# Developing a Non-Toxic Handload for Indoor Range Use

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## Introduction

Lead is a material that is commonly used in the production of rifle, shotgun, and pistol ammunition. When ammunition containing lead components is fired, lead particles may be discharged into the atmosphere. This airborne lead is toxic to humans and as such, it poses a potential health hazard, especially in indoor ranges where it is not as readily dispersed as it is at outdoor ranges. In order to reduce the shooter's exposure to airborne lead, many indoor ranges are beginning to require the use of "non-toxic" or "clean" ammunition that is designed to minimize the discharge of particulate lead.

All of the major commercial ammunition manufacturers offer non-toxic ammo in popular handgun calibers. Winchester *WinClean*, Remington UMC *LeadLess*, and Federal *BallistiClean* are but a few of the many products currently available.

Some shooters prefer to load their own ammunition. Handloading allows the shooter to "fine tune" the performance of a particular round. It also saves the shooter money. On average, the cost of handloads is about one-half that of factory loaded ammunition.

Unfortunately, none of the aforementioned manufacturers sells the components used in the production of their non-toxic factory loaded ammunition. However, there are reloading components available from a variety of other manufacturers that are suitable for the production of non-toxic handloads.

This article will describe in detail how these components can be used to produce a high performance non-toxic 9mm Luger target load. The principles described can be applied to other calibers as well.

## Sources of Airborne Lead

Most bullets are made from lead, alloyed with other metals such as tin and antimony. When a round loaded with an unjacketed bullet is fired, the base of the bullet is subjected to high temperatures, which produces lead vapor.

Primers contain a compound called lead styphnate. Other compounds containing barium and antimony are often part of the primer mix. When the round is fired, the primer ignites, and metallic lead and other toxic substances are expelled into the air.

According to the National Bureau of Standards, on average, 80% of the airborne lead in firing ranges comes from the projectile and the remaining 20% comes from the combustion of the primer mixture.

 


**Figure 1. The story behind Winchester *WinClean***

Airborne lead levels can therefore be reduced dramatically through the use of jacketed bullets. But not all jacketed bullets are created equal. In addition, there is the issue of lead residue from the primers. To produce a truly "clean" handload, lead free primers and fully jacketed bullets must be used.

Figure 1, an illustration from a box of Winchester *WinClean* ammunition, graphically depicts how the use of proper components can virtually eliminate airborne lead.

**Primer Selection**

Conventional lead-based primers are available from a variety of manufacturers. Readily available brands include Winchester, Federal, Remington, and CCI. Unfortunately, none of these companies sell lead free primers.

After considerable research, the author learned that PMC Ammunition manufactures lead free primers in both small pistol and large pistol sizes. In lieu of lead styphnate, these primers use an explosive compound called diazodinitrophenol (DDNP) as the primary ingredient. This is the same compound that is used in *WinClean* primers. The handloads featured in this article use PMC small pistol primers.

Magtech, a manufacturer of high performance self defense ammo, is another company that sells non-toxic primers. The Magtech primers also use DDNP, and are marketed under the trade name *CleanRange.*

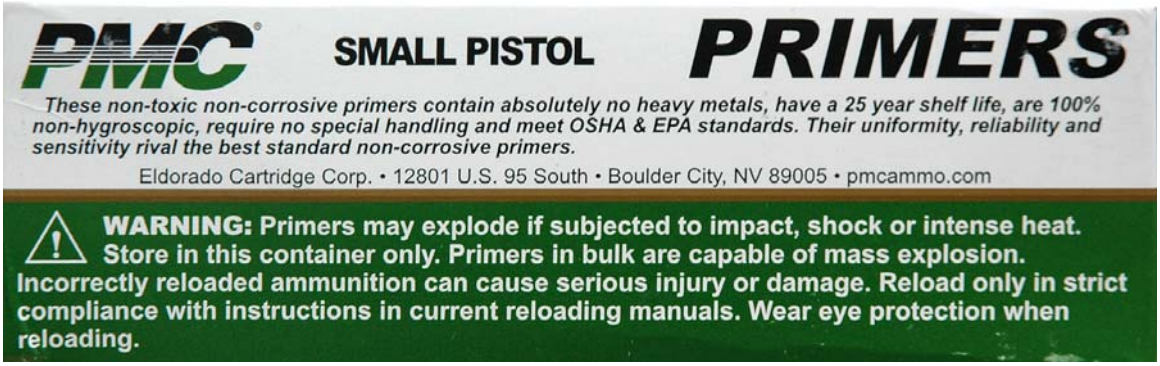


**Figure 2. Side panel on a box of PMC lead free primers**

**Bullet Selection**

The ideal bullet for a non toxic load should have no exposed lead whatsoever. At the very least, the jacket must cover the base of the bullet and the surface of the bullet that comes into contact with the barrel.

The jackets on most so called “Full Metal Jacket” (FMJ) bullets do not provide 100% coverage. Typically, the jacket material does not cover the base of the bullet. As figure 1 illustrates, the exposed lead base is a potential source of airborne lead. This type of bullet is therefore not suitable for use in a non-toxic load.

