



GUIDE TO LEAD MANAGEMENT FOR AIR GUN SHOOTING



A Guide to Ensuring Participant Health during Air Rifle and Air Pistol Shooting through Proper Range Design, the Effective Management of Lead Exposures, Personal Hygiene Practices and Range Cleaning Procedures.

Produced by USA Shooting and the Civilian Marksmanship Program

INTRODUCTION

LEAD MANAGEMENT FOR AIR GUN SHOOTING

This ***Guide to Lead Management for Air Gun Shooting*** was produced and published by USA Shooting and the Civilian Marksmanship Program to provide practical answers to the many questions that arise as a result of the use of lead pellets or projectiles during air rifle and air pistol target training and competitions.

Lead is a toxic substance and when taken into the body in amounts exceeding minimum amounts established by medical experts, it can have serious adverse health impacts. Fortunately, all available research shows that air gun shooters, regardless of age, do not face any health risks from air gun shooting if they follow proper hygiene practices and the air gun range is properly managed.

This Guide provides the best information that is currently available regarding a series of questions about the use of lead pellets for air gun shooting. The contents of the Guide are:

Health and Environment Information Regarding the Use of Lead Pellets on Indoor Air Gun Ranges; this section summarizes available research data on issues related to air gun shooting.

Guidelines for Air Gun Range Cleaning and Maintenance; an article that describes range cleaning procedures that tests show can successfully reduce lead residues on range floors to non-detectable levels.

Health & Environmental Technology Tests; a summary of the test protocol and test results of the 2007 lead tests conducted on the U. S. Olympic Shooting Center air gun range, together with a test certification.

QUESTIONS OR COMMENTS

Anyone with questions or comments concerning information in this Guide or concerning issues related to the use of lead pellets on air gun ranges is invited to contact:

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Health and Environment Information Regarding the Use of Lead Pellets on Indoor Air Gun Ranges

By Gary Anderson, Director Emeritus Civilian Marksmanship Program¹

This article summarizes current information regarding possible health issues or concerns that might result from competitors handling lead pellets during air rifle and air pistol training and competition or from working on air rifle ranges where lead pellets are fired. It answers commonly asked questions about the use of lead pellets in air gun shooting by using data from the best available scientific and professional testing as well as information about known best practices for safe air gun range management.



Lead air gun pellets that are used in air rifle and air pistol shooting. Pellets are 4.5 mm in diameter and weigh 0.50 – 0.53 grams. They are shaped like badminton shuttlecocks to give them optimum aerodynamic stability and accuracy.

HOW IS LEAD USED IN AIR GUN SHOOTING?

In air rifle and air pistol target shooting, projectiles made of lead are placed in the breech ends of rifle or pistol barrels and are propelled towards the target by bursts of compressed air or CO₂ gas. The pellets used for target competition are 4.5 mm (.177 caliber) in diameter and weigh approximately 0.50-0.53 grams (8 grains). Target air gun velocities typically vary from 450 fps. to a maximum of 600 fps.² Pellet energies in flight are quite low; approximately five foot-pounds at the muzzle,

but target grade air guns are capable of producing extremely precise accuracy with match grade pellets. The air rifle target, which is placed at a distance of 10 meters, has a ten ring that is only 0.5 mm in diameter so extreme precision or accuracy is required from the pellets that are used in this type of shooting.

¹ Anyone with questions about this topic or who has access to additional information about it is invited to contact Gary Anderson at the Civilian Marksmanship Program, DCM@thecmp.org.

² National Three-Position Air Rifle Council rules and JROTC regulations limit air rifles to those with muzzle velocities of < 600 fps. Manufacturers of competition air rifles and pistols have confirmed through testing that velocities that produce optimum accuracy are in the 560-580 fps. range so muzzle velocities of <600 fps are standard for all commonly used target air rifles and air pistols.

During air gun firing, the shooter must pick up lead pellets and insert them into the breech end of the rifle or pistol barrel. When the air gun fires, the pellet flies towards the target to penetrate it. After passing through the target, the pellet is captured by a pellet trap or backstop. Lead management issues arise from handling pellets, the passage of pellets through the barrel and the fragmentation of pellets that occurs when pellets strike backstops.

CAN ANY OTHER MATERIAL BE USED TO PRODUCE AIR GUN PELLETS?

