United States
Environmental Protection
Agency

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Region 2

Best Management Practices for Lead at Outdoor Shooting Ranges

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Copies of this manual along with any additions or updates can also be obtained on-line at:
http://www.epa.gov/region2/waste/leadshot

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Fourth Printing, June 2005

Best Management Practices for Lead at Outdoor Shooting Ranges

Notice

This manual is intended to provide useful general information to shooting range owners/operators. The United States Environmental Protection Agency (EPA) does not certify or approve ranges, range design or lead management practices. While every effort has been made to provide up-to-date technical information, this manual is not to be used as a substitute for consultation with scientists, engineers, attorneys, and other appropriate professionals who should be called upon to make specific recommendations for individual range design and lead management.

Any variation between applicable regulations and the summaries contained in this guidance document are unintentional, and, in the case of such variations, the requirements of the regulations govern.

This guidance was developed by EPA Region 2 in cooperation with a few states as well as many EPA offices. In addition, EPA, with the assistance of the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) provided all 50 states with an opportunity to review the RCRA regulatory portion of the guidance. At the time of printing, about 40 states had contacted the EPA and given their support and concurrence. EPA is continuing to get the agreement of the remaining states. Therefore, it appears that most, if not all, states will share the same view as to how lead shot is regulated.

Following the steps set forth in this guidance should result in compliance with applicable regulations. EPA does not make any guarantee or assume any liability with respect to the use of any information or recommendations contained in this document.

This guidance does not constitute rulemaking by the EPA and may not be relied on to create a substantive or procedural right or benefit enforceable, at law or in equity, by any person.

Acknowledgements

The USEPA would like to acknowledge the support of:

- The National Rifle Association of America
- The National Shooting Sports Foundation
- The Wildlife Management Institute
- Mark Begley of the Massachusetts Department of Environmental Protection
- Mr. Dick Peddicord of Dick Peddicord and Company, Inc.

These participants provided valuable information and assistance as peer reviewers in the development of the manual and their efforts are truly appreciated. EPA also wishes to give special thanks to Dr. Charles W. Sever of Okie Environmental Consulting, L.L.C., Inc., Mr. Mike Warminsky of Brice Environmental Services Corp., and Mr. Victor Ordija of Sporting Goods Properties.The EPA also wishes to acknowledge and thank the many others who provided important comments and insight, and especially those individuals who took the time to meet with us in person or on the phone.

Cover photo by: Mr. Jack Hoyt, EPA Region 2

Statement of Goals

The goals of this manual are:

- to inform shooting ranges :
    - that the United States Environmental Protection Agency's (EPA) purpose in developing and distributing this manual is to assist range owners and operators to operate in an environmentally protective manner.
- to promote an understanding of:
    - why lead is an environmental, public and regulatory concern,
    - what laws and regulations apply,
    - the benefits of applying good management practices,
    - what can be done to successfully manage lead,
    - why implementing lead best management practices is an integral part of environmental stewardship,
    - how to minimize litigation risk.
- to promote action by ranges to:
    - adopt and implement best management practices for managing lead,
    - recycle a finite natural resource,
    - become a model for other ranges through proper lead management,
    - advocate environmental stewardship.

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EPA Statement on National Guidance

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 10 2001

OFFICE OF
SOLID WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

SUBJECT: National Guidance on Best Management Practices for Lead at Outdoor Shooting Ranges

FROM: Elizabeth A. Cotsworth, Director
Office of Solid Waste

TO: RCRA Senior Policy Advisors

The purpose of this memo is to transmit a Region 2 document entitled "Best Management Practices for Lead at Outdoor Shooting Ranges," EPA-902-B-01-001, January 2001. This report is a technical information manual to assist range owners and operators in managing lead at shooting ranges. The report covers the environmental concerns, applicable laws and regulations, and current best management practices. This document was developed collaboratively with a number of stakeholders and is considered by my office to be the national guidance on this subject.

Background

Lead at some shooting ranges can be a significant environmental concern depending on location (e.g., proximity to wetlands) and hydrogeologic setting, as evidenced by a number of cases where lead pellets and shot have been taken in by fish and fowl at ranges over wetlands, and at some ranges where streams in acid lead-leaching environments have picked up lead contamination. Recognizing these problems, Region 2 in collaboration with EPA HQ, States, shooting range associations, and other shooting range experts, developed the enclosed technical guidance to identify the problems and solutions for preventing and controlling these problems. We commend this guidance to you as an information source for your use in working with range owners and operators to identify and address these concerns at specific ranges. Copies of this manual have been sent to all 50 States, with the help of ASTSWMO, and at least 40 States have responded with concurrence and support for this guidance.

Also enclosed for your information is a list of references "Summary of Shooting Range Lead Management Guidance" prepared by various shooting range-interested associations, and a copy of an NPDES permit for the Naperville, IL Sportsman's Park shooting range.

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If you have any questions regarding lead at shooting ranges, please contact George Meyer (Chief, RCRA Compliance Branch, Region 2) at 212-637-4144, Meyer.George@epa.gov, or Ken Shuster in the Office of Solid Waste at 703-308-8759, shuster.kenneth@epa.gov.

It is my hope that wide distribution of these documents will help encourage greater cooperation and coordination on shooting range issues among RCRA, Superfund, and Water staff in the regions and states. To this end, it would be helpful if you would send the name of a point of contact in your region to Ken Shuster and George Meyer.

For additional copies of the Region 2 guidance, please contact George Meyer. It is also available at www.epa.gov/region2/waste/leadshot.

Enclosures

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Best Management Practices for Lead at Outdoor Shooting Ranges

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Introduction

This manual provides owners and operators of outdoor rifle, pistol, trap, skeet and sporting clay ranges with information on lead management at their ranges. This manual serves as a reference guide and presents best management practices (BMPs) available to the shooting range community. The practices have been proven to effectively reduce or eliminate lead contamination and may also be economically beneficial to the range owner/operator. Since each range is unique in both the type of shooting activity and its environmental setting, specific solutions are not provided in this manual. Rather, a range owner or operator may use this manual to identify and select the most appropriate BMP(s) for their facility. Other information on environmental aspects of management at outdoor shooting ranges can be found in the National Shooting Sports Foundation's *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges*.

The manual does not address range layout or design to meet range safety or competition requirements. For information on range safety and competition requirements, range owners/operators are directed to other comprehensive reference materials available on that subject, such as the National Rifle Association's *Range Source Book,* and the National Association of Shooting Range's website (www.rangeinfo.org).

Owners/operators of ranges may want to assign the use of this BMP Manual to a specific team or committee. Delegating this responsibility to a specific team or group helps to assure that the BMP's are identified and implemented.

The manual is organized as follows:

- Chapter I provides the background on why lead is of concern to human health and the environment. It includes a discussion of how environmental laws impact shooting ranges and the importance of an integrated BMP program to manage lead.
- Chapter II discusses physical and operational characteristics to be considered when selecting a successful BMP program.
- Chapter III addresses best management techniques for rifle/pistol ranges, skeet and trap ranges, and sporting clay ranges. In this chapter, the manual explores possible solutions to prevent, reduce and/or remove lead contamination for each type of range.
- The Appendices provide current (as of June 2005) contacts for lead reclamation and recycling companies, vendors that provide prevention and/or remediation techniques and shooting organizations that have additional information on the lead issue. Additionally, the Appendices provide information on alternatives to lead, diagrams of bullet trap designs, summaries of regulatory requirements and interpretations, and a sample Environmental Stewardship Plan.

EPA is very interested in any suggestions you have about practices included in this manual which have proven effective in controlling lead contamination or recycling lead bullets/shot. Please send such information to the address below. Also, for additional information, or to be added to the list of lead reclaimers or remediation contractors, contact the National Rifle Association (NRA), the National Shooting Sports Foundation (NSSF) or:

Lead Shot Coordinator
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Chapter I: Environmental and Regulatory Concerns at the Shooting Range

1.0 Background

Outdoor shooting ranges provide recreational facilities for millions of shooting sports enthusiasts in the United States. Recently, there has been a growing public concern about the potential negative environmental and health effects of range operations. In particular, the public is concerned about potential risks associated with the historical and continued use of lead shot and bullets at outdoor ranges.

This concern is not unfounded. An estimated 9,000 non-military outdoor ranges exist in the United States, collectively shooting millions of pounds of lead annually. Some ranges have operated for as long as several generations. Historical operations at ranges involved leaving expended lead bullets and shot uncollected on ranges. Many of these ranges continue to operate in the same manner as in the past.

It is estimated that approximately four percent (4%) (80,000 tons/year) of all the lead produced in the United States in the late 1990's (about 2 million tons/year), is made into bullets and shot. Taking into account rounds used off-range, and rounds used at indoor ranges, it is clear that much of this 160,000,000 pounds of lead shot/ bullets finds its way into the environment at ranges.

Since the mid-1980's, citizen groups have brought several lawsuits against range owners and have urged federal and state agencies to take action against owners and operators of outdoor shooting ranges. The citizen groups argued that range owners improperly managed discharged lead bullets and shot. Federal courts have supported parts of these suits, requiring range owners/operators to clean up lead-contaminated areas. Concurrent with the increased citizen suit activity, the federal EPA, the Centers for Disease Control and Prevention (CDCP), and a large number of states have identified human exposure to all forms of lead as a major health concern in the United States.

Lead management practices at ranges across the United States remain inconsistent. Some range owners/operators have examined the impact of range operations on human health and the environment and have implemented procedures to manage and/or remove accumulated lead from ranges. Other range owners/operators are just beginning to characterize and investigate their ranges in order to design an environmental risk prevention and/or remediation program(s) specific to their sites. A third group of ranges has adopted a "wait and see" policy – taking no action until specifically required to do so by law or clear guidance is in place. Finally, a fourth, small, but important group of range owners/operators remain unaware of lead's potential to harm human health and the environment, and of existing federal and state laws.

To manage lead, many owners and operators have successfully implemented Best Management Practices (BMPs) at their ranges. These range owners and operators have realized many benefits from sound lead management including:

- stewardship of the environment, natural resources and wildlife,
- improved community relations,
- improved aesthetics of the range/good business practices,
- increased profitability through recovery/ recycling lead, a valuable and finite resource, and
- reduced public scrutiny.

Shooting sports organizations [e.g., National Rifle Association (NRA) and the National Shooting Sports Foundation (NSSF)] promote lead management throughout the United States. These organizations have researched different methods to effectively address potential and actual lead mobility and exposure without detracting from the enjoyment of the sport. The NRA, NSSF, and a number of other shooting sports organizations strongly encourage range

owners/operators to develop a BMP program that contains elements discussed later in this manual. Contact the NRA and NSSF for additional guidance materials available on lead management practices.

By implementing appropriate lead management at outdoor shooting ranges, range owners and operators can reduce the environmental and health risks associated with lead deposition, meet legal requirements and realize quantifiable benefits.

1.1 Lead Contamination's Impact on Human Health and the Environment

Exposure Routes

Historically, the three major sources for human exposure to lead are lead-based paint, lead in dust and soil and lead in drinking water. Typically, human exposure occurs through ingestion, which is the consumption of lead or lead-contaminated materials, or by inhalation. The main human exposure to lead associated with shooting ranges is through lead-contaminated soil. However, other pathways are discussed below, along with lead's detrimental effects on humans and animals.

Lead can be introduced into the environment at shooting ranges in one or more of the following ways. Each of these pathways is site-specific and may or may not occur at each individual range:

- Lead oxidizes when exposed to air and dissolves when exposed to acidic water or soil.
- Lead bullets, bullet particles, or dissolved lead can be moved by storm water runoff.
- Dissolved lead can migrate through soils to groundwater.

<u>Lead oxidizes when exposed to air and dissolves when exposed to acidic water or soil</u>

When lead is exposed to acidic water and/or soil, it breaks down by weathering into lead oxides, carbonates, and other soluble compounds. With each rainfall, these compounds may be dissolved, and the lead may move in solution in the storm runoff waters. Decreases in water acidity (i.e., increases in its pH) will cause dissolved lead to precipitate out of solution. Lead concentrations in solution are reduced by this precipitation. At pHs above 7.5, very little lead remains in solution. Increased time of contact between lead and acidic water generally results in an increase in the amount of dissolved lead in the storm runoff water. The five factors which most influence the dissolving of lead in water are summarized below:

Annual Precipitation Rate - The higher the annual precipitation rate, the faster the lead weathers. Also, during prolonged rains, the contact time between water and lead is increased. In general, the higher the precipitation rate, the higher the potential risk of lead migration off-site in solution.

pH of Rain and Surface Water - The acidity of the rainwater decreases as basic (alkaline) minerals in the soil are dissolved. If sufficient minerals such as calcium, magnesium, and iron are present in local soils, then the lead may quickly precipitate out of solution entirely as these other minerals are dissolved. The pH of shallow surface water is an indicator of the presence or absence of basic minerals in the local soil and in gravel within the stream beds through which the water has moved. The water in deeper streams and lakes is more likely to be composed of acidic rainwater that is not neutralized.

Contact Time - The contact time between acidic surface water and lead is a factor in the amount of lead that is dissolved. For example, lead shot deposited directly into a lake has a longer contact time then lead shot deposited in upland areas.

