

Development of Lower-Toxicity Ammunition by the US Army

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For hundreds of years, soldiers have used small arms weapons in training and combat. Virtually all the projectiles fired from these weapons contained lead alloy. Lead bullets typically shatter upon impact with soil. The resulting debris and its corrosive by-products infiltrate the soil and can accumulate in sediment, surface water and groundwater.

The US Army Environmental Center is working with the US Army Armament Research, Development and Engineering Center and other agencies through the Joint Working Group for Non-Toxic Ammunition to replace the lead in small caliber projectiles. Efforts are underway to make bullets with materials that perform as well as or better than lead, but without the potential environmental effects.

The Army has selected tungsten—a resilient metal used in light bulbs and cutting tools—to replace lead. Suitable for combat, tungsten bullets pose no risk of lead contamination, and could reduce environmental compliance burdens on many small arms ranges. The new bullets might also result in lower cleanup costs. Environmental impacts vary depending on site conditions, but the cost of removing hazardous metals from soil can range from \$100 to \$300 per cubic yard. Removing lead from one Navy range cost \$2.5 million up front and \$100,000 a year for long-term monitoring.

The “Green Ammunition” project combines the expertise and resources of the US Department of Defense and several US Department of Energy laboratories. The bullets have been tested successfully and the tungsten-core 5.56mm round was approved for production in March 1999. The ammunition has been safety tested by the Army Test and Evaluation Command and approved for use.

Greening Service Ammunition is part of a US Army effort to reduce the costs of main-

taining environmental compliance on military ranges. By combining the expertise of multiple government agencies, costs are reduced while effectiveness, acceptance, and results are increased.

This is an issue of interest to many Americans because they may live near or on a base that actively trains soldiers. Lead has become a highly regulated substance and has been removed from everyday items such as paint and gasoline. Although there is no specific regulation prohibiting the Army from firing lead bullets, contamination of groundwater and/or soil is regulated.

In addition to removing lead from the projectile, the Joint Working Group is looking into improving the entire manufacturing process and removing all hazardous and toxic materials used in small arms ammunition. The paint used to mark the various types of projectiles has been replaced with a low Volatile Organic Compound (VOC) based paint. A second follow-on program to totally eliminate VOCs is in progress. In addition, an Ozone Depleting Compound (ODC), methyl chloroform, has been eliminated from case mouth sealants and is now being replaced in tracer mixes. The contractor has eliminated other ODCs and VOCs used in manufacturing cleaning, and heavy metals are being removed from tracer and incendiary mixes.

The cost of remediation and cleanup of lead from small arms ranges can be phenomenal. The US Armed Forces fire approximately 689 million rounds of small arms ammunition annually during training. It is estimated that the amount of lead introduced into the environment as a result of this training is about 20,000 tons per year. Environmental impacts vary depending on site conditions, but the cost of removing hazardous metals from soil can range from \$100 to \$300 per cubic yard. Evidence of the expensive nature of this cleanup can be seen at the Massachusetts Military Reservation where remediation of lead at small arms ranges cost over \$4 million. Also, removing lead from one Navy range cost \$2.5 million up front and \$100,000 a year for long-term monitoring.

The initial costs of the “green” bullets presently are slightly higher per bullet due to

the higher unit cost of tungsten versus lead. However, recovery and recycling techniques currently being investigated for tungsten have the potential to lower the raw material costs and consequentially lower the cost of the bullet. The additional cost of each bullet is insignificant when weighed against the amount of money and resources saved through the minimization of environmental compliance impacts on training and costly cleanup efforts in the future.

In addition to the costs associated with the remediation of lead, during the manufacture of small caliber ammunition, potentially hazardous materials are either used as prime components or generated as by-products of the manufacturing process. Large-scale production of these rounds magnifies the amount of hazardous materials that are produced: Associated with this waste is a cost for treatment and handling that is computed as part of the overhead charge expressed in the individual cartridge cost to the government. If the manufacturing facilities do not address these environmental issues; they may be forced to shut down, resulting in a strategic problem for the US Department of Defense. The Joint Working Group is dedicated to addressing all of these issues.

On January 30, 2001, MG Robert Van Antwerp, the Assistant Chief of Staff for Installation Management, presented the Joint Working Group for Non-Toxic Ammunition and eight other teams with the Vice President’s Hammer Award at a ceremony in the Pentagon. On hand for the ceremony was LTG John Pickler, Director of the Army Staff. The Hammer Award is presented to teams of federal employees who have made significant contributions in support of re-inventing government principles.

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