The choice of lead as the basic material for the manufacture of air gun pellets is based on its combination of density and malleability. It is the only material that is both practical and economically feasible for use in producing competition-quality air gun projectiles. Steel is used to produce BBs, but they are notoriously inaccurate and dangerous because projectiles with the hardness of steel can ricochet back from the target holders and backstops. There have been several attempts to produce air gun pellets from other materials such as tin, but none are a satisfactory substitute for lead. Air gun shooting requires extreme accuracy. Lead pellets meet this precise accuracy standard, but no non-lead or so-called “green” pellets have yet proven to be consistently capable of producing the same degree of accuracy³. Many non-lead pellets are, in fact, so inaccurate that they cannot even be satisfactorily used in the earliest stages of youth target shooting. In addition to lacking acceptable accuracy, non-lead or green pellets are also two or three times more expensive than lead pellets. There are currently no non-lead air gun pellets suitable for target shooting.

³ 10-meter air rifle targets have a ten-ring that is actually a 0.5 mm dot. To produce satisfactory accuracy for target shooting, all pellets fired from a rifle held in a machine rest must be capable of hitting that dot.

IS THERE ANY MEDICAL EVIDENCE THAT AIR GUN COMPETITORS OR RANGE OFFICERS HAVE DEVELOPED HEALTH ISSUES THAT CAN BE ATTRIBUTED TO AIR GUN SHOOTING?



During air gun shooting, shooters handle lead pellets while loading them into air rifles or air pistols.

During the last 20 years, there have been numerous medical evaluations to determine whether individuals who practice regular air rifle or air pistol target shooting are exposed to any real health risks as a result of handling lead pellets or being present on ranges during the firing of air rifles or pistols. Shooters in the U. S. Olympic Training Center

Resident Athlete program at Colorado Springs, Colorado train on a daily basis with air rifles or air pistols. USOC-monitored blood lead-level testing is routinely required and conducted. This testing has never detected a single case of elevated lead levels that required medical intervention among athletes in the program. In fact, most athletes in these tests had lead levels well below the lead levels found in the general population.

These medical evaluations are especially important in understanding the extremely low risk to those who practice air gun marksmanship because Olympic Training Center athletes regularly do several hours of range training every day, five or six days per week, throughout the entire year. This testing by the U. S. Olympic Committee demonstrated that even individuals who engage in extensive air rifle and pistol firing on a daily basis are not exposed to lead that in any way endangers or adversely affects their health. Participants in youth or club marksmanship programs typically have exposures that are much less than what these athletes have so it is probable that their exposures are even less than those evaluated in the USOC tests.

In addition, colleges, like the Univ. of West Virginia and Univ. of Kentucky, whose NCAA rifle team members also do extensive daily training with air rifles and smallbore rifles, have mandated blood lead-level testing for their rifle team members. Their tests

also produced negative results similar to those from the USOC tests. Several national shooting organizations, including federations in Germany, Sweden, Finland and Norway, report lead tests with similar results. No known tests conducted by qualified medical personnel have shown that air rifle or air pistol shooters who train and compete on properly maintained air gun ranges, who follow recommended hygiene practices and who do not have significant lead exposures outside of the shooting range have developed elevated lead levels as a result of air gun shooting. This conclusion has been verified even for the shooting athletes who practice and train the most.

All available medical testing shows that air rifle and air pistol target shooting participants do not develop elevated lead levels as a result of this activity. Target shooting with air rifles and smallbore rifles does not create real health risks for shooting sports participants.

WHAT CAN AIR GUN SHOOTERS DO TO MINIMIZE THEIR EXPOSURE TO LEAD WHEN HANDLING PELLETS?

Even though all available medical evidence indicates that handling lead pellets during air gun firing does not create elevated lead levels, lead is still a toxic substance and ingesting lead into the body has a potential risk to one's health. For this reason it is important that all air gun shooters take certain precautions while handling lead pellets.

In 1988, William L. Marcus, PhD., a researcher at the National Institute of Health, examined the issue of lead exposure for air gun shooters. He concluded that if young target shooters follow a few simple precautions, their use of lead pellets during target shooting does not constitute a health hazard. Dr. Marcus worked with shooting sports leaders to develop two simple rules that are still the basis for health guidelines that are taught to shooting coaches and shooting sports participants. Those rules are:

- 1) Anyone who handles air gun pellets during shooting must wash hands their hands, with soap and water, after they finish shooting.⁴
- 2) No food or open beverage containers may be taken into the range and no food may be consumed on air gun ranges. It also should go without saying that pellets should never be placed in a shooter's mouth.

To minimize health risks from handling air gun pellets, do not allow food or open drink containers on air gun ranges and have participants wash their hands after firing activities on air gun ranges.