Soil Cover - Organic material will absorb lead and remove it from a water solution. The thicker the organic leaf and peat cover on the soil, the lower the lead content in solution in water leaving the shot area. Organic material has a strong

ability to extract lead out of solution in water.

pH of Groundwater - During periods of no rainfall, the water flowing within most streams comes from groundwater discharging into the stream channel. Therefore, the acidity of the groundwater affects the acidity of the surface water, and hence, affects the solubility of any lead particles carried into the stream during storm runoff.

Lead bullets, bullet particles or dissolved lead can be moved by storm water runoff

The ability of water to transport lead is influenced by two factors: velocity of the water and weight or size of the lead fragment. Water's capacity to carry small particles is proportional to the square of the water's velocity. Clear water moving at a velocity of 100 feet per minute can carry a lead particle 10,000 times heavier than water moving at a velocity of 10 feet per minute. Muddy water can carry even larger particles. The five factors that most influence velocity of runoff are described below:

Rainfall Intensity - The greater the volume of rainfall during a short period of time, the faster the velocity created to carry the rainfall off-site. The higher the annual rainfall, the greater the number of periods of heavy rainfall.

Topographic Slope - Generally, the steeper the topographic slope, the faster the velocity of stormwater runoff.

Soil Type - More rainfall will soak into sandy soils then into clay soils. Hence, for a given rainfall intensity, the volume of runoff will be greater from areas underlain by clays or other low permeable soils than from permeable sandy soil.

Velocity - Velocity tends to decrease as stream width increases. Merging streams, eddy currents, and curves in streams are other factors that may reduce the velocity. Generally, the shorter the distance from the lead deposit to the property line, the more likely it is that the lead fragments in suspension will be transported off-site.

Vegetative Cover and Man-made Structures - Structures such as dams and dikes reduce the water's velocity and greatly reduce the size and weight of the lead particles the water can carry. Since lead particles are heavy compared to the other suspended particles of similar size, they are more likely to be deposited under the influence of anything that reduces velocity of the storm runoff. Grass and other vegetation reduce runoff velocity and act as a filter to remove suspended solids from the water.

Dissolved lead can migrate through soils to groundwater

Acidic rainwater may dissolve weathered lead compounds. A portion of the lead may be transported in solution in groundwater beneath land surfaces. Groundwater may transport lead in solution from the higher topographic areas to the lower areas such as valleys, where it is discharged and becomes part of the surface water flow. If the water flowing underground passes through rocks containing calcium, magnesium, iron, or other minerals more soluble then lead, or through minerals that raise the pH of the water, then the lead in solution may be replaced (removed) from the solution by these other metals. However, if the soil is a clean silica sand and gravel, fractured granite, or similar type material, then the lead may move long distances in solution. The factors most likely to affect the amount of lead carried by the groundwater in solution are discussed below:

Annual Precipitation - Generally, high precipitation rates result in heavy dew, more frequent rainfall, numerous streams, shallow depth to groundwater, shorter distance of travel, and more rapid rates of groundwater flow. Also, the greater volumes of rainfall over geologic time probably have reduced the amount of calcium and other soluble basic minerals that could raise the water pH and cause lead to precipitate (settle) out of solution from the groundwater.

Soil Types - Clays have a high ionic lead bonding capacity and more surface area to which the lead can bond. Also, groundwater movement in clay is very slow, which increases the contact time for lead to bond to the clay.

Low permeability reduces the amount of historical leaching and increases the probability of the presence of basic (pH-increasing) minerals that can precipitate out of solution in groundwater or cause the lead to bond to the clay. All of the basic calcium and related minerals generally will have been removed from the clean silica sand and gravel soils, so the lead in solution in groundwater in these type soils can move long distances (miles) through the ground relatively unchanged.

Soil Chemistry - The more basic minerals like calcium and magnesium that are present in soils along the pathways through which the groundwater moves, the greater the lead precipitation (removal) rate. Lead should move in solution only a short distance (a few feet) through a sand composed of calcium shell fragments, but could move in solution long distances (miles) through clean quartz sand.

Depth to Groundwater - In areas of groundwater discharge such as river flood plains and most flat areas, the groundwater surface is often a few feet below the surface. Remember, the shorter the distance traveled, the greater the risk that the lead will migrate into the environment. Shallow depth to groundwater is indicative of higher risk for lead to reach the water.

pH of Groundwater - Although other factors influence solubility of lead in water, a good rule of thumb is that lead will precipitate out of solution when the pH or alkalinity of water is greater then about 7.5. But, lead dissolved in acid groundwater may travel many miles without change.

Health Effects of Lead Exposure on Ranges

Lead poisoning is a serious health risk. At higher concentrations, it is dangerous to people of all ages, leading to convulsions, coma and even death. At even very low concentrations, it is dangerous to infants and young children, damaging the developing brain and resulting in both learning and behavioral problems. Figure 1-1 describes the effects of exposure to lead on children and adults.

Federal, state and local actions, including bans on lead in gasoline, paint, solder and many other lead-containing products, have resulted in significant reductions in average blood-lead levels. Despite these advances, the number of lead-poisoned children remains alarmingly high. Children living in older homes may be exposed to lead in peeling paint or paint dust. Children can also come in contact with lead in soil and with lead dust carried home on the clothing of parents.

On ranges, inhalation is one pathway for lead exposure since shooters are exposed to lead dust during the firing of their guns. Because wind is unlikely to move heavy lead particles very far, airborne dust is generally considered a potential threat only when there are significant structures that block air flow on the firing line. Under such conditions, the hygiene and other practices proposed by the NRA for indoor shooting ranges in their “Source Book” are applicable to outdoor ranges.

Range workers may also be exposed to lead dust while performing routine maintenance operations, such as raking or cleaning out bullet traps. Owners/operators may want to protect these workers by requiring them to wear the proper protective equipment or dampening the soil prior to work.

Another exposure route for lead at outdoor ranges is ingestion by direct contact with lead or lead particles. For example, lead particles generated by the discharge of a firearm can collect on the hands of a shooter. These particles can be ingested if a shooter eats or smokes prior to washing his/her hands after shooting. **The relative risk of lead exposure to people in a well managed facility is low.**

Detrimental effects due to elevated lead levels can also be found in animals. Excessive exposure to lead, primarily from ingestion, can cause increased mortality rates in cattle, sheep and waterfowl. For example, waterfowl and other birds can ingest the shot, mistaking it for food or grit. Waterfowl, in particular, are highly susceptible to lead ingestion. This is a concern at ranges where shooting occurs into or over

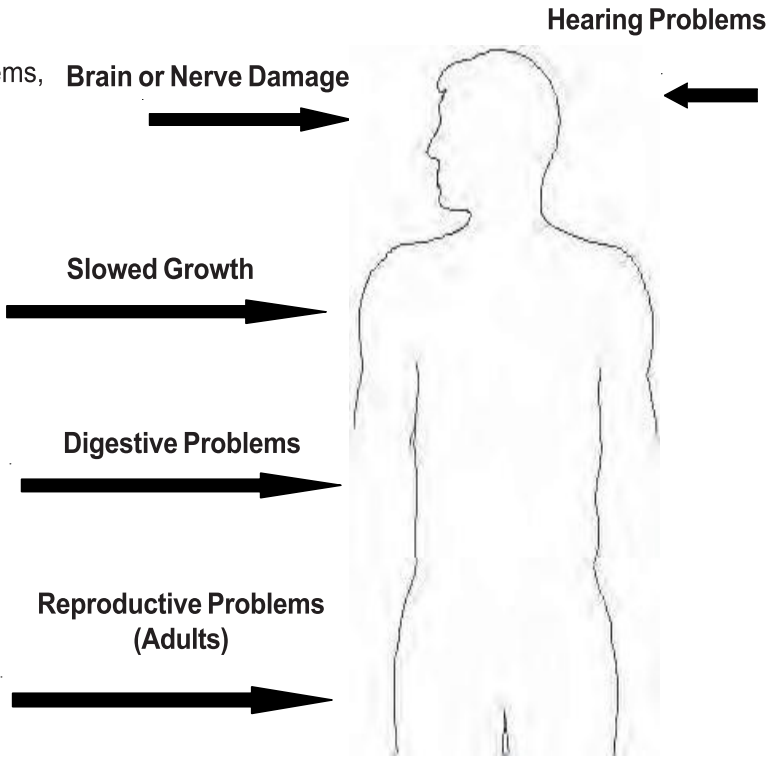
Effects on the Human Body from Excessive Exposure to Lead

If not detected early, **children** with relatively low levels of lead (as low as 10 microgram/deciliter for children) in their bodies can suffer from:

- damage to the brain and nervous system,
- behavior and learning problems (such as hyperactivity and aggressiveness),
- slowed growth,
- hearing problems,
- headaches, and
- impairment of vision and motor skills.

Adults can suffer from:

- difficulties during pregnancy,
- reproductive problems in both men and women (such as low birth weight, birth defects and decreased fertility),
- high blood pressure,
- digestive problems,
- neurological disorders,
- memory and concentration problems,
- muscle and joint pain, and
- kidney dysfunction.



Lead affects the body in many ways

Figure 1-1: Effects on the Human Body from Excessive Exposure to Lead

water. Many of the legal and government actions that have been brought against ranges are based on elevated levels of lead and increased mortality in waterfowl. For example, in one case, an upland area of a range became a temporary pond after a thunderstorm. Waterfowl used the pond to feed and shortly thereafter, there was a waterfowl die-off (increase in bird mortality), apparently from lead ingestion.

1.2 Legal Requirements & Court Rulings

To date, most litigation concerns have been at shotgun ranges where the shotfall zone impacts water or wetland areas. The potential environmental and human health risks are greater at these ranges. However, all ranges, including those not located near water bodies, may be subject to legal and government action if proper range management programs are not implemented. Range owners/operators should expect greater scrutiny as ranges become more visible to regulators, environmental groups and the general public.

Citizen groups have been the driving force behind most legal actions taken against outdoor ranges. These groups have sued range owners/operators under federal environmental laws. Two of EPA's most comprehensive environmental laws, the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA), specifically provide citizens with the right to sue in cases in which the environment and human health are threatened. These citizen suits have been highly effective in changing the way ranges operate, even when out-of-court settlements have been reached. The decisions of the United States Court of Appeals for the Second Circuit in *Remington Arms* and *New York Athletic Club* set a legal precedent in the application of RCRA and/or the CWA to outdoor ranges. Lead management programs at outdoor ranges must comply with both laws. Actions have also been taken under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) commonly know as Superfund. State and local statutes and regulations may also apply. To ensure environmental laws are being followed, range owners/operators must understand the legal issues and requirements.

1.2.1 Resource Conservation and Recovery Act (RCRA)

RCRA provides the framework for the nation's solid and hazardous waste management program. Under RCRA, EPA developed a "cradle-to-grave" system to ensure the protection of human health and the environment when generating, transporting, storing, treating and disposing of hazardous waste. RCRA potentially applies to many phases of range operation because lead bullets/shot, if abandoned, may be a solid and/or a hazardous waste and may present an actual or potential imminent and substantial endangerment.

Connecticut Coastal Fishermen's Association v. Remington Arms Company, et al.

In the late 1980s, the Connecticut Coastal Fishermen's Association filed a lawsuit against Remington Arms Company as the owner of the Lordship Gun Club. The Lordship Gun Club (a.k.a. Remington Gun Club) is a 30-acre site in Stratford, Connecticut, located on the Long Island Sound at the mouth of the Housatonic River. In the mid-1960s, the Lordship Gun Club was reconstructed to its final configuration of 12 combined trap and skeet fields and one additional trap field. Over the years, the Lordship Gun Club became known as one of the premier shooting facilities on the East Coast.

The Connecticut Coastal Fishermen's Association filed a lawsuit, alleging that lead shot and clay targets are hazardous waste under RCRA. The Complaint alleged that because the lead shot and clay targets were hazardous wastes, the gun club was a hazardous waste storage and disposal facility subject to RCRA requirements. The plaintiff also sought civil penalties and attorney's fees.

Remington moved for a summary judgment dismissing the complaint, and the Connecticut Coastal Fisherman's Association cross-moved for a partial summary judgment on the issue of liability. On September 11, 1991, the United

States District Court for the District of Connecticut ruled on the case.

Regarding the plaintiff's claims under RCRA, the District Court ruled in favor of the Connecticut Coastal Fishermen's Association, holding that the lead shot and clay targets were "discarded materials" and were "solid waste;" therefore, the materials were subject to regulation under RCRA. The court further stated that the discharged lead shot was a "hazardous waste," but declined to rule on whether the clay target fragments were also hazardous waste. Remington petitioned the United States Court of Appeals for the Second Circuit Court to review the lower court's ruling.

On June 11, 1992, both parties presented oral arguments before the court. Subsequent to oral arguments, the appellate court requested that EPA file an amicus brief "addressing whether lead shot and clay target debris deposited on land and in the water in the normal course of trap and skeet shooting is 'discarded material'... so as to constitute 'solid waste' under RCRA."

On March 29, 1993, the United States Court of Appeals for the Second Circuit reached its decision. With respect to RCRA, the court both reversed and affirmed the lower court's opinion in part.

