,99	11,98
Reference*	SAKO Range	FMJ	105 G	.223 Rem	no	150	3,18	3,19
13223	SAKO Range	FMJ	105 G	.223 Rem	998	150	3,18	3,19
14223	SAKO Range	FMJ	105 G	.223 Rem	1014	150	3,18	3,2
15223	SAKO Range	FMJ	105 G	.223 Rem	1000	150	3,18	3,2
Reference*	Lapua OTM Scenar	OTM	GB 544	.223 Rem	no	150	4,52	4,54
16223	Lapua OTM Scenar	OTM	GB 544	.223 Rem	781	150	4,52	4,52
17223	Lapua OTM Scenar	OTM	GB 544	.223 Rem	783	150	4,52	4,52
18223	Lapua OTM Scenar	OTM	GB 544	.223 Rem	771	150	4,52	4,52
Reference*	Lapua FMJ	FMJ	S 538	.223 Rem	no	150	3,6	3,58
19223	Lapua FMJ	FMJ	S 538	.223 Rem	857	150	3,6	3,6
20223	Lapua FMJ	FMJ	S 538	.223 Rem	850	150	3,6	3,6
21223	Lapua FMJ	FMJ	S 538	.223 Rem	856	150	3,6	3,6
Reference*	Lapua Center-X	Solid lead	no nro.	.22 LR	no	50	2,6	2,59
2222	Lapua Center-X	Solid lead	no nro.	.22 LR	300	50	2,6	2,59
2322	Lapua Center-X	Solid lead	no nro.	.22 LR	307	50	2,6	2,57
2422	Lapua Center-X	Solid lead	no nro.	.22 LR	310	50	2,6	2,59
Reference*	SK Standard plus	Solid lead	no nro.	.22 LR	no	50	2,59	2,56
2522	SK Standard plus	Solid lead	no nro.	.22 LR	279	50	2,59	2,5
2622	SK Standard plus	Solid lead	no nro.	.22 LR	294	50	2,59	2,58
2722	SK Standard plus	Solid lead	no nro.	.22 LR	292	50	2,59	2,57

## Conclusions

In the opinion of the Finnish Hunters' Association, a derogation to the restriction should be made for hunting bullets of the FMJ and OTM types, as they are the only alternative on the market for long-distance hunting for small game due to their accuracy. In addition, a .22 LR caliber solid lead bullets should be allowed as it seems that it is not leaving any lead to the gamebird and as there is no exact non-lead option. In addition, in Finland, an subsonic .22 LR cartridge enables so-called quiet use where noise nuisance may become a problem (lead-replacement cartridges are always supersonic).

According to the test results, FMJ, OTM and .22 LR bullets do not cause lead contamination in game meat. This also eliminates the scavengers of the secondary poisoning phenomenon and, moreover, their small annual (table 1. page 3) use does not cause a large lead load on the environment. Birds also do not eat bullets as grindstones as they may eat shotgun shot pellets.

All bullets have been photographed, weighed and cataloged and all shot pheasants have been vacuum-packed, frozen and cataloged. All materials are available if the field test raised further questions.



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*Pic 5. Pheasants vacuum-packed. Vacuum bags were disinfected for birdflue for possible later X-rays on the university.*



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