DOES THE FIRING OF LEAD PELLETS IN AIR GUNS CREATE AIRBORNE LEAD THAT CAN BE BREATHED BY SHOOTERS?

Dr. Heinz Lösel, a distinguished German physician who was the Chairman of the International Shooting Sport Federation's Medical Committee from 1980 through 2004,⁵ conducted extensive research on issues dealing with lead exposures for shooters during air gun firing. Dr. Lösel supervised a series of tests measuring airborne lead on ranges in Germany where air rifles and pistols were fired. In his report on these tests he wrote:

Contrary to the situation where smallbore and center-fire ammunition is fired, no propelling charge is necessary for air guns to fire. The abrasion of lead pellets in the barrel, when overcoming mechanical resistance, is of no consequence due to the low barrel velocity of air gun pellets, so lead is not released until a pellet bursts against the pellet trap. Consequently, there is no danger of air pollution on air gun ranges.

⁴ Some air gun range managers take extra precautions by providing commercial towelettes that are produced specifically for removing heavy metals from the skin for their shooters to use to clean their hands after firing. One product that has been successfully used on indoor rifle and pistol ranges is D-Wipe Towels sold by D-LEAD® Cleaning Products: <http://www.professionalequipment.com/>.

⁵ The ISSF is the international governing body for Olympic shooting. Dr. Lösel was the Medical Director for the Olympic shooting competitions on seven occasions. He was also the personal physician of German Chancellor Helmut Kohl.

In fact, the only physiological concern Dr. Lösel had was not with any lead exposure that shooters on the firing line might have, but with the possible depletion of oxygen in the range environment caused by the release of CO₂ gas from air pistols that used CO₂ as a propellant. He concluded that individuals who fire air guns face no health hazards from airborne lead.

The issue of whether air gun firing creates airborne lead was re-examined in 2007 tests conducted by Health & Environmental Technology (HET), a professional environmental testing firm from Colorado Springs, Colorado. These tests were conducted on an air gun range at the U. S. Olympic Shooting Center. For these tests, air samplers were placed in the breathing space of the air gun shooters while they fired and next to the target backstops. No measurable airborne lead was detected by any of these monitors during air gun firing. These tests confirmed Dr. Lösel's conclusion that breathable airborne lead is not generated by firing air gun pellets at the velocities prescribed for target air guns.

Firing air rifles or air pistols at muzzle velocities prescribed for target shooting (<600 fps) does not generate any detectable airborne lead. There is therefore no need for special ventilation systems on air gun ranges since there is no airborne lead to exhaust from the range. Normal ventilation achieved by modern HVAC systems provides more than adequate ventilation for air gun ranges.

ARE ANY LEAD DEPOSITS LEFT ON THE RANGE AS A RESULT OF AIR GUN FIRING?

Wipe tests conducted by the HET firm on the floor of the range at the same time as the airborne lead tests indi-



During air gun range firing, competitors fire from behind a firing line at targets placed in target holders 10 meters downrange. Air gun firing does not generate airborne lead, but detectable lead residues do fall to the floor in front of the muzzles and in the areas around the target holders. These lead residues can be reduced to non-detectable levels with proper cleaning procedures.

cated that small amounts of lead fragments or residue do come off of the lead pellets just after they exit the gun muzzles that are deposited on the range floor in front of the firing line. This testing showed that these fragments or residues are of sufficient density that they do not remain suspended in the air, but rather fall to the floor where they may be cleaned. In addition to showing that during air gun firing, minute deposits of detectable lead fragments and residue are deposited on the range floor in front of the gun muzzles, lead residues are also deposited on the floor in the area around the backstops. The amounts deposited on the floor around the backstops depends upon the type of backstop used and how well it contains the fragments that are created by pellet impacts against the backstop. Floor wipes taken during the Olympic Training Center tests yielded lead residues of up to 69 $\mu\text{g}/100\text{cm}^2$ just ahead of the firing line and 50 $\mu\text{g}/100\text{cm}^2$ in the target backstop area.

These tests confirm that lead residues are deposited on the range floor by the firing of air guns and by the fragmentation of pellets when they strike the backstop. Since these residues are of sufficient density that they do not become suspended in the air, but rather fall to the floor, the deposit of lead residues in front of the firing line does not constitute an immediate health hazard to persons on the range if movement ahead of the firing line is properly controlled. If shooters or coaches move forward of the firing line, they can potentially pick up lead fragments on their shoes and track them back to the firing points or areas behind the firing line. For this reason, personnel movements forward of the firing line should be reduced and restricted to marked lanes on either side of the firing points (see the ***Guidelines for Airgun Range Design, Cleaning and Maintenance*** on Page 14).