Briefly, the decision affects currently operating and future gun clubs, and the following key points are of primary concern:

1. With respect to RCRA, the court agreed with EPA's amicus brief, which had argued that shooting at gun clubs is not subject to regulatory (as opposed to statutory) requirements. In other words, during routine operations, gun clubs are not viewed as facilities that manage hazardous wastes subject to RCRA regulations and, as such, do not require RCRA permits.

2. Another argument in the EPA's amicus brief with which the court agreed was the view that the RCRA statute allows citizen suits to be brought if a gun club's shooting activities pose an "imminent and substantial endangerment to health or the environment." Although gun clubs are not subject to RCRA regulations, EPA or any state, municipality, or citizen group can take legal action under the statutory provisions of RCRA against gun clubs for actual or potential environmental damage occurring during, or even after, the operation of the club. Under RCRA, the plaintiff would be eligible to recover its legal fees as well.

3. The court concluded that lead shot and clay targets meet the statutory definition of solid waste because these materials were "discarded (i.e. abandoned)" and "left to accumulate long after they have served their intended purpose." Further, the court concluded that based upon toxicity testing and evidence of lead contamination, the lead shot was a hazardous waste subject to RCRA.

The important point to consider here is that if lead shot and clay target debris are discarded (i.e. abandoned), these materials are considered a solid waste as defined in the statute and the facility may be subject to governmental or citizen suits.

If, on the other hand, the discharged lead shot is recovered or reclaimed on a regular basis, no statutory solid waste (or hazardous waste) would be present and imminent hazard suits would be avoided.

Thus, the Remington Arms case is an important legal precedent. Even though regulations have not been issued regarding gun club operations and environmental protection, gun clubs are still at risk of legal action under RCRA if they fail to routinely recover and reclaim lead, do not take steps to minimize lead release or migration, or if they abandon lead in berms.

Gun clubs where there is shooting into water, wetlands, rivers, creeks, and other sensitive environments have the highest degree of litigation risk. Conversely, gun clubs that have the lowest risk of environmental litigation or government action are those clubs that do not shoot into water or wetlands and which have an active program to recover lead.

The following describes how RCRA may apply to outdoor shooting ranges.

How is Lead Shot Regulated Under RCRA?

Lead shot is not considered a hazardous waste subject to RCRA at the time it is discharged from a firearm because it is used for its intended purpose. As such, shooting lead shot (or bullets) is not regulated nor is a RCRA permit required to operate a shooting range. However, spent lead shot (or bullets), left in the environment, is subject to the broader definition of solid waste written by Congress and used in sections 7002 and 7003 of the RCRA statute.

With reference to reclaiming and recycling lead shot, the following points should serve as guidance in understanding RCRA and how it applies to your range. (A more detailed discussion of the underlying RCRA rules applicable to lead shot removal at ranges is included in Appendix D)

- **Removal contractors or reclaimers should apply standard best management practices, mentioned in this manual, to separate the lead from soil. The soil, if then placed back on the range, is exempt from RCRA. However, if the soil is to be removed off-site, then it would require testing to determine if it is a RCRA hazardous waste.**

- **Lead, if recycled or reused, is considered a scrap metal and is, therefore, excluded from RCRA.**

- Collected lead shot and bullets are excluded from RCRA regulation, and need not have a manifest, nor does a range need to obtain a RCRA generator number (i.e., the range is not a hazardous waste "generator"), provided that the lead is recycled or re-used. The reclaimer does not need to be a RCRA transporter. **However, it is recommended that ranges retain records of shipments of lead to the receiving facilities in order to demonstrate that the lead was recycled. Records should also be kept whenever the lead is reused (as in reloading.) The range should be aware that it ultimately may be responsible for the lead sent for reclamation. Therefore, only reputable reclaimers should be utilized.**

- Lead from ranges destined for recycling may be temporarily stored on range property after separation from soil if the lead is stored in closed, sealed containers, the containers are stored in a secure location and routinely inspected by range staff, and records of inspections are maintained.

- Sections 7002 and 7003 of the RCRA statute allow EPA, states or citizens to use civil lawsuits, to compel cleanup of or other action for "solid waste" (e.g., spent lead shot) posing actual or potential imminent and substantial endangerment. Such actions can be sought whether the range is in operation or closed, and is based solely on a determination that harm is being posed or may be posed by the range to public health and/or the environment. Since the risk of lead migrating increases with time, making ranges that have not removed lead more likely candidates for government action or citizen lawsuits under RCRA Section 7002 and 7003, ranges are advised to maintain a schedule of regular lead removal.

- With time, lead in soil can become less desirable to reclaimers and smelters, thereby potentially reducing or eliminating financial returns from lead removal. Moreover, such soil may be subject to more expensive treatment to separate the lead for recycling.

- Lead removal will allow the range to: avoid contamination of the site and potential impacts to human health and the environment; reduce liability with regard to potential government agency or citizen suit action; and, possibly, benefit economically from the recycling of lead. Additional guidance on reclaiming lead is provided in other parts of this manual.

- Soil from berms and shotfall zones may be moved to another area of the range for such reasons as addressing potential environmental impacts (e.g., runoff), altering the layout to address safety concerns or allowing different types of shooting activities, or adding or removing shooting positions. However, removal of lead prior to such

movement of soil is normal practice and highly advised because it extends the usable life of the materials and reduces the possibility of release of lead into the environment. If lead is not first removed, it will be further dispersed and will be more difficult to remove in future reclamation. Written records of all such activity should be maintained indefinitely, as they will be necessary in subsequent construction or range closure.

- This RCRA summary applies to operating and non-operating ranges, and the use of BMPs at operating ranges is highly recommended. However, because of increased risk if lead is not actively managed, such application may not preclude the need for remediation, as appropriate and/or as required by states' regulations, when a range is permanently closed, on-site lead is abandoned, or the land use changes. Introductory guidance for remediation can be found at www.epa.gov/epaoswer/osw or www.epa.gov/superfund. Look under the sections "Cleanup" or "Resources," or use the Search function.

1.2.2 - Clean Water Act

The goal of the Clean Water Act (CWA) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The most common allegation against ranges by the EPA and citizen groups, is that they violate the CWA if they do not have permits that allow spent ammunition to be discharged into water. The CWA prohibits "the discharge of any pollutant by any person" into the waters of the United States without a National Pollution Discharge and Elimination System (NPDES) permit. There have been two court cases that have applied the provisions of the CWA to civilian shooting ranges. To understand how the CWA can apply to shooting ranges, a summary of the cases follows. Also see Table 1-1.

To understand the application of the CWA to outdoor ranges, one must know the definitions of key terms and how they have been applied to shooting activities. See Table 1-1.

In the *Remington Arms* and the *New York Athletic Club* lawsuits, citizen groups argued that the defendants violated the CWA by discharging pollutants from point sources into the Long Island Sound without a NPDES permit. Application of the CWA requires the violations to be ongoing. Consequently, the court in *Remington Arms* dismissed the CWA charge against the range because it had ceased operating before the lawsuit was filed.

However, in the *New York Athletic Club* case, the club was still in operation during the time of litigation, but had switched to steel shot. EPA's opinion on this case also addressed the CWA violation. EPA argued that certain trap/skeet ranges can convey pollutants, via point sources, to water in violation of the CWA if a NPDES permit is not obtained. Although some shooting organizations have disagreed with the EPA position, the United States District Court for the Southern District of New York specifically found that:

- The mechanized target throwers, the concrete shooting platforms, and the shooting range itself are considered point sources as defined by the CWA;

- Expended shot and target debris, including non-toxic shot, such as steel shot, left in water, are pollutants as defined by the CWA.

Although the New York district court's decision in the *New York Athletic Club* case is not controlling in any other district, range owners and operators of outdoor ranges that shoot over or into wetlands or other navigable waters of the United States should be aware of it.
Based on the court's decision in the *New York Athletic Club* case, any range whose shot, bullets or target debris enter the "waters of the United States" could be subject to permitting requirements as well as governmental or citizen suits. "Waters of the United States" or "navigable waters of the United States" are waters of the United States, including territorial seas that include any body of water that has any connection to, or impact on, interstate waters or commerce. The waters may include lakes,

Table 1-1: Application of Key Terms to Outdoor Ranges

Key Term	Statutory Definition	Application to *New York Athletic Club*
Discharge of a Pollutant	"any *addition* of any pollutant to navigable waters from any point source" (emphasis added) 33 U.S.C. § 1362 (12)	Shooting into water (including wetlands) constitutes a discharge. In the *New York Athletic Club*, the range did not dispute that its shooting operations resulted in the deposition of spent shot and other debris into the waters of the United States.
Point Source	"any discernible, confined, and discrete conveyance... from which pollutants are or may be discharged" into the Nation's waters. 33 U.S.C. § 1362 (14)	In *New York Athletic Club*, the court found that shooting ranges act to systematically channel pollutants into regulated waters and that mechanized target throwers convey pollutants directly into water. Specifically, it stated, "A trap shooting range... is an identifiable source from which spent shot and target fragments are conveyed into navigable waters of the United States." The court also determined that the concrete shooting platforms can be seen as separate "point sources" under the CWA or as one facet of the shooting range that systematically delivers pollutants (e.g. shot and wadding) into the water.
Pollutant	"dredged spoil, solid waste,... munitions... discharged into water" 33 U.S.C. § 1362 (6)	In *New York Athletic Club*, shot and target residue constitute a form of "solid waste" subject to regulation under the CWA as a "pollutant." Based on these determinations, the court supported EPA's contention that the ranges were discharging pollutants from a point source without a permit, in violation of the CWA.

ponds, rivers, streams, wetlands, or even guts that are frequently dry, which may not be obvious to range owners/operators. These ranges may be required to remediate contaminated sediments and soils, which could be both difficult and expensive, and to cease operations over waters and wetlands. **It is essential that these ranges change the direction of shooting, to avoid shooting over or into wetlands or other navigable waters of the United States, and initiate lead removal and recycling activities, where feasible.**

In addition, these ranges can cause a substantial impact on wildlife and wetlands, which range owners/operators may be required to restore under other federal laws (e.g., CERCLA, discussed below). Lead shot entering a water body substantially increases the potential risk of contaminating surface and groundwater which, in turn, threatens human health and the environment. Finally, as *New York Athletic Club*, *Remington Arms* and similar cases show, neighbors have the most leverage when range activity affects wetlands and waterways.

For ranges located away from coastal areas or whose operating areas are situated wholly over land, compliance with the CWA can be achieved by obtaining a NPDES permit for piped or channeled runoff from the range into water[1].

Shooting ranges impacting wetland areas may be subject to other regulations found in Section 404 of the CWA. This section is the principal federal regulatory program protecting the Nation's remaining wetland resources. Any plan by range owners/operators to dredge and/or fill wetlands may require a permit and will come under close scrutiny by federal, state and local governments and citizen groups. Owners and operators must comply with the CWA for range design, redesign, construction, reclamation or remediation occurring in wetland areas.

[1] The term "land" in this instance refers specifically to terrain recognized as "non-wetland" areas.

1.2.3 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), imposes liability on past and present owners or operators of properties where a release of a hazardous substance into the environment exists. CERCLA is used to ensure that an owner/operator cleans a contaminated site or to seek reimbursement from past owners/operators or disposers (potentially responsible parties or PRPs) when a party, either the government or private party, has cleaned up the contamination. Under CERCLA, lead is considered a hazardous substance.

EPA has the authority to order a PRP to clean up a site or conduct the cleanup and recover its costs from the PRP under CERCLA. Responsible parties may be held liable for all cleanup costs, which can be substantial. Under CERCLA, shooting ranges may be liable for government costs incurred during the cleanup of ranges, natural resources damages, and health assessments and/or health effects studies. The following two examples illustrate how shooting ranges (including one operated by the federal government) can be affected by CERCLA.

Southern Lakes Trap and Skeet Club Site, Lake Geneva, Wisconsin, et al.

In 1992, the US Fish and Wildlife Service (USFWS) began an investigation to determine the cause of death of over 200 Canada geese. The geese died as a result of acute lead poisoning after ingesting lead shot, which research indicated came from the Southern Lakes Trap and Skeet Club. The USFWS, in its role as Natural Resource Trustee, took action to recover the cost of damage to the natural resources (i.e., migratory geese) under CERCLA. In addition, EPA pursued a separate action under the Agency's CERCLA response authority. The club had leased the property from the property owners to operate a shooting range. Shortly after EPA sent out the notice of potential liability to the current and former owners and

operators of the club site, the club closed permanently.

In 1994, EPA issued an Administrative Order on Consent (AOC) against one current and one former owner of the property where the now closed Southern Lakes Trap and Skeet Club was located. The AOC required the owners to perform a site assessment, which included an evaluation of the costs to restore the wetlands. In 1998, EPA completed activities to clean up the site and restore some of the natural resources and wetlands. In a negotiated settlement, EPA recovered $1 million of the cost of the cleanup.

Walter L. Kamb v. United States Coast Guard, et al.