The 9mm handloads featured in this article use Hornady 124 grain FMJ FP-ENC bullets. The “ENC” designation signifies that the bullet is totally encapsulated in a heavy copper jacket. Hornady FMJ/ENC bullets are available in a variety of weights and profiles in both 9mm (.355” diameter) and .45 caliber (.451” diameter).

Copper plated “Total Metal Jacket” (TMJ) bullets are available from Rainier, Berry’s, and X-treme Bullets (formerly West Coast Bullets). Since the copper plating provides 100% coverage of the lead projectile, these bullets are suitable for use in the production of non-toxic handloads. Rainier markets their plated bullets under the trade name “Lead Safe,” and there is quite a bit of information on the Rainier website www.rainierballistics.com on the subject of airborne lead.

**Figure 3. TMJ bullets: Hornady encapsulated (left), West Coast plated (right).**

**Powder Selection**

All modern small arms ammunition uses smokeless powder as a propellant. Smokeless power is comprised mostly of nitrocellulose (guncotton), a flammable compound that produces a large amount of energy and gas when it is burned.

Small amounts of various chemical compounds are added to smokeless powder to control its burning rate, to retard its deterioration with age, and to improve its flow characteristics so that charges can be accurately measured. None of these additives contain lead or any other heavy metals, so smokeless powder and its combustion byproducts are inherently free of toxic heavy metals.

Smokeless powder's chief advantage over its predecessor, black powder, is that it burns very cleanly. The combustion byproducts of black powder are approximately 50% gas and 50% particulate solids. However, when smokeless powder burns, the process produces nearly 100% gas, and only trace amounts of solids – most of which is carbonaceous soot.

Do different brands and types of smokeless powder burn more cleanly than others? In an effort to answer this question, four 9mm test loads were developed, each with a different type of smokeless powder. All of the test rounds used new unfired brass, were primed with PMC lead free primers, and were loaded to produce a muzzle velocities in the range of 1000 to 1100 fps. The test rounds were fired, and the spent cartridge casings were compared with a spent *WinClean* case.

Figure 4 is a photograph of the five spent 9mm cartridge cases. The *WinClean* factory load is on the far left. The remaining four cases are the handloads. Left to right, the powder used in the handloads is: Winchester 231, Winchester WST, Hodgdon Clays, and Hodgdon Titegroup. As can be seen in the photograph, all five cases are clean, shiny, and free from any appreciable residue.

**Figure 4. Spent 9mm cases (left to right): *WinClean*, W231, WST, Clays, Titegroup**

Critical examination of all five cases revealed that the case loaded with Winchester 231 was the cleanest, followed closely by the one loaded with Titegroup. Interestingly, both of these appeared cleaner than the *WinClean* case. The cases that had been loaded with WST and Clays were free of any sooty residue, but the brass was not as shiny as the others. This suggests that these two powders may have produced a different type of residue that dulled the appearance of the brass.

**Shooting Impressions**

Of the four handloads, the one loaded with Titegroup was the most accurate, the most consistent, and the most pleasant to shoot in the author's Smith&Wesson 952 pistol. All four handloads produced less recoil and considerably less muzzle flash than the *WinClean* factory loads.

The parameters for the Titegroup handload are as follows:

Bullet: Hornady 124 grain FMJ FP-ENC (Hornady catalog number 33567)
Primer: PMC NTSP
Powder: 4.1 grains Hodgdon Titegroup
Brass: Starline
C.O.L.: 1.07"

In addition to its accuracy and shootability, the Titegroup handload left very little residue in the author's S&W 952 pistol. Figure 5 compares the residue left in the breech of the pistol by the WinClean load and by the Titegroup handload. The left hand photo in this figure is of a clean pistol. The center photo was taken after 50 rounds of WinClean had been fired in a clean pistol. The right hand photo was taken after 50 rounds of the Titegroup handload had been fired in a clean pistol. These photos show that the Titegroup handload left slightly more sooty residue on the feed ramp of the barrel than the Winclean load.

Close examination of the inside of the pistol's barrel revealed that the Winclean load left appreciably more residue than the Titegroup handload. In terms of the total amount of residue left in the pistol after 50 rounds were fired, the author would rate the two loads as comparable.

**Figure 5. Left to right: clean pistol, pistol after 50 rounds of Winclean, pistol after 50 rounds of Titegroup handload**

The amount of smoke produced by the Titegroup handload was equal to or less than that of the Winclean load.

### Additional Considerations

Spent cartridge cases primed with lead styphnate primers contain lead residue. Ideally, they should not be used for non-toxic handloads. Only new brass or spent cases that have been previously loaded with non-toxic primers should be used.

In order to prevent their contamination, spent "non-toxic" cartridge cases should be cleaned and stored separately from brass which has been previously primed with lead styphnate primers.

### Conclusion

Using readily available reloading components, it is possible to produce nontoxic handloads that are as clean as and more shootable than factory loaded noxtoxic ammunition.

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