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Statement – Impacts of possible lead-restriction in centerfire ammunition for manufacturing

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This document has been prepared to provide information and evaluate possible impacts in the case of possible restrictions use of lead in ammunition from the perspective of the centerfire bullet and cartridge manufacturer.

Within its Cartridges business unit Sako Ltd. manufactures approx. 10 million cartridges per year including manufacturing of lead core bullets. Main part of the business in ammunition side is focused on commercial area and specifically for hunting and hunting training segment (over 80%).

In regards of bullet manufacturing the basic manufacturing principle is cold forming of two materials: copper jacket and lead core. Cold forming takes place by means of presses and drawing machines which are tailored into needs of bullet manufacturing process. Lead as an element possesses several qualities that has advantages in use of ammunition, it is malleable (manufacturing), is has high density (exterior and terminal ballistics for good bullet function) and suitable ratio for ductility/strength (weight retention and expansion capability). The manufacturing of lead core bullets is based using several small presses (force capacity approx. 1 to 5 tons) that have different purpose in the overall process. The tools that execute the actual cold forming are punches and dies that are each designed and hardened for specific operation. Production of these tools require specific high-level skill and are high in cost. Moreover, each different variation of bullet (different length, weight or bullet shape) require own specific series of tools so the flexibility of the process is very limited.

The changing the base material from lead to some alternative material has significant impact on the production processes of manufacturers. In comparison to the copper that which is considered as an alternative to the lead as bullet material, material properties are very different. Ultimate tensile strength of Copper (Cu) is 210 MPa whereas Lead (Pb) has 12 Mpa (over 15 times stronger). Because of these material characteristics (higher material strength) the existing production lines of manufacturers are not compatible with the currently proposed alternative materials. Production would require replacement to cold forming press with approximately 50 tons (over 10 to 20 times more than the existing) of force output and combination of several different manufacturing stages into one process which makes the process complexity level whole different. In addition to this, the production lines would still be slower than the existing machines which will have impact to the product supply and price. Investment cost to the new copper bullet manufacturing line is expected to be around 1.0 to 3.0 million euros depending on the scope of tooling and different bullet variations. To supply the overall demand of the bullets/ammunition it would be necessary to replace multiple of the existing manufacturing lines with several new lines which would be considerable or if not too heavy investment to many of the manufacturers. Another factor to consider is the fact that there are only limited knowledge among ammunition manufacturers on producing bullets from alternative materials.

In general terms, changing from lead material to copper in bullets would increase the average price of the bullet significantly. This comes mostly from the fact that the production cost of the ammunition is mainly driven by the material costs. The copper material price is approximately three (3) times more expensive than the lead which is the primary direct impact to the cost/price increase. Secondary causes that have impact to the increased costs is in slower manufacturing process (because of significantly more force required) and increased tooling costs because more wear of the tooling.

Another thing to consider is the functionality of the copper bullet compared to typical lead-core. In hunting use *exterior ballistics* plays very important role when it comes to efficient and ethical hunting. In order to effectively stop the animal the bullet has to A.) expand with certain resistance level and B.) certain expansion diameter. These properties will set the capability of the bullet to transfer the bullet's kinetic energy into terminal shock caused to animal. Current experience and research suggest that the alternative material bullets (ie. Copper) are feasible with larger animals (such as moose or large deer species) which can provide enough resistance to expand bullet enough causing desired terminal effect. However, the concern is the lower resistance situations such as when bullet impacts the large animal into the large volume lungs, hunting smaller game in general and bullets impacting the animal with slower velocities (ie. longer range shooting situations and small caliber heavy bullets). Currently there are not known scientifically proved research to show the performance of the alternative material bullets in these hunting situations and what are the effect on wounding the animal and what are the average escape distances. For competitive shooting there are not known feasible alternative to lead core bullet.

Currently there are many lead core bullets available that are capable of offering effective performance in terminal ballistics (expansion of the bullet) together with high weight retention that minimizes the lead residues of the bullet when impacted to an animal. The bullet weight retention can be significantly increased by utilizing bonding technology that chemically bonds the bullet core to the copper jacket. This technology together with the optimal jacket design and thickness can greatly increase the weight retention and can be further developed to achieve even 99% weight residues even in the most severe impact situations.

All in all, the proposed change for restricting use of lead in centerfire bullets represent high risk in regards of socio-economical factors. Substantial investments caused by the proposed change may be too large to overcome for many ammunition manufacturers and the continuity and viability to continue profitable operations is at high risk. Although the military uses are outside the scope of commission's request, the proposal has direct impact on supply of military ammunition supply as the ammunition manufacturers' production is much dependent on commercial volumes in general (volume sensitive manufacturing). From global and Defense-strategic perspective, the proposed change would cause unbalanced basis in competitiveness between European and US ammunition manufacturers.