In another CERCLA action, Mr. Kamb (court appointed property guardian) sued the U.S. Coast Guard, California Highway Patrol, City of Fort Bragg, and the County of Mendocino (the defendants) for recovery of cleanup costs under CERCLA. Mr. Kamb had been appointed by the Mendocino County Superior Court to sell the property on behalf of the property owners. The property was formerly used by defendants as a rifle, pistol and trap range. Soil analysis indicated the presence of lead in the form of leadshot, bullets, pellets, and dust. The court found the defendants were “responsible parties” (liable for cleanup costs) under CERCLA. No apportionment of liability was made and the final determination of each parties’ pro rata share of the response cost was deferred.

This case shows that range activity need not affect a water body to trigger CERCLA liability. CERCLA is a powerful statutory authority that can greatly impact current and former range owners/operators. The statute allows for recovery of damages to natural resources, the cost of any health assessment studies and all cleanup costs. Liability may extend to past owners and operators long after a range ceases operation.

1.2.4 Additional Laws and Regulations

Shooting ranges may also be subject to state and local laws and regulations. Many states have adopted their own environmental laws, which are based on federal laws. Specifically, these states have laws and regulations that mirror the CWA and RCRA program laws. EPA-approved state program laws must be as stringent as the federal laws and may be more stringent. Activities at shooting ranges may also be subject to local laws, ordinances and regulations addressing issues such as noise, zoning, traffic, wetlands and nuisance. Often, citizens or neighbors of outdoor shooting ranges can initiate noise nuisance claims against range owners/operators. Because many states have passed legislation protecting ranges from noise nuisance lawsuits, these may turn into claims of environmental violations under the laws discussed above due to the presence of lead and other products at ranges.

1.3 Benefits of Minimizing Lead’s Environmental Impact

All ranges will benefit from proactively implementing successful BMPs. Even if range activities currently do not cause adverse public health and environmental impacts, by developing and promoting active lead management programs, ranges will benefit in the following ways:

- **Through a sound lead management program, shooting sports enthusiasts can reduce the potential of lead exposure and contamination to humans, animals and the environment.**

- **A lead management program will result in improved public relations for the range and the shooting sports**. Ranges can promote and publicize their successful BMP programs to improve their public image. Since many of the legal and governmental actions begin with or are due to citizen groups, an active lead management program may improve the public image of the range with these citizen groups.

- **The removal of spent lead from the range presents a clean, well maintained facility, which will increase customer satisfaction.**

- **Lead is a recyclable and finite resource and can be recovered from the active portion of ranges and sold to lead reclaimers.** Frequently, reclaimers do not charge range owners/operators to recover lead from ranges, and owners and operators may receive a percentage of the profit from the sale of reclaimed lead. This factor drives recycling efforts at many ranges.

- **By reducing or eliminating a potential source of lead migration in soil, surface water and groundwater, range owners/ operators may avoid costly and lengthy future remediation activities**.

- **Finally, implementing a BMP program for lead may eliminate or greatly reduce the risk of citizen lawsuits and the legal costs associated with these lawsuits**. Through management and removal practices, lead may no longer represent a threat upon which citizen lawsuits are based.

Range owners/operators may question whether the benefits of a regular and timely BMP program outweigh the efforts of implementing and maintaining a program. The questions may arise especially for ranges at which shooting activities involve waterways, since national attention has focused on ranges located adjacent to water (e.g., *Remington Arms* and the *New York Athletic Club*). However, all outdoor ranges may be subject to legal actions under RCRA and CERCLA authority. All of the benefits for adopting best management practices are available and worthwhile for every range owner and operator.

The following sections provide information that will assist the range owner or operator in implementing a BMP program for recovery and recycling of lead shots and bullets.

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Chapter II: Range Characteristics & Activities to Consider When Implementing Best Management Practices (BMP)

2.0 Background

Since each firing range site is unique, BMPs for lead must be selected to meet site-specific conditions in order to achieve maximum success. A range's physical characteristics and the operational aspects (e.g., volume of shooting, shooting patterns and operating schedules) will effect which BMPs may apply and how they will be implemented. Accordingly, whether designing a new outdoor range or operating an existing range, it is important that BMPs incorporate techniques appropriate for the range's individual characteristics.

Section 2.1 of this chapter identifies the physical characteristics that must be considered when evaluating your range. A summary of common physical characteristics at ranges is also presented in Table 2-1. These factors include:

- Range Size (primarily for shotgun ranges)
- Soil Characteristics
- Topography/Runoff Direction
- Annual Precipitation
- Ground and Surface Water
- Vegetation
- Accessibility

Section 2.2 discusses the operational aspects that must be considered. These factors include:

- Lead Volume
- Size of Shot/Bullets
- Operating Schedule
- Shooting Direction and Pattern
- Range Life Expectancy

In addition, Section 2.3 discusses issues that are specific to implementing BMPs when planning a new range.

2.1 Physical Characteristics

Physical characteristics of ranges, relative to lead management issues, are discussed below.

Range Size

Shotgun range design and type affects the ease of lead shot collection. Larger ranges typically tend to have lead shot that is dispersed over a wider area, while smaller ranges tend to concentrate lead shot in a smaller area. Reducing the area of the shotfall zone will concentrate the shot within a smaller area, allowing for easier cleanup and reclamation. BMP techniques for reducing the shotfall zone at trap and skeet ranges, as well as sporting clay ranges, are discussed in Chapter III.

Soil Characteristics

Spent lead bullets and shot are most often deposited directly on and into soil during shooting. When lead is exposed to air and water, it may oxidize and form one of several compounds. The specific compounds created, and their rate of migration, are greatly influenced by soil characteristics, such as pH and soil types. **Knowing the soil characteristics of an existing range site is a key component to developing an effective lead management plan**.

Soil pH

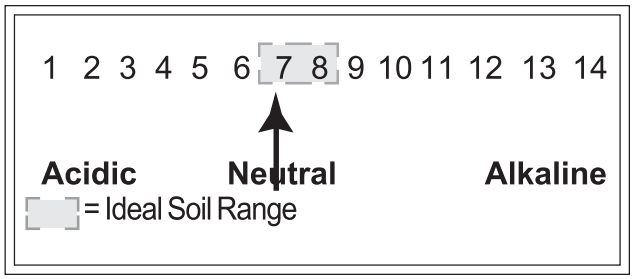

Figure 2-1 – pH scale

Soil acidity is measured as pH on a scale (illustrated as Figure 2-1) between 1 (most acidic) and 14 (most alkaline, or basic), where 7 is termed neutral. Ideal soil pH for shooting ranges is 6.5 to 8.5.[1]

1 National Shooting Sports Foundation, "Environmental Aspects of Construction and Management of Outdoor Shooting Ranges," June 1997.

Lead reacts more readily and may become more mobile under acidic (pH < 6) or higher alkaline (pH>8) conditions. This means that spent lead shot left in or on such soils may eventually break down and contaminate underlying soil. In moderately alkaline soils (pH 7 - 8.5), the lead precipitates out of solution and binds to the soil. This "binding" effect prevents the lead from migrating to the subsurface. In general, soils in the eastern part of the United States tend to be acidic, whereas western soils tend to be more alkaline.

Soil Physical Characteristics

The migration rate of specific lead compounds is affected by the physical characteristics of soil. For example, dense soils, consisting of heavy clays, will prevent the lead compound from moving quickly through the subsurface. Any "free" lead ions become attached to clay particles, with this bond helping to prevent migration. However, with denser soils, the amount of surface runoff increases.

Although clay soils inhibit migration, lead reclamation by contemporary removal machinery tends to be more difficult in clayey conditions. Clayey soils tend to clog the screens and "bind" with shot and bullets. This situation may require additional traditional screening, or perhaps screening using water to enhance separation.

In contrast, sandy soils or gravel may not impede migration because the open pores of these soils allow lead compounds to percolate quickly. Fortunately, lead reclamation activities are more easily conducted in sandy soils. With this in mind, ranges located in sandy soils should remove lead more frequently.

Annual Precipitation

One of the most important factors that influences lead degradation (i.e., chemical reactions) and migration is precipitation. Water, most often in the form of rain, provides the means by which lead is transported. In general, ranges located in areas with high annual/seasonal rainfall[2] have a higher risk of lead migration than those located in arid regions. This is especially true of outdoor ranges using "Steel Bullet Traps."

Steel bullet traps build up a layer of lead residue; these particles are extremely small and more easily transported by rain/water. Also, the smaller the particle, the quicker it will degrade. A bullet trap needs to have a means to collect contact water, or be covered to prevent water from reaching it, and to minimize releases and degradation.

Topography/Runoff Directions

The topography of your range impacts both the ease of lead reclamation and the mobility of the lead. For example, lead reclamation is more successful at ranges where the shotfall zone is relatively flat, since many lead reclamation companies use heavy machinery that cannot operate on slopes or steep hills.

Another important characteristic is the direction in which your range topography slopes. During and after periods of rain, stormwater runoff may wash lead particles or lead compounds off the range. If there are surface water bodies such as lakes, rivers, or wetlands downgradient, the potential for lead to adversely affect the surrounding environment is even greater. Therefore, it is important to identify and control the direction of surface water runoff at your range. BMPs for modifying and controlling runoff are described in detail in Chapter III.

Groundwater

Groundwater depth should be considered when developing a lead management plan since the closer the groundwater is to the surface, the greater the potential for dissolved lead to reach it.

Vegetation

Vegetative ground covers can impact the mobility of lead and lead compounds. Vegetation absorbs rainwater, thereby reducing

2 Heavy annual rainfall is anything in excess of the average annual rainfall, which for the northeast United States (e.g. New York, New Jersey) is between 40 and 45 inches.

Table 2-1 – Common Physical Characteristics at Ranges – Potential Risks and Benefits Associated with Range Operations

Physical Characteristics	Potential Risk to Environment	Potential Benefits in Preventing/Managing Contamination
Clay, acidic soils	Acidic soils contribute to lead dissolution -- increasing the potential for lead contamination -- may increase run-off Difficult to reclaim lead via sifting/raking	May impede percolation of water through contaminated soil Binds "free" lead ions May benefit growth of vegetative covers
Sandy, alkaline soils	Contaminated rainwater can easily percolate through soil and groundwater Extremely alkaline soil will not support vegetation	Alkaline soils may inhibit lead dissolution Easier to reclaim lead via sifting/raking
Sandy, acidic soils	Acidic soils contribute to lead dissolution -- increasing the potential for lead contamination Contaminated rainwater percolates quickly through sandy soils	Easier to reclaim lead via sifting/raking
Steep Rolling Terrain	May promote off-site drainage or drainage to on-site surface water bodies Can impede reclamation of expended shot via raking	None
Flat Terrain	Rainwater may "pond" in areas, promoting lead dissolution and contamination	Expended shot easily recovered Off-site drainage minimized
Wooded areas	May impede lead reclamation activities making equipment difficult to maneuver May provide habitat for wildlife - increasing exposure to lead	None
On-site or contiguous surface water bodies	VERY high potential for contamination when shot fall zone is located over or adjacent to water; increased wildlife exposure; increased lead dissolution. This is NOT an option for successful range location and may be more likely subject to litigation and/or governmental action if lead is deposited into water bodies	None
Vegetation	Lead may be absorbed into grasses, other wildlife food sources	Ground covers slow down surface water run-on and run-off Some vegetation can extract lead ions from the soils

the time that the lead is in contact with water. Vegetation also slows down surface water runoff, preventing the lead from migrating off-site. However, excessively wooded areas (such as those often used for sporting clay ranges) inhibit lead reclamation by making the soils inaccessible to some large, lead-removal machinery. Understanding the type, concentration and variety of vegetation on your range is necessary for developing your lead management program and implementing BMPs at your range.

Accessibility

Accessibility to shotfall zones and backstops is extremely important for lead reclamation activities. A range that is not accessible to reclamation equipment will have difficulty implementing lead reclamation practices.

2.2 Operational Aspects

Operating practices can have a great affect on the volume and dispersion of lead at your range.

Lead Volume

Keeping records of the number of rounds fired over time at your range is important. The number of rounds fired provides a realistic estimate of the quantity of lead available for reclamation. This information helps to determine when reclamation is necessary in order to prevent accumulation of excess amounts of lead, thereby decreasing the potential for the lead to migrate off-site.

Size of Shot/Bullets

Knowledge of the size shot/bullets used on your range may be helpful. Lead reclamation companies generally use physical screening techniques to separate lead shot and bullets from soil. These screens come in a variety of sizes. Knowing what size shot/bullets have been used at your range will allow the reclaimer to maximize the yield of lead shot/bullets at your range.

Shooting Direction and Patterns

Shooting directions and patterns are important to consider when determining the effectiveness of bullet containment devices. For example, many bullet traps are effective in containing bullets fired from specific directions. It is vital that you utilize bullet containment devices that match your range's specific shooting patterns and manufacturers specifications. Understanding the shooting direction and patterns will also help to correctly identify the shotfall zone at trap and skeet ranges.

Shooting into Water Bodies

Shooting into water bodies or wetlands should not occur. Besides the environmental impacts discussed previously, the introduction of lead to surface water bodies will likely cause a range to be susceptible to litigation and/or governmental action. Shooting into water bodies or wetlands is NOT an option for ranges that want to survive in the future.