HOW CAN THE POTENTIAL RISKS FROM EXPOSURE TO LEAD DEPOSITS ON THE RANGE FLOOR BE MITIGATED?

A key to minimizing the risks of lead exposures from any residues that are deposited between the firing line and the targets is to minimize requirements for coaches or shooters to go downrange in order to prevent lead residues from migrating back to the firing points or area behind the firing line. If electronic targets or target

carriers are used, it is not necessary for anyone other than range maintenance personnel to go downrange. When it is necessary to go downrange to retrieve or change targets, minimize these exposures by 1) reducing the number of people authorized to go forward of the firing line, 2) controlling the paths used to go downrange so that no one walks in the area immediately in front of the firing line, 3) if possible, using pellet traps that are behind the target holders so that any lead deposits fall behind the targets, or by using combination target holders and pellet traps that are especially effective in keeping lead fragments within the trap itself, 4) using disposable plastic shoe covers when going downrange and 5) regularly and properly cleaning the range floor so that lead residues do not remain there.

Downrange movement by range officers and other range personnel is necessary to perform maintenance on the target systems. When paper targets are hung on target holders so that it is necessary to go downrange to hang or change targets, then it is also



One way to mitigate potential risks from lead deposits on the range floor is to minimize the number of personnel who are authorized to go downrange for target changing and maintenance.

necessary to manage how range officers and shooters go downrange so that the lead residue on the floor is not picked up on their shoes and tracked back to the firing line. The ***Guidelines for Airgun Range Design, Cleaning and Maintenance*** that are published on Page 14 provide detailed instructions on how to manage downrange movement of range personnel in order to change targets or perform target maintenance. If these guidelines are followed, lead deposited on the range floor during airgun firing will not be tracked back to the firing line where shooters can contact it.

CAN LEAD RESIDUES ON THE RANGE FLOOR BE REMOVED?

The short answer is yes; lead residues on range floors can be very effectively cleaned and removed. If shooters do not move past the firing line to go downrange except as authorized, and if personnel who go downrange follow the ***Guidelines for Air-gun Range Design, Cleaning and Maintenance***, there is no immediate health hazard to shooters or other persons who remain behind the firing line. Nevertheless, the lead deposits that fall on the range floor between the firing line and the target must periodically be removed from the range by employing prescribed range cleaning procedures.

The lead testing that was done in conjunction with the development of the ***Guidelines for Airgun Range Design, Cleaning and Maintenance*** confirmed that relatively simple cleaning procedures can successfully remove lead from the range floor to the point where no detectable lead remains. When range cleaning procedures employing a normal shop or industrial vacuum and periodic wet mopping with a solution of water and tri-sodium phosphate⁶ were used, the 2007 U. S. Olympic Shooting Center tests showed that lead residues remaining after cleaning were not detectable.⁷

When air gun range cleaning is performed according to prescribed range management guidelines, lead residues from air gun firing can be effectively removed from the range floor.

WHAT PROCEDURES SHOULD BE FOLLOWED IN REMOVING LEAD FROM PELLET TRAPS OR TARGET HOLDERS?

The first step in cleaning the range and target traps is to restrict this task to adults who follow proper procedures. When cleaning pellet traps, wear old clothes that are not used for other purposes, disposable plastic gloves, shoe covers and a fine particulate breathing mask. Dump the spent pellet fragments into a bucket or container designated for this purpose. The container should have a cover that can be securely fastened. Dump fragments out

⁶ *Tri-sodium phosphate is a cleaning agent available at most hardware stores.*

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of the pellet traps frequently enough that the pellet holders do not become over-filled.

Wear the same old clothing when using a shop or industrial vacuum cleaner or wet mop to clean the floor. If downrange movement is minimized on the range, this procedure does not have to be done after every shooting day. Vacuum cleaning should be done more often than wet mopping. Detailed cleaning procedures are given in the ***Guidelines for Airgun Range Design, Cleaning and Maintenance***.

After vacuum and wet-mop cleaning is finished, it is necessary to secure the vacuum filters and old mop heads in another container that must be labeled and stored so that unauthorized persons do not have access to it.

Only authorized adult personnel who follow proper procedures should remove lead from pellet traps or target holders.

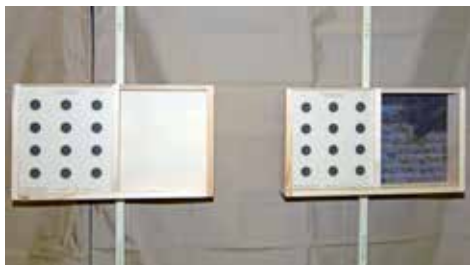
WHAT ARE PROPER WAYS TO DISPOSE OF LEAD THAT IS REMOVED FROM THE TARGET TRAPS OR CLEANED FROM THE RANGE FLOOR?

Lead consisting of spent pellets or pellet fragments that is removed from the pellet traps is regarded as a recyclable material.⁸ After a quantity of this lead is accumulated, take it to a recycling center. Another disposal option sometimes used is to make it available or sell it to shooters who use the lead to cast bullets for muzzle-loading guns or other firearms.

The ShopVac filters and mop heads that have been stored for disposal are generally regarded as hazardous waste. In some locations this material can be taken to recycling centers. Some schools handle this material by combining it with hazardous wastes that come from their chemistry labs and other similar activities and using the same disposal methods with both.

Spent lead pellets and pellet fragments should be recycled. Vacuum filters and mop heads used for range cleaning may be taken to recycling centers or disposed of as hazardous waste.

⁸ *Guidelines from several state Environmental Protection Agency organizations indicate that this form of lead should be handled as a recyclable material.*



The target boxes supplied with the Creedmoor Air Rifle Target Systems that are used on many JROTC ranges use a steel plate (see right side of right box) to stop fired pellets and drop them to the bottom of the box. They also use a backing card that is placed behind the target (see right side of left box) to prevent lead fragments or residues from escaping out of the target box.

WHAT OTHER CONSIDERATIONS SHOULD BE MADE WHEN DESIGNING AND MAINTAINING AIRGUN RANGES?

Dr. Lösel recommended that pellet traps designed to effectively contain the pellets and pellet fragments be used. Most standard pellet traps in use for three-position air rifle shooting that combine target holders with pellet backstops are capable of containing almost all lead residues that are created by the pellet impacts

against the pellet traps. Open traps with steel impact plates set at a 45 degree angle generally expel the most lead. The target boxes that are supplied with the Creedmoor Air Rifle Target Systems⁹ are quite effective in containing lead pellet residues. If you are designing and building your own air rifle or air pistol target boxes, make sure there is a barrier at the bottom of the box that prevents spent pellets from falling out of the box. Placing a backing card between the target and backstop plate can also reduce the amount of lead residue that comes out of the target box.¹⁰

A key to effectively cleaning the range is having a smooth floor. A smooth floor without cracks or pits makes it much easier to clean up all lead residues. If you are designing or developing a new range, put “smooth floor” in the specifications. If you are working with an older range that does not have a smooth floor, consider replacing or covering the floor to achieve a smooth surface that is easier to clean.

⁹ Creedmoor Air Rifle Target Systems were purchased by the Marine Corps and Navy JROTC Commands and issued to their units. This equipment is commercially available from Creedmoor Sports Inc., <http://www.creedmoorsports.com>.

¹⁰ The target box design posted in the CMP website at <http://thecmp.org/training-tech/coaching-resources/air-rifle-target-stand-plans/> can be used to build air rifle target boxes that minimize the deposit of lead on the range floor in the area around the pellet traps.

In order to carry out recommended air gun range management procedures, range managers should have these supplies and materials available to them:

- Shop or industrial vacuum cleaner
- Mops and disposable mop heads
- Tri-Sodium Phosphate
- Disposable plastic shoe covers
- Disposable plastic gloves
- Container (bucket) with secure closure for spent pellets
- Container (bucket) with secure closure for vacuum filters and mop heads

WHAT CONCLUSIONS WERE REACHED AS A RESULT OF LEAD TESTS DESCRIBED IN THIS BOOKLET?

- ⊙ **There is no scientific evidence that firing lead projectiles in target airguns with velocities of less than 600 fps. generates any detectable airborne lead.**
- ⊙ **There is no medical evidence that shooters who handle lead pellets in accordance with established hygiene procedures, will develop elevated lead levels that require medical intervention.**
- ⊙ **Anyone who handles lead pellets during air rifle or air pistol shooting can effectively minimize their lead exposure by washing their hands after firing and by not consuming food materials on the range.**
- ⊙ **Lead residues are deposited on the floors of air gun ranges in the area between the firing line and the target, but the proper management of downrange movement by range officials and shooters and the employment of proper range cleaning procedures effectively minimizes any health risks associated with these lead residues.**
- ⊙ **Pellet traps that do the best job of capturing and holding spent pellets and pellet fragments must be used. Only adult supervisors who take proper precautions should handle lead pellet residues that are collected in pellet traps after firing.**

Guidelines for Airgun Range Design, Cleaning and Maintenance

Depending on range design, varying amounts of small particulate residue from pellets will accumulate on range area surfaces during air rifle and air pistol firing, particularly in the downrange area, ahead of the firing line. These guidelines provide instructions for cleaning and maintaining ranges used exclusively for air rifle or air pistol shooting. This document describes recommended methods to clean lead pellet residue and maintain the range area free of lead pellet residue. Also presented are range design considerations that will limit residue accumulation.

The procedures described in these guidelines were developed as a result of testing done by the Civilian Marksmanship Program and USA Shooting in cooperation with the firm Health and Environmental Technology, LLC (HET), Colorado Springs, Colorado. HET CEO Robert M. Rodosevich, GRI, I. H., conducted all lead sample tests under controlled conditions on the U. S. Olympic Training Center ranges located at Colorado Springs. The test samples were analyzed by a certified lab selected by Mr. Rodosevich. Analytical Chemistry Inc., Tukwila, Washington, analyzed all samples.

First and foremost, this testing proved that the firing of the soft lead pellets normally used for air rifle and air pistol training and competition produced no airborne lead contamination. Airborne contaminate testing was done in a small enclosed range with no special air handling or ventilation system. Airborne testing was done with air samplers hung next to the shooters' breathing zones while they were firing and from air samplers hung next to the target traps, with samples again taken during firing. No detectable lead was found in any of these air samples.

Wipe testing was performed for particulate matter on the range floor. Testing was done at three points between the firing line and the target line: 1) just in front of the barrel area of the firing line, 2) at mid range, and 3) in front of the target (results of analysis provided as Annex A). Wipe tests were taken at four different stages in the firing and cleaning sequence: 1) before firing to confirm that the range was free of lead from any previous firing, 2) after

the firing of a minimum of 400 and as many as 700 shots per firing point (the equivalent of several days of normal range firing) to determine the amount of lead deposited on the range surfaces as a result of extensive air gun firing, 3) after vacuum cleaning and 4) after wet mopping. Testing steps 3) and 4) were done to evaluate cleaning methods and whether they successfully abate lead pellet residue to undetectable levels ($<2 \text{ ug}/100\text{cm}^2$).

RANGE DESIGN. This section of the document provides some details on range design and preferred flooring materials to optimize the procedure outlined below and to yield optimum cleaning results.

- a. The best range design is one that has a trap system behind the target line. This trap system design should be constructed to allow lead pellet residue to be contained or fall behind the target line. If all residues fall behind the target line, it is possible for the targets to be changed without the possibility of personnel who are changing targets contaminating other portions of the range. With this type of pellet traps, you must still ensure all residues fall behind the target line by carefully inspecting the areas behind and in front of the target line before establishing the range map.
- b. Where pellets are not contained behind the target line, the biggest problem with contamination is that lead pellet residues on the floor can be tracked to other portions of the range or outside areas when range personnel walk through them and pick up the residues on the bottoms of their shoes. Additionally, walking across the lead fragments grinds them into the surface of the floor creating the need for more frequent mopping as opposed to just using a simple vacuuming process. Properly using shoe covers aids in preventing contamination migration if it is not possible to use a trap system where all residue falls behind the target line.
- c. The type of floor in the range also impacts the amount of lead residue left on the floor and the cleaning process that must be used to remove it. Is important that range flooring be as smooth as possible and well sealed. Smooth, sealed tile provided the best test results and the easiest cleaning proce-

dures. Well maintained and sealed wood gym flooring is also recommended. Sealed and/or painted concrete is not completely smooth and must be maintained with more care and more frequent inspections to ensure the surface imperfections are being cleaned adequately. Rough and porous surfaces will require more frequent and thorough cleaning.

- d. If using target stands/frames with cardboard front faces, ensure that the cardboard is replaced as needed to maintain a “seal” and that it extends down to the catch tray of the pellet trap. There should be some form of catch tray to help contain the lead and facilitate removal. If you have significant lead contamination immediately in front of the target line, you may also want to look into soft catch type backstops (cloth/putty) instead of steel plates. USA Shooting and CMP recommend two styles of target frames for airgun shooting. Detailed plans are available from the CMP at <http://thecmp.org/training-tech/coaching-resources/air-rifle-target-stand-plans/>.

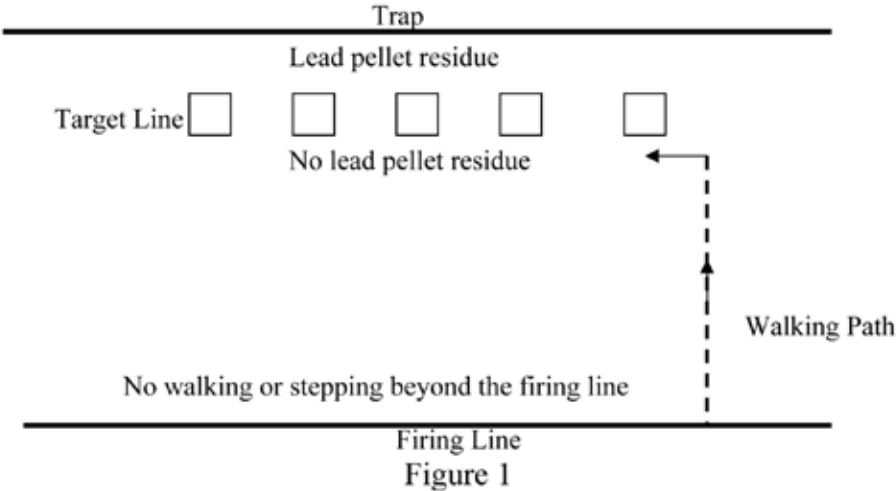
If air pistol is to be fired on 4-bull targets on the range, modify these designs to accommodate two 4-bull sheets of air pistol targets that are 14” X 14”.

MANAGING LEAD DEPOSITS TO MINIMIZE HEALTH RISKS.

The following procedures are recommended for use in managing lead deposits on air gun ranges so that any risks of lead exposure or ingestion are eliminated or minimized:

- **STEP ONE:** Create a clean environment in which to work. This step is done once, at the beginning or the end of the shooting season. Use a standard shop or industrial vacuum to vacuum all visible lead pellet residue from the entire range including behind the firing line and the target frames. Starting behind the firing line, mop with a new, previously unused mop and a solution of water and tri-sodium phosphate. Finish mopping around and under the target frames. Do not use this mop on any other area of the range or in any other area. Dispose of the mop once completed.
- **STEP TWO:** Determine the range set-up and establish the range policy for keeping lead pellet residue contained to as small an area as possible.

- 1) On ranges where a trap system keeps lead pellet residue completely behind the targets, it is recommended that range staff establish a lane (paint or tape a line) that provides a walking path for the coach or designated athlete to walk down to the target line to change targets. Do not allow athletes to step forward of the firing line as pellet residues coming from air rifle or air pistol muzzles when pellets exit the barrels can be picked up on shoes or boots and tracked throughout the range area. Testing showed that a small amount of residue were deposited from the ends of the barrels just in front of the firing lines (up to 70 ug/100 cm²). See Figure 1 below.



- 2) On ranges where the target system allows lead pellet residues to deposit on the floor forward of the targets, it is recommended that the range staff establish a lane (paint or tape a line) to provide a designated walking path for the coach or authorized athlete to follow while moving to the target line. At the target line, it is recommended that the designated target changer put on disposable shoe covers before walking over any residues that may be in front of the targets. Once targets are changed, the designated target changer should remove the disposable shoe covers before stepping onto the walking path and returning to the firing line. Shoe covers are disposable, elasticized

paper or plastic. They fit over shoes to allow an individual to slip them on before entering a contaminated area and to take them off and dispose of them immediately upon leaving the contaminated area. USA Shooting obtains shoe covers from Airgas Safety Products at www.airgas.com, but they also may be obtained from medical supply stores. Do not allow athletes to step forward of the firing line as the fine particulate lead sheared from the pellets as they exit the barrel will be picked up on shoes or boots and tracked throughout the range area. See Figure 2 below.

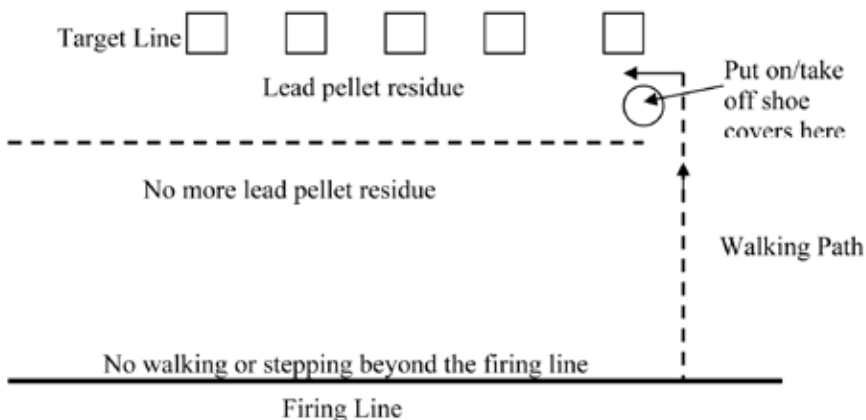


Figure 2

- 3) In all cases, range configuration and residue accumulations will determine the need for a walking path or extra measures to ensure that residue is kept contained and not moved throughout the range area. Each coach or range officer should carefully consider all possible locations for unnecessary contamination and establish a policy for containment.
- **STEP THREE:** Cleaning procedures to remove lead residues from the range. If the range is a dedicated range where no one other than authorized range personnel will walk beyond the firing line, these procedures can be performed on a pe-

riodic basis, as needed. If the air gun range is in a multi-use facility where other activities will take place in the downrange area after air gun firing concludes, that area must be cleaned after every training or competition session.

- 1) After firing activities have ended, have the athletes remove shooting equipment from the firing line, ensuring that they do not step over the firing line. Using a shop vacuum, start from behind the firing line and move parallel to the firing line, carefully vacuuming from the firing line downrange for ten feet. Start again from ten feet in front of the target line and move parallel to the target line, vacuuming to the target line (or beyond if there is lead pellet residue behind the target line. See Figure 3 below.

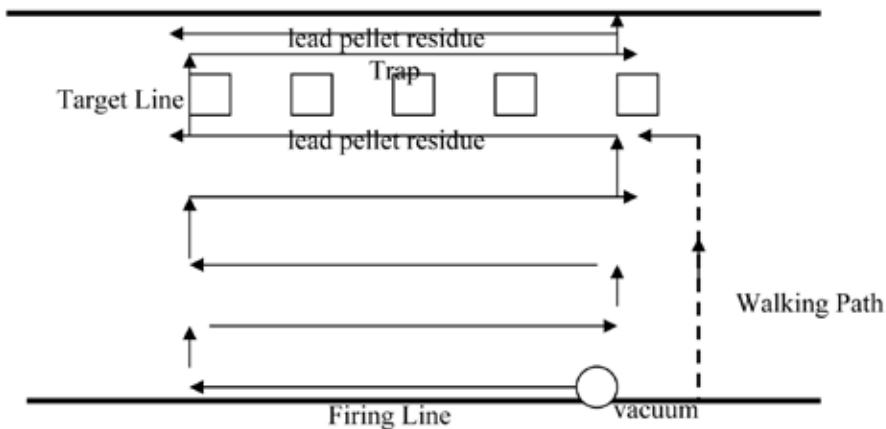


Figure 3

- 2) Ensure that the shop vacuum's cord, wheels and hoses do NOT drag through un-vacuumed area. Always keep the vacuum and the vacuum operator in the clean area of the range. The operator should not step on or stand in a potentially contaminated area.
- 3) Occasional mopping after thoroughly vacuuming, using the same procedure described above, with a new, unused mop, will contribute to the overall cleanliness of the range area. Here wet mopping is adequate to eliminate all pellet

residues. Range floors that are roughly textured or porous may require mopping with tri-sodium phosphate, a buffering solution that suspends particulates long enough to be picked up by the mop.

- 4) Testing has shown that thoroughly vacuuming the range area while ensuring that inadvertent contamination is prevented by using a good mopping policy reduces lead pellet residue below detectable levels.

HEALTH AND ENVIRONMENTAL TECHNOLOGY, LLC

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April 6, 2008

Mr. Robert Mitchell
Chief Executive Officer
US Olympic Complex
1 Olympic Plaza
Colorado Springs, Colorado 80909

During the months of May through August, 2007 Health and Environmental Technology, LLC was requested to conduct environmental sampling within the indoor shooting ranges at the Olympic Training Center, located at One Olympic Plaza, Colorado Springs, Colorado. The assessment was conducted to determine a safe and economic process for the maintenance of the indoor shooting ranges.

All ambient and wipe samples were collected according to the current Environmental Protection Agency and the American Standard for Testing and Methods. All samples were analyzed by Analytical Chemistry, Inc, Tukwila, Washington, a certified and forensic laboratory. The results of the tests indicated that the ambient air samples did not contain lead; the floor samples did contain lead. The study provided the information for the Olympic Training Center to establish a maintenance protocol as to the type of flooring, cleaning of the floor and safety practices that would be the most economical, and provide an environmentally and maintenance safe indoor shooting range.

Sincerely,

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