Range Life Expectancy and Closure

The life span of your range may be impacted by many factors, including financial and environmental issues, noise, and encroachment on residential areas. If your range is slated for closure, contact your local state or EPA representatives for guidance.

2.3 Planning a New Range

As discussed in the previous sections, site characteristics and operational aspects affect lead migration, degradation and reclamation activities at ranges. **If you are planning on opening a new range, you should select and/or design a site in consideration of the factors discussed in this manual**. This will allow you to minimize the potential of lead impacting your site or adjacent properties. A new range owner has the advantage of being able to design a successful lead management program in full consideration of the site characteristics and recommended BMPs. This advanced understanding of operational aspects

and requirements will allow you to minimize the potential for lead migration prior to opening.

The most important site selection criteria to consider when selecting a new range location include: topography; surface water flow patterns; and depth to groundwater. If possible, ranges should be developed on flat terrain, as it facilitates reclamation and reduces the chance of off-site migration due to surface water runoff as compared with highly sloped terrain. When considering a prospective location for a range, ask yourself: What is the direction of surface water runoff? Does the site drain to surface water (e.g., streams, rivers) on-site? Off-site? Can the range design be modified to minimize potential runoff? Is reclaimation equipment accessible to the area to clean the range?

By selecting an appropriate location and designing a lead management program in consideration of site characteristics, new shooting ranges can be developed to minimize the potential for lead contamination. Other important site characteristics can be modified. For example, a new shotgun range can be designed to concentrate the shotfall area, vegetation can be added or altered, and the most advantageous shooting direction can be selected. These modifications are BMPs, and are discussed in further detail in Chapter III.

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Chapter III: Best Management Practices (BMPs) For Outdoor Ranges

3.0 Background

To operate an outdoor range that is environmentally protective requires implementing an integrated lead management program, which incorporates a variety of appropriate BMPs. These BMPs create a four step approach to lead management:

- Step 1 - **Control and contain lead bullets and bullet fragments**
- Step 2 - **Prevent migration of lead to the subsurface and surrounding surface water bodies**
- Step 3 - **Remove the lead from the range and recycle**
- Step 4 - **Documenting activities and keeping records**

An effective lead management program requires implementing and evaluating BMPs from each of the four steps identified above and illustrated as Figure 3-1. The BMPs discussed in Sections 3.1 and 3.2 should not be considered alternatives to lead reclamation, but rather practices that should be followed between lead reclamation events.

It is important to note that the cost and complexity of these BMPs vary significantly. **It is your range's individual characteristics that will determine which BMPs should be implemented.** The specific BMPs are described more fully below.

3.1 Bullet and Shot Containment Techniques (Step 1)

3.1.1 Bullet Containment

Knowing where spent lead is allows the appropriate BMP to be used. The single most effective BMP for managing lead in these areas is by bullet containment. Owners/operators should employ a containment system that allows for the maximum containment of lead on-site. The containment systems mentioned in this section are for reference only. Each containment design for a range is site specific. Each owner/operator must look at the various factors in determining which containment system is best for his or her range. Some factors include: overhead, cost of installation, maintenance (e.g., creation of lead dust from steel containment systems). Range owner/operators should consult with various contractors to determine which containment system is best for their range.

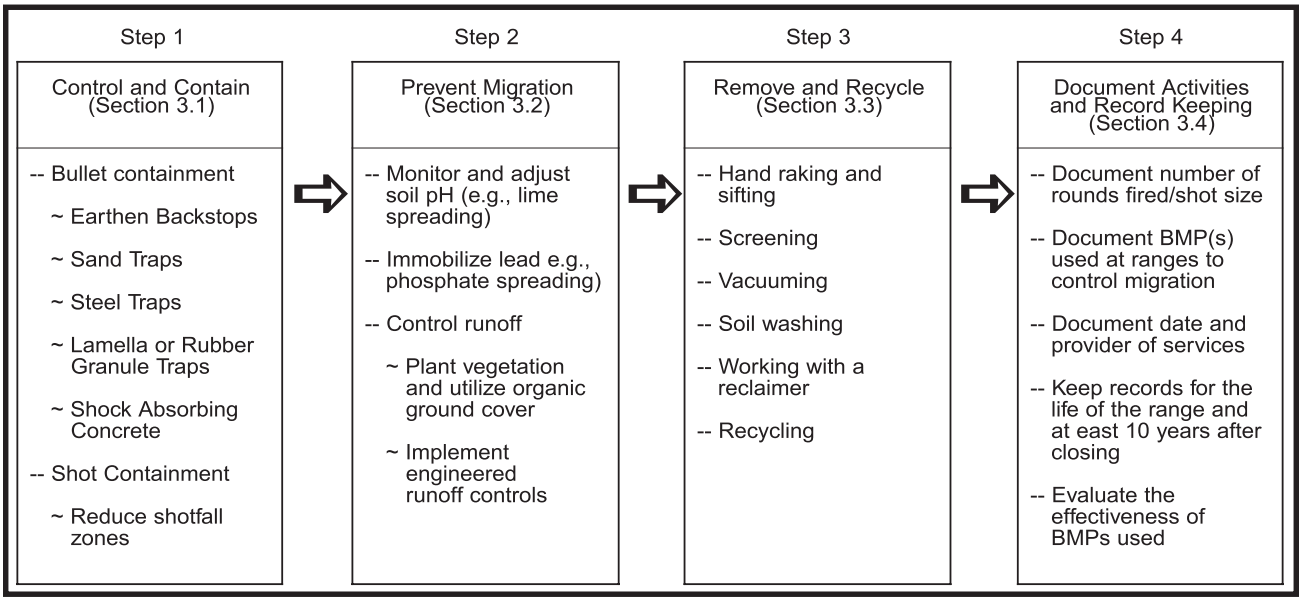

Figure 3-1 – 4 Steps to Build a Successful Lead Management Program Utilizing a Variety of BMPs

This section discusses BMPs for controlling spent lead bullets and fragments in a "controlled" and well-defined area behind the target area. Containing bullets and bullet fragments is critical to successfully managing lead.

There are a variety of containment device options available that serve as BMPs to control lead. The principle behind all of them is trapping and containing the actual bullet. They include:

- Earthen Berms and Backstops
- Sand Traps
- Steel Traps
- Lamella or Rubber Granule Traps
- Shock Absorbing Concrete

For each type of trap, design variations have been developed to fit the specific needs of an individual range. Below are discussions of each general category of trap. Some bullet containment devices are so comprehensive that they virtually eliminate lead's contact with the environment.

However, it is important to discuss all types of bullet containment devices because they are part of comprehensive BMPs for managing lead at rifle and pistol ranges.

EPA does not endorse any bullet containment design as being "better" than another. Different containment designs attempt to eliminate lead's contact with the environment, however, additional BMPs may be required for lead management.

EPA recommends that you discuss your range's bullet containment needs with a variety of vendors before deciding what type of containment device to use. This manual does identify the possible advantages and disadvantages associated with each containment device in Table 3-1, at the back of this chapter.

Earthen Berms and Backstops

Perhaps the most common bullet containment system at rifle and pistol ranges is the earthen backstop (earthen material, i.e., sand, soil, etc., which is located directly behind the targets). The earthen backstop is generally between 15 and 20 feet high with a recommended slope as steep as possible[1]. In many instances, backstops may be naturally occurring hillsides. When using an earthen berm or backstop, ensure that the uppermost layer (to a depth of one to two feet) exposed to the shooting activity is free of large rocks and other debris. These materials tend to increase ricochet and bullet fragmentation, which will, in turn, make lead reclamation activities more difficult, not to mention possible safety issues.

Removal of lead from earthen backstops may require lengthy reclamation (see Section 3.3) of the soil to remove the lead. Continued use of the backstop without removing the lead may result in increased ricochet of bullets and fragments. In addition, the backstop may lose its slope integrity because of "impact pockets" that develop. Once the lead has been removed from the earthen backstop, the soil can be placed back on the range and used again. Adding lime and phosphate during the rebuilding process is recommended as appropriate (see Section 3.2). However, other bullet containment techniques, including those listed below, should be considered prior to reestablishing an earthen backstop.

Sand Traps

A variation of the earthen backstop is the sand trap. Sand traps range from those that are simply mounds of sand or soil located directly behind the bullet targets, which serve as backstops to a sand trap that employs a system designed to contain, collect and control lead and contact water. This sand trap uses a grade of sand that is ballistically acceptable. Regular maintenance must be performed to remove larger particles (bullets) from the impact area. These traps are placed so that bullets fired across the range pass through the targets and become embedded in the sand. These traps are typically 15 to 20 feet high with a slope as

1. National Rifle Association, "The NRA Range Source Book: A Guide to Planning and Construction," June 1998

steep as possible. The most important design criterion for these traps is that the uppermost layer (to a depth of 1 to 2 feet) be free of large rocks and other debris to reduce ricochet and bullet fragmentation, and to facilitate reclamation efforts. There may also be an impermeable layer (e.g., clay or liner) under the sand to prevent lead from contacting the soil underlaying the trap.

Sand traps come in various designs and levels of complexity. The sand trap may be ballistic grade sand contained in a high backstop, or a more complex "Pit and Plate" system. The Pit and Plate system uses an angled, steel deflection plate cover that helps to direct bullets and bullet fragments to the top layer of sand only. Some of the more sophisticated sand traps incorporate lead recovery devices. However, the Pit and Plate may increase the surface-to-mass ratio of the bullet splatter and, therefore, may increase environmental risk of lead migration.

Regardless of the type of sand trap that is used, the traps become saturated with bullets/bullet fragments. Once this happens, the sand must be sifted (see Section 3.3) to remove the bullets. The recovered bullets can then be sold to a lead recycler (this is discussed in more detail later in the chapter). After sifting, the sand can be returned to the trap. Continued use of the trap, without removing the lead, may result in an increased risk of ricocheting off the backstop and thus creating an increased safety hazard. Furthermore, the sand trap will become unstable over time. Sand traps may be located over an impermeable liner, to prevent lead from contacting soil underlying the trap. This will provide additional protection to soil and groundwater.

Steel Traps

Steel traps are located directly behind the targets so that expended bullets, along with bullet particles, are directed into some form of deceleration chamber. Once inside the chamber, the bullets decelerate until the bullets/ bullet particles fall into collection trays at the bottom of the deceleration chamber. When the trap is full, or on a more frequent basis, the spent lead can easily be reclaimed for recycling.

With some steel traps, expended lead bullets may not come in direct contact with soils, thereby possibly minimizing lead's contact with the environment. Consequently, the need for other BMPs (e.g., lime spreading, and/or engineering controls), such as those required at ranges with unlined earthen backstops or unlined sand traps, may be avoided if this trap design is selected for the range's bullet containment device. In addition, bullet removal is somewhat easier than from a sand trap, and may only require emptying the bucket or tray containing the bullets and/or bullet fragments. However, an increase of lead dust and fragmented lead may be an additional environmental concern. Therefore, understanding the amount of lead dust and fragments is important to a successful lead management program. Also, some steel trap designs are not intended for shooting at different angles, therefore limiting the shooter to shooting straight on (no action shooting).

As with sand traps, steel traps vary in design and complexity. For example, the Escalator Trap has an upward sloping deflection plate that directs bullets into a spiral containment area at the top. The Vertical Swirl Trap is a modular, free standing trap with four steel plates that funnel the bullets into a vertical aperture in which they spin, decelerate, and become trapped in a bullet collection container. The Wet Passive Bullet Trap is equipped with steel deflection plates that slope both upward and downward. The upwardly sloped deflection plate is covered with an oil/water mixture to help reduce the occurrence of ricochet and bullet fragmentation. The bullet follows its own path in the round deceleration chamber for bullet recycling.

Lamella and Rubber Granule Traps

The Lamella Trap uses tightly-hanging, vertical strips of rubber with a steel backing to stop bullets. This trap is located directly behind the targets and, in many cases, the targets may actually be mounted to the trap. Lead removal

requires mining the bullets from the rubber. The Rubber Granule Trap uses shredded rubber granules, housed between a solid rubber front and a steel backing, to stop bullets once they pass through the target. For both traps, the bullets remain intact, thus eliminating lead dust and preventing lead and jacket back splatter. Depending on the design of the rubber trap, the bullet either remains embedded in the rubber strip or falls to the bottom of the trap, from which the bullets are removed for recycling.

These traps, when properly installed, are intended to increase safety by decreasing the occurrence of back splatter and eliminating the introduction of the lead dust into the air and ground. However, there are several concerns over their use, since they may:

- require additional maintenance;
- in some cases, present a fire threat under extremely high volume use (due to heat from friction created upon bullet impact);
- not withstand weather elements over the long term; and
- cause the rubber particles to melt to the lead bullets, making reclamation more difficult.

With the availability of fire-resistant rubber and gels (see Appendix A), these issues are becoming less of a concern than in earlier models.

Shock Absorbing Concrete

In addition to the bullet containment devices discussed above, there are new designs and innovations continually being developed. One of these innovative bullet containment devices is Shock Absorbing Concrete (SACON). SACON, which has been used as a bullet containment device since the 1980s and was extensively field tested by the military, has become commercially available in the past several years as a backstop material for small arms ranges. For conventional rifle and pistol ranges, SACON may provide a means to easily reclaim lead. Additionally, crushed, lead-free SACON can be recycled (recasted) after bullet fragments have been removed by adding it to other concrete mixtures for use as sidewalks, curbs, etc.

3.1.2 Shot Containment

Reducing the Shotfall Zone

Unlike rifle and pistol ranges, the area impacted by lead shot fired at trap, skeet and sporting clays ranges is spread out and remains primarily on the surface. **Knowing where spent lead is allows the appropriate BMP to be used. The single most effective BMP for managing lead in these areas is reducing shotfall zones.**

Concentrating the lead shot in a smaller area by modifying the shooting direction facilitates lead management by providing a smaller and more dense area of lead to both manage in-place and reclaim, thereby making the management and reclamation process simpler and more effective.

Sporting Clays Courses

Technologies have been developed to assist in reducing the range size of trap and skeet, and sporting clays facilities. The National Sporting Clays Association (NSCA) supports and promotes the Five-Stand Sporting Clays compact course design for shooting sporting clay targets, invented by Raymond Forman of Clay-Sport International, Cochrane, Alberta, Canada. The targets are directed over a smaller area than in English Style Sporting Clays (conventional sporting clays). It was originally designed to be overlaid on a conventional trap or skeet field and to be an alternative to earlier designs, which cover a much larger area. Another design, known as the National Rifle Association (NRA) Clays, is a portable target throwing unit which concentrates 15 rail-mounted machines on a two-story flatbed trailer. The NRA has also developed “compact sporting,” which is specifically for sporting clay facilities. This practice alters the angle that the target is thrown to concentrate the shotfall zone.

Skeet Fields

The typical single skeet field has a shotfall zone that is fan-shaped. For skeet fields with multiple stands side-by-side, the shotfall zones would overlap creating a shotfall zone that has a concentration of shot near the center of the fan.

Trap Fields

One way to reduce the shotfall zone at trap fields is to build the fields at an angle to one another. This will make the shape of the shooting dispersal pattern smaller and more concentrated. However, if you do decide to choose this option, be aware of safety issues when designing the overlapping shotfall zones.

For a range with only one trap field, one way to minimize the shotfall zone is to keep trap machines set in as few holes as possible (e.g., the number two or three hole setting). This reduces the area of lead concentration by limiting the angles for pigeon throwing, and therefore the area for lead shot fall. However, when two or more trap fields are positioned side by side, the shotfall zone will be continuous regardless of the "hole" setting.

Shot Curtains

Another method to consider for concentrating lead shot is the use of a shot curtain. This device is emerging as a potentially effective tool to keep lead shot out of selected areas of the range and, thereby, reduce the size of the shotfall zone and corresponding cost of reclamation. Different designs and material have been utilized in shot curtains and a number are in operation. The effectiveness of shot curtains is site specific and their long term viability and expense have yet to be fully determined.

3.2 BMPs to Prevent Lead Migration (Step 2)

This section discusses BMPs for preventing lead migration. These BMPs include:

- **Monitoring and adjusting soil pH**
- **Immobilizing lead**
- **Controlling runoff**

These BMPs are important for all outdoor ranges.

3.2.1 Monitoring and Adjusting Soil pH and Binding Lead

Lime Addition

The BMP for monitoring and adjusting soil pH is an important range program that can effect lead migration. Of particular concern are soils with low pH values (i.e., acidic conditions), because lead mobility increases in acidic conditions since the acid of the soils contributes to the lead break down. **The ideal soil pH value for shooting ranges is between 6.5 and 8.5**. This BMP is important because many soils in the eastern United States have pH values lower than 6.[2]

To determine the pH of your soil, purchase a pH meter at a lawn and garden center. The pH meters are relatively inexpensive but valuable tools in the management of lead at your range. If the soil pH is determined to be below 6, the pH should be raised by spreading lime. **It is recommended that the pH be checked annually**.

One way to control lead migration is by spreading lime around the earthen backstops, sand traps, trap and skeet shotfall zones, sporting clays courses and any other areas where the bullets/shots or lead fragments/dust accumulate. For example, lead mobilized in rainwater from the lead that spatters in front of backstops after bullet impacts can be effectively controlled by extending a limestone sand layer out about 15 feet in front of the backstop. Likewise, spreading lime over the shotfall zone will help to raise the pH of the very top soil layer to a pH closer to ideal levels and reduce the migration potential of lead. This is an easy, low cost method. Spreading lime neutralizes the acidic soils, thus minimizing the potential for the lead to degrade. Lime can be easily spread by using a lawn fertilizer drop spreader available at any lawn and garden center.

Smaller forms of limestone (powdered, pelletized, and granular) are better suited

2 National Shooting Sports Foundation, "Environmental Aspects of Construction and Management of Outdoor Shooting Ranges," June 1997

because they dissolve and enter the soil more quickly then larger forms. However, the smaller forms of lime must be replenished more often. Conversely, limestone rock dissolves more slowly but does not need to be replenished as often. The larger rock form is better suited for drainage ditches, where it can decrease lead mobility by raising the pH of the storm water runoff.

Another way to control lead migration in earthen backstops is to break the capillarity within the base of the backstop. Most porosity in the soil material used in backstop is of capillary size, and, as a result, water is pulled upward into a capillary fringe within the base of the backstop. The height to which the water will rise in an earthen backstop depends on the soil material in the backstop. Water will rise more then 6 feet in clay, 3.3 feet in silt, 1.3 feet in fine sand, 5 inches in coarse sand, and only 2 inches in gravel.

Because of capillarity, the spent bullets may be in contact with acidic rainwater for a longer period of time, hence more lead is dissolved. Breaking the capillarity by adding a layer of limestone or gravel to the base of the backstop should reduce the rate of deterioration of spent bullets, the erosion of the backstop, and the amount of lead going into solution in the water in the backstop. Also, any lead dissolved should precipitate out of solution as the acids are neutralized and the pH raised from the water passing through and reacting with the limestone.

Lime spreading is an especially important method for implementing this BMP at sporting clays ranges where heavily wooded areas are less accessible to conventional lead removal equipment. These types of ranges also tend to have more detritus (e.g., leaves, twigs, etc.) on the ground, which can increase soil acidity as they decompose. **In these areas, semiannual monitoring of the soil pH levels is suggested**.

Spreading bags of 50 pounds (at ranges with sandy soils) or 100 pounds (at ranges with clayey soils) per 1,000 square feet of range will raise the pH approximately one pH unit for a period of between one and four years, respectively. The market price of lime in either the granular or pelletized form commonly ranges from approximately $2.00 to $4.00 per fifty pound bag.

Table 3-2 provides information for raising pH levels of clay soils in temperate climates (i.e., Mid-Atlantic/Northeast). Additional information on the amount of lime to apply may also be found on the bags of the purchased lime and/or from the local lawn and garden center. It should be noted that if the soil pH is below 4.5, the addition of lime may only raise the soil pH to approximately 5. In this situation, other BMPs should be used as well. If the soil pH is above the ideal range upper value (8.5), do not add lime. Adding lime to a soil of this pH could result in mobilization of the lead. Lime spreading may be done at anytime during the year, except when the ground is frozen.

Additionally, it is important to remember to monitor the soil pH annually, as the effectiveness of the lime decreases over time. Additional routine applications will be necessary throughout the life span of most ranges.

Table 3-2 – Calculating Weight of Lime to Increase Soil pH Values*

		Current pH							
		4.0	4.3	4.5	4.8	5.0	5.5	6.0	6.5
Desired pH	5.0-6.0	14	11	8	5	3	-	-	-
	6.5-8.5	-	-	-	20	17	11	7	-

* Lime requirements stated as pounds of lime/100 square foot of problem area for clay soils in temperate climates (i.e., Mid-Atlantic/Northeast US).

Phosphate Addition

In addition to lime spreading, another way to control lead migration is phosphate spreading. This method is recommended where lead is widely dispersed in range soils, a range is closing, or there is a high potential for vertical lead transport to groundwater (e.g., low soil pH, shallow water table). Under these circumstances, range soils may benefit from phosphate treatment. Unlike lime spreading, the main purpose of phosphate spreading is not to adjust soil pH but to bind the lead particles. This process also decreases the potential amount of lead that can migrate off-site or into the subsurface. Phosphate spreading can be done either separately or in conjunction with lime spreading. Generally, 15 to 20 pounds of phosphate per 1,000 square feet will effectively control the lead.

Phosphate spreading is especially recommended for sporting clays ranges and those parts of ranges not easily accessible by reclamation equipment. Phosphate spreading should be repeated frequently during the range's lifetime. See pilot testing under "Other Ways to Bind Lead" below for proper frequency for replacing phosphate.

You can purchase phosphate either in its pure form, as phosphate rock, or as lawn fertilizer. The average lawn fertilizer costs approximately $7.00 per 40 pound bag. If you purchase lawn fertilizer, remember to check the bag for the actual percentage of phosphate. Most fertilizers contain 25% phosphate, so that if you purchase a 40 pound bag of fertilizer that contains 25% phosphate (i.e., 10 pounds of phosphate) you will need to spread 80 pounds of fertilizer per 1,000 square feet of the backstop. A typical fertilizer drop spreader can be used for distributing the phosphate. Like lime, phosphate should not be spread when the ground is frozen. In addition, it is not advised to use phosphate near water bodies since it contributes to algal blooms. Rock phosphate is a better choice if water is nearby.

Other Ways to Bind Lead

Although it may be possible to minimize lead's mobility by spreading fertilizers that contain phosphate at impacted areas of the range, a more comprehensive procedure for immobilizing leachable lead in soils, by using pure phosphate in rock form or a ground phosphate rock [Triple Super Phosphate (TSP)], was developed and patented by the U.S. EPA/Ohio State University Research Foundation and RHEOX, Inc. This procedure used a three step approach to minimize lead's mobility. The first step was to identify the boundaries of the area of the range to be treated. This included not only determining the length and width of the range area, but also the depth of lead within the area.

Depth was determined by taking sample cores of the area, which also identified "hot spots" where lead accumulation was greatest. Once the area was identified, the second step was to treat the area with TSP. Pure phosphate rock was used rather then fertilizers, as this phosphate is insoluble in water and will not cause an increase in phosphate runoff.

In this step, pilot testing was conducted. Here, various amounts (in increasing percentages by weight) of TSP were added to the affected soil areas, then the area was tested according to an EPA test method that identified the amount of leachable lead in a given soil sample. This test is called the Toxicity Characteristic Leaching Procedure, or TCLP. Separate TCLP testing of the range's hot spots was conducted.

Upon completion of the pilot testing, which determined the amount of TSP needed at the range, the third step was to begin actual treatment of the range. Where the depth of the lead accumulation was shallow (less than two feet), then standard yard equipment, such as tillers, seed/fertilizer spreaders, and plows were used to mix TSP with the affected soil. Where the affected area's lead accumulation was deeper than two feet, an auger was required to mix the TSP with the affected soil. Random testing of the range ensured the effectiveness of the treatment level.

3.2.2 Controlling Runoff

The BMPs for controlling soil erosion and surface water runoff are important to preventing lead from migrating off-site. There are two factors that influence the amount of lead transported off-site by surface water runoff: the amount of lead fragments left on the range and the velocity of the runoff.

The velocity of the water can successfully be controlled at outdoor ranges by: (1) using vegetative, organic, removable and/or permanent ground covers; and (2) implementing engineered controls which slow down surface water runoff and prevent or minimize the chances of lead migrating off-site. Bear in mind that safety considerations and potential ricochets need to be considered when implementing any engineered controls.

Vegetative Ground Cover

Planting vegetative ground cover (such as grass) is an important and easy erosion control method. Vegetation provides several benefits by minimizing the amount of lead that will run off the land surface during heavy rainfall. It is important to use a mixture of grass seeds to ensure that the cover will last into the future (i.e., annual rye grass lasts one year and dies and perennial rye grass lasts three to four years, then dies off). Fescue grasses form useful mats that are effective in controlling erosion.

Ground cover absorbs rainwater, which reduces the amount of water the lead is in contact with, as well as the time that the lead is in contact with the water. Furthermore, the ground cover will divert and slow down surface water runoff, thus helping to prevent lead from migrating off-site.

Grasses yield the greatest benefit at rifle and pistol ranges where the bullet impact areas are sloped, and water runoff and soil erosion may be more likely. Specific recommendations are to:

- Utilize quick growing turf grass (such as fescue and rye grass) for the grass covering of backstops, which can be removed prior to reclamation and replanted thereafter;
- Avoid vegetation that attracts birds and other wildlife to prevent potential ingestion of lead by wildlife; and
- Use grass to direct surface water drainage away from the target area (e.g., planting them at the top of the backstop or sand trap). This will minimize the water's contact with lead bullet fragments, minimizing the potential for lead migration.

Grass is not impermeable; however, it does slow down the rate of flow and reduce the amount of lead entering the soil via rainwater. Remember, grass requires periodic maintenance (i.e., mowing) to maintain its effectiveness as well as for aesthetic reasons.

Mulches and Compost

Mulches and composts can reduce the amount of water that comes in contact with the lead fragments. In addition, mulches and compost contain hermic acid, which is a natural lead chelating agent that actually sorbs lead out of solution and reduces its mobility. At a minimum, the material should be two inches thick. These materials can be spread over any impacted area and/or low lying areas where runoff and lead may accumulate. Like vegetative covers, organic surface covers are not impermeable. In addition, the organic material needs periodic replacement to maintain effectiveness and aesthetic integrity. Furthermore, these materials should be removed prior to any lead removal event, as they may impede sifting or screening. **Note that these materials tend to be acidic (especially during decomposition), so, if low pH is a concern at your range, this option may not be appropriate. Again, however, lime may be used to control pH (see Section 3.1.1)**

Surface Covers

Removable Surface Covers

Removable surface covers may be effective at outdoor trap and skeet ranges. In this case, impermeable materials (e.g., plastic liners) are

placed over the shotfall zone during non-use periods. This provides the range with two benefits during periods of rainfall: (1) the shotfall zone is protected from erosion; and (2) the spent lead shot is contained in the shotfall zone and does not come in contact with rainwater.

Permanent Surface Covers

For outdoor rifle and pistol ranges, impact backstops and target areas can also be covered with roofed covers or other permanent covers to prevent rainwater from contacting berms. However, this method may be less desirable because of the cost to install the roof, which must be carefully designed to avoid safety issues with ricochets, etc.

For shotgun and other ranges, synthetic liners (e.g., asphalt, Astroturf™, rubber, other synthetic liners) can also be used beneath the shotfall zone to effectively prevent rainwater or runoff from filtering through lead and lead contaminated soil. Synthetic liners will generate increased runoff, which must be managed, however. No single type of liner is suitable for all situations based on site characteristics. Therefore, liners must be chosen on a site-specific basis, bearing in mind the site's unique characteristics, such as soil type, pH level, rainfall intensity, organic content of soil, and surface water drainage patterns.

Engineered Runoff Controls

Runoff control may be of greatest concern when a range is located in an area of heavy annual rainfall because of an increased risk of lead migration due to heavy rainfall events. A "hard" engineered runoff control may be needed in this situation. A heavy rainfall event is defined as rainfall that occurs at such a rate that it cannot be absorbed into the ground and causes an increase in the volume and velocity of surface runoff. The impacts of rainfall are greater in rolling or sloped terrain (increases velocity of runoff) or where surface water bodies are located on, or immediately adjacent to, the range.

Examples of "hard" controls include:

- Filter beds
- Containment Traps and Detention Ponds
- Dams and Dikes
- Ground Contouring.

Designing and implementing these "hard" engineering controls may require the assistance of a licensed professional civil engineer. They are included in this manual to offer the reader a general understanding of these BMP options. However, this manual does not offer specific instructions for construction and operation of these controls. For information about designing and implementing any of these controls, or assistance with other range design questions, contact a licensed professional civil engineer having applicable experience or the NRA Range Department, at (800) 672-3888, ext. 1417. The National Sports Shooting Foundation (NSSF) may be contacted at (203) 426-1320 for specific references regarding the use and design of these controls.

Filter Beds

Filter beds are engineering controls built into an outdoor range to collect and filter surface water runoff from the target range. The collected runoff water is routed to a filtering system, which screens out larger lead particles, raises the pH of the water (thus reducing the potential for further lead dissolution), and drains the water from the range area. This technique may not completely prevent lead from entering the subsurface, since lead bullets, fragments and large particles may still remain on the range.

Filter beds should be established at the base of the backstop (see Figure 3-2). In addition to mitigating off-site migration, the filter beds work to raise the pH of the rainwater, which has fallen on the target range, to reduce lead dissolution, and to strain small lead particles out of the rainwater. The filters typically consist of two layers: a fine-grained sand bed underlain by limestone gravel or other neutralization material. By design, the backstops and berms direct the runoff so that it drains from the range to the filters. The collected water then soaks through the top sand layer into the neutralization material,

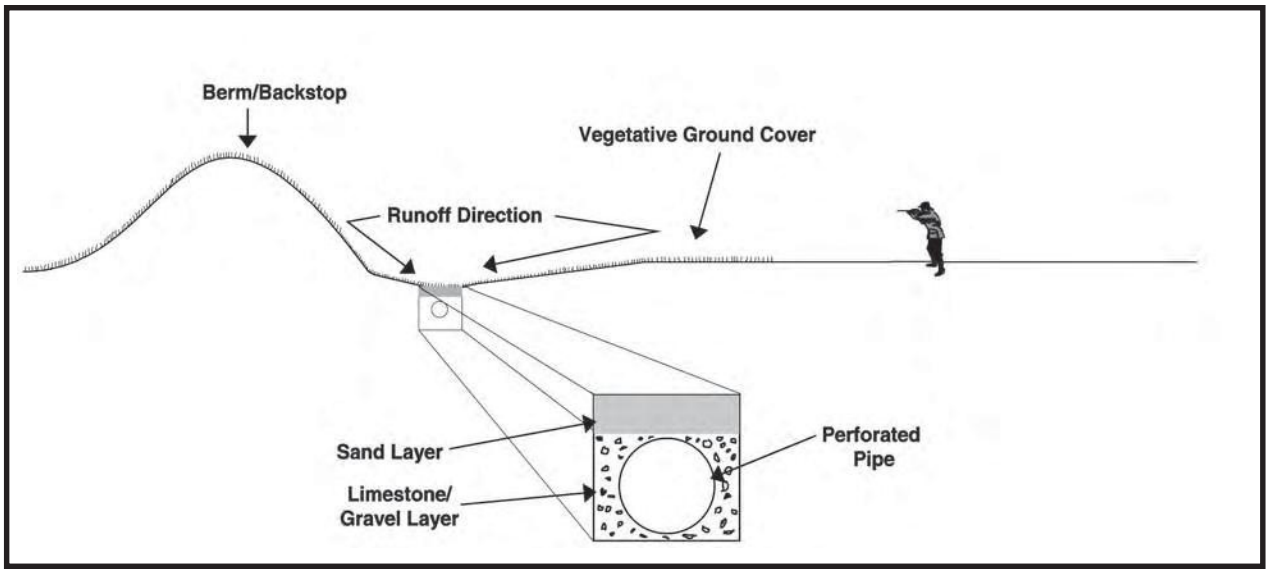

Figure 3-2 – Sample Filter Bed System (Adapted from Proceedings for National Shooting, Range Symposium, October 17-19, 1993, North American Hunting Club and Wildlife Forever)

which raises the pH of the filtrate. The lead particles in the rainwater are collected on the sand, while the pH-adjusted water drains through the filter to a perforated drainage pipe located within the limestone gravel.

Filter beds are designed to capture fine particles of lead transported in surface water runoff. They are not designed to capture bullets. The operation and maintenance requirements of filter beds are minimal. Maintenance activity is limited to periodic removal of debris (such as litter, leaves, etc.) and occasional replenishment of the limestone.

The use of filter beds is most effective on sites with open, rolling terrain where surface water runoff is directed to them. At existing rifle and pistol ranges, a limited system of trenches and filters can be installed at the base of natural soil backstops or at natural drainage depressions.

Containment Traps and Detention Ponds

Containment traps and detention ponds are designed to settle out lead particles during heavy rainfall. Typically, they are depressions or holes in the range's drainage paths. Here, the lead-containing runoff passes through the trap or pond, allowing the lead bullet fragments to settle out. Vegetative cover can be placed in the drainage path to increase the effectiveness of containment traps and ponds by further reducing the velocity of runoff and allowing for more lead fragments to settle from the runoff. It is important to regularly collect the lead and send this lead to a recycler.

Dams and Dikes

At shotgun ranges, dams and dikes can also be used to reduce the velocity of surface water runoff. Dams and dikes must be positioned perpendicular to the direction of runoff to slow the flow of surface water runoff. To accomplish this, determine the direction of the range's surface water runoff. This will be particularly obvious at ranges with sloped terrain. The dams or dikes should be constructed using mounds of dirt that are approximately a foot high. These mounds should transect the entire range perpendicular to the stormwater runoff direction.

These runoff controls are most important at ranges at which off-site runoff is a potential problem, such as ranges where the lead accumulation areas are located upgradient of a surface water body or an adjacent property. Since lead particles are heavier than most other suspended particles, slowing the velocity of surface water runoff can reduce the amount of lead transported in runoff.

Ground Contouring

Another mechanism to slow runoff and prevent lead from being transported off site is ground contouring. By altering drainage patterns, the velocity of the runoff can be reduced. Furthermore, in areas where pH is high (resulting in a lower potential for lead dissolution), the soil can be graded or aerated to increase the infiltration rate of precipitation, so that rainwater is more easily absorbed into the soil. This slows down or prevents surface water runoff and off-site migration. It should be pointed out that this design, in effect, collects lead in the surface soils. Therefore, range operation and maintenance plans should include lead reclamation as well as adjusting the pH, and adding phosphate.

3.3 Lead Removal and Recycling (Step 3)

To successfully minimize lead migration, the most important BMP for lead management is lead reclamation. Implementing a regular reclamation program will allow you to avoid expensive remediation and potential litigation costs. Ranges in regions with high precipitation and/or with acidic soil conditions may require more frequent lead recovery since the potential for lead migration is greater. In regions with little precipitation and/or where the soil is somewhat alkaline, spent bullets may be allowed to accumulate on the soil for a longer time between reclamation events. It should be noted that to ensure that lead is not considered “discarded” or “abandoned” on your range within the meaning of the RCRA statute (i.e., a hazardous waste), periodic lead removal activities should be planned for and conducted. This typically requires one or more of the following:

- Hand Raking and Sifting
- Screening
- Vacuuming
- Soil Washing (Wet Screening, Gravity Separation, Pneumatic Separation)

These methods are discussed in detail below. Figure 3-3 provides examples of common lead reclamation equipment.

Figure 3-3 – Examples of Common Lead Reclamation Equipment

Example of shaker system.
Courtesy of National Range Recovery

Example of final separation device ***(Patented Pneumatic Separation Unit) used with a Shaker System. Courtesy of MARCOR.***

Also, it is important to be aware that state regulations may require that the material being sent for recycling have a minimum lead content in order to qualify as a scrap metal that can be shipped under a bill of lading (i.e., exempt from RCRA).

3.3.1 Hand Raking and Sifting

A simple BMP that can be done by club members, particularly at small ranges, is raking and/or sifting bullet fragments from the soil. Sifting and raking activities should be concentrated at the surface layer. This is a low-technology and low-cost management alternative for lead reclamation. Once collected, the lead must be taken to a recycler or reused. Arrangement with a recycler should be made prior to collecting any spent lead to avoid having to store the lead and avoid potential health, safety and regulatory concerns associated with storing lead.

At trap and skeet ranges, conducting sifting and raking activities in the shot fall zone (approximately 125 - 150 yards from the shooting stations) will yield the most lead. For sporting clay ranges, these activities should be conducted around tree bases, where lead shot tends to collect. Basically, the process consists of raking with a yard rake the topsoil in the shot fall areas into piles, as if you were raking leaves, removing any large debris (e.g., rocks, twigs, leaves, etc.), and then sifting the soil using screens.

Once the soil has been raked and collected, pass it through a standard 3/16 inch screen to remove the large particles. This process will allow the lead shot sized particles to pass through the screen. The sifted material (those not captured by the 3/16 inch screen) should be passed through a 5/100 inch screen to capture the lead and lead fragments. This process will also allow sand and other small sediment to pass through the screen. Screens can be purchased at many local hardware stores. The screens should be mounted on a frame for support. The frame size will vary based on the technique used by each range. For example, if one person is holding the framed screen, it may be better to use a smaller frame (2 feet by 2 feet) whereas, if several people are holding the framed screen, it can be larger.

Raking and sifting can be performed by club members on a volunteer basis. Some clubs provide incentives, such as reduced fees, to members who assist with the lead removal process. Other clubs have hired college students during the summer. A number of small clubs have found that reloaders will volunteer to rake in exchange for collected shot.
Hand sifting and raking are cost effective lead removal techniques for small ranges, or low shooting volume ranges. However, these techniques may not be appropriate for situations in which there is a large volume of lead on the range. In this instance, reclamation machinery may be more appropriate.

Note: Those conducting the hand raking and sifting reclamation at ranges should protect themselves from exposure to lead. Proper protective gear and breathing apparatus should be worn. The Occupational Safety and Health Administration (OSHA) or an appropriate health professional should be contacted to learn about proper protection.

3.3.2 Purchasing/Renting Mechanical Separation Machinery

Reclamation equipment may be rented from local equipment rental services. One type of machine that it may be possible to rent for lead shot reclamation is known as a screening machine (also referred to as a mobile shaker, gravel sizer, or potato sizer). This device uses a series of stacked vibrating screens (usually two screens) of different mesh sizes and allows the user to sift the lead shot-containing soil [gathered by hand raking, sweeping, or vacuuming (discussed above)]. The uppermost screen (approximately 3/16 inch mesh) collects larger than lead shot particles, and allows the smaller particles to pass through to the second screen. The second screen (approximately 5/100 inch mesh) captures lead shot, while allowing smaller particles to pass through to the ground. The lead shot is then conveyed to a

container such as a five gallon bucket. In the Northeastern United States, the typical rental cost for this equipment is between $500 and $4,500 a week, depending on the size shaker desired. It may be possible to get more information on rentals for this type of equipment from heavy equipment rental companies.

Another possible option is to rent a vacuum system that will collect the lead shot-containing soil from the range. Here, vacuuming takes the place of hand raking or sweeping. A vacuum machine is used to collect the lead shot-containing soil. Once collected, the lead shot-containing soil must be sifted through a screening system (either a rental screening machine, or a series of home made framed screen sets). You may be able to obtain more information about renting vacuums or vacuuming services (e.g., it may include a person to operate the machinery) from heavy equipment rental companies.

Some clubs have found that performing their own lead reclamation to be very time consuming. Part of the reason these reclamations took so long is that the soils were wet. Reclamation is much easier under dry soil conditions. For example, one club reclaimed lead from their range using equipment they modified themselves. Twenty-five tons of lead were collected but the reclamation took over two years. Another club took a year to reclaim 10 tons of lead. A more preferable option may be to hire a reclamation company.

3.3.3 Hiring a Professional Reclamation Company

Another option for lead removal is to hire a professional reclaimer. Lead reclamation companies claim to recover 75%-95% of the lead in the soils. Generally, with reclamation companies there is no minimum range size requirement for lead reclamation. Concentration of lead is more important than quantity spread over a field, especially if it is a difficult range for reclamation (e.g., hilly, rocky, a lot of clay in the soil).

Please note that reclamation companies tend to be in high demand — it may take over a year for the company to start at your club. Therefore, it is wise to plan ahead and make the call to the reclamation company as early as possible.

Some reclamation companies require a site visit to view the topography, the soil composition, and amount of lead observed on the ground. During the visit, some companies may even do a site analysis to determine whether or not it is feasible to reclaim. This analysis identifies the location of lead, the expected recovery amount, and the depth lead reaches into the soils.

3.3.4 Reclamation Activities

Using machinery to reclaim lead usually requires that the area be clear of scrub vegetation. Grass, mulch, or compost is generally removed or destroyed during the reclamation process. Some reclamation companies have no problem beginning reclamation on a grassy field. Other reclamation companies will remove grass before or during reclamation (by burning it, if allowed locally, leaving behind the lead shot), and still others require that all vegetation be removed before they arrive at the range. Some companies will re-seed the area once the reclamation is completed.

Since sporting clay ranges generally have many trees, removal of vegetation as discussed above may not directly apply to existing sporting clay ranges. At these ranges, the focus is on removing vegetative debris (i.e., fallen limbs, tree bark, etc.) prior to reclamation. This may include removing some trees to gain better access with the reclamation machinery. Of course, when designing a new sporting clay range, steps to facilitate lead reclamation should be taken into account. For example, less and more widely spaced trees will facilitate lead reclamation.

Reclamation companies use several types of machinery to reclaim lead. Some companies drive their separation machinery over the site. The lead-laden soil is picked up, processed and then returned to the ground after most of the lead

is removed. Other companies scrape off the top several inches of soil from the ground, using a front-end loader to bring the soil/lead to stationary reclamation machines, and then return the soil to the field after reclamation. Many companies till the top two to five inches of soil and grass immediately prior to reclamation to facilitate the process (some companies may require this to be done prior to arrival on the range).

Regardless of how it is collected, the actual reclamation of the lead follows the same general pattern. Most often, it is sifted through a series of shaking screens. The lead and soil pass through shaking screens (usually at least two screens) of decreasing mesh (hole) size, with the topmost screen having the largest mesh. This part of the reclamation machinery is usually adapted from machinery used for potato or gravel sizing.

Any soil/debris automatically screened out as being too big or too small is either returned to the field or re-screened to ensure no lead is caught in the debris. This procedure is why moist, clay soils are more difficult to reclaim. The moist, clay soils can bind together into shot-sized pellets producing more “product” for the second part of the reclamation. The wet soils can also clog the screens.

For some reclamation companies, their process ends after sifting the soil and returning it to the ground. However, some companies take reclamation one step further. After screening, the resulting lead, soil, and other lead-sized particles enter a blowing system. Here the lead shot is easily separated from the soil and other debris by the blowing air. The lead is much more dense than the soil and other lead-sized debris so that it falls out first. Figure 3-3 depict examples of actual lead reclamation machinery.

Some lead reclamation companies will perform the reclamation during club off-hours so that club activities are not interrupted. Additionally, some perform the reclamation on a field-by-field basis, to minimize any disruptions to club activities. However, others companies require the club to shut down during the reclamation.

Reclamation time varies depending on weather, site accessibility, range size, and number of personnel assigned to perform the reclamation.

Reclamation activities may generate dust, especially in drier western locations. To prevent or minimize dust from traveling off the range and causing complaints from neighbors, reclamation activities generating dust should only be conducted during periods of no wind. In addition, such activities should be completed as quickly as possible.

Vacuuming

For ranges that are located on hilly, rocky, and/or densely vegetated terrain, several reclamation companies employ a vacuum system that collects the lead shot (and soil and other detritus). The resulting mix is then placed into the reclamation machinery discussed above. This method is especially effective for sporting clay ranges where lead shot tends to pile up around tree bases.

Vacuuming has traditionally been used for removal of lead shot from trap, skeet and sporting clay ranges. Another way to apply this method involves removing the top layer of an earthen backstop or sand trap with shovels. It is then spread thinly over an impermeable material such as plywood. A vacuuming device is then used to collect the materials that are lighter than lead (e.g., sand or soil), while leaving behind the heavier materials (i.e., lead bullets/shots and fragments). The soil can then be returned to the range. This process is most efficient for dry, sandy soils without a lot of organic material. A more recent innovation is the use of a high suction vacuum. This vacuum itself does not have to be moved about, since a very long hose (up to 600 feet) is used to move in and around trees during the collection of lead shot at trap and skeet ranges.

Soil Washing (Physical and Gravity Separation)

Soil washing is a proven technology and another lead reclamation method used by some reclaimers to separate the lead particles from

the soils. Soil washing is the separation of soils into its constituent particles of gravel, sand, silt and clay. Because of the much higher surface area and surface binding properties of clay, most lead contaminants tend to adhere to the clay particles.

Soil washing, therefore, attempts to generate a clean sand and gravel fraction by removing any fines adhering to the larger soil particles and, if necessary, to transfer contaminants bound to the surface of the larger particles to the smaller soil particles. Typically, the soils are first excavated from the range and then mixed into a water-based wash solution. The wet soil is then separated using either wet screening or gravity separation techniques. One benefit of this system of reclamation is that it does not require that soils be dry.

In addition, soil washing may be able to recover all or almost all lead particles through a combination of wet screen sizing and density separation. This technique is an option for remediation of a range being closed and may compare favorably from an economic standpoint with the disposal option.

Soils treated using this method have been shown to be below 5 mg/L TCLP and to have up to 99% of particulate lead removed. Treatment costs are site specific, but can range from less then $40 per ton (1999 levels) for simple physical/gravity separation up to about $100 per ton for processes involving leaching. Credits for recycled lead help offset the treatment cost and the cost of recycling any treatment sludges and concentrated soil fines. Water used in soil washing is from a closed loop system and should only be disposed at completion of cleanup. Experience shows the water to not be a RCRA regulated hazardous waste, therefore probably allowing disposal to a local wastewater treatment plant.

Wet Screening

With this method, particles larger and smaller than the surrounding soils are passed through a series of large-mesh to small-mesh screens. Each time the mixture passes through a screen, the volume of the soil mixture is reduced. Large particles such as lead shot/bullets and fragments are screened out of the soil/wash mixture early in the process and can be taken off-site for recycling - allowing the soil to be placed back on-site.

Gravity Separation

This technique can be used in cases where the lead particles are the same size as surrounding soil particles. The wet soil/wash mixture is passed through equipment, which allows the more dense materials (i.e., lead materials) to settle to the bottom of unit and separate out of the soil/wash mixture.

Pneumatic Separation

Pneumatic separation (see figure 3-3) is an effective means to enhance the traditional screening results. Traditional screening cannot separate shot and bullets from other shot and bullet sized material, i.e., rocks, stones, roots, and various debris. A recycling facility considers non-lead items as “contaminants” which drastically reduces the value of the recycled lead. Pneumatic separation utilizes an air stream, and specific density analysis, to effectively separate the shot/bullets from the other shot/bullet sized material.

3.3.5 BMPs to Assist Lead Reclamation and Recycling

There are several operational activities that should be conducted throughout the year to facilitate reclamation. The following is a discussion of these activities.

Frequency of Lead Removal

It is important to perform lead removal at a frequency appropriate for your site. The frequency is dependent on several factors. These include:

- Number of rounds fired
- Soil pH
- Annual precipitation
- Soil Type
- Depth to groundwater.

Lead quantity, as estimated by the number of rounds fired, is a factor in determining the appropriate frequency of reclamation at ranges. It also assists in determining the cost of reclamation. One reclamation company indicated that reclamation was most cost effective when it contains at least 20 pounds of lead per square foot of backstop. Another source indicated that a minimum of 100,000 rounds per firing lane should be allowed before lead reclamation occurs. This would ensure good range operation and maintenance, while minimizing the cost per quantity of lead recovered.

For shotgun ranges, tracking the number of targets thrown can help indicate when the lead shot should be reclaimed. For example, considering environmental issues, the market for scrap lead and common cleanup methods, one source indicated that when a range has thrown at least 250,000 to 1,000,000 targets, depending on the shooting area, reclamation of the lead shot is encouraged. Another reclaimer indicated that if at least two pounds of lead per square foot have accumulated on the range, reclamation is recommended.

Because the number of rounds fired is important to know, establishing record keeping procedures to monitor the number of rounds fired is recommended. This can be accomplished by maintaining logbooks and asking shooters to list the number of rounds shot and the type/size of shot/bullets they use. This should be done by lane and by stand.

There are many ranges at which lead removal has not occurred for many years. Many of these ranges are used extensively. Such ranges are especially good candidates for lead removal and recycling. Subsequent removal frequency depends on range use and environmental factors. The NRA recommends a frequency of one to five years for lead cleanup, even on ranges with minimal use[4]. One possible approach to reducing the cost of reclamation more cost effective is for a number of ranges in the same geographical area to work together in organizing coordinated removals at their ranges. This will reduce the reclaimer travel and mobilization cost for each range.

Minimization of Vegetation

As discussed previously, vegetation is useful both for controlling the amount of runoff and erosion from the range and inhibiting lead mobility. **However, excessive or unmaintained vegetative cover can interfere with reclamation activities.** For example, large amounts of vegetation impedes the screening and sifting processes used by many reclamation companies. Therefore, prior to reclamation activities, it is best to remove, reduce, or mow excessive vegetation from the area. Once the reclamation has been conducted, quick-growing vegetation such as a rye/fescue grass mix should be replanted. This process should be repeated for each reclamation event.
In addition, heavily wooded areas may inhibit lead reclamation because they are less accessible by heavy reclamation machinery. For ranges that are heavily wooded, it is recommended that you minimize the vegetation or modify the range design to allow lead reclamation equipment access to the range. Access to the impact area should be developed to facilitate reclamation. **Make sure that the pathways do not present a safety risk.**

Innovative Landscaping

Some new ranges are landscaping their ranges to include a sand track (an area the size of the shotfall zone that is only sand) located behind some aesthetically pleasing shrubs. This allows the spent shot to concentrate on the sand, making it very easy to perform reclamation because there is no interference by vegetation.

Selecting a Lead Reclaimer

In ensuring that the reclamation is conducted appropriately, selecting a reclaimer that is right for your range is extremely important. Some lead reclamation companies will travel to your range and assess the range prior to conducting

4. National Rifle Association, “Metallic “Bullets” lead Deposits on Outdoor and Indoor Firing Ranges” 1991

lead collection activities. This assessment trip allows the reclamation company to confirm information gained during initial discussions, as well as to assist in appropriately estimating costs, time required, and the estimated volume of lead at the range. Conducting this pre-assessment also allows you to determine which reclaimer is right for your situation.

Questions Commonly asked by the Reclaimer

When you contact a reclamation company, it is likely that the reclaimer will ask several general questions. Typical questions include:

- When was the last reclamation conducted?
- How many rounds have been shot since that last reclamation?
- What is the use frequency of the range?
- What are the site characteristics and soil types?
- What type of bullet containment device is used at the range?

Answering these questions will be a lot easier if you have maintained good records, as is suggested above.

Questions to ask the reclaimer

When choosing a reclaimer be sure to ask the general questions about prior cleanups (past projects), insurance to cover company and cleanup (general liability insurance, pollution insurance, bonding, etc.), and site plans to ensure health and safety of workers and range personnel. Other questions you may want to ask the reclaimer include:

- Can the reclamation take place outside normal hours of range operation?
- What costs are involved?
- How long will the reclamation take?
- Does vegetation at the range need to be removed?

Economic Considerations

Lead removal costs may vary dramatically depending upon the type and volume of soil or sediments, topography, amount of lead, location, and reclamation company and technique used. Because the economics vary due to many factors, this manual does not provide specific estimates. However, it is important to understand that lead reclamation will generally require an expenditure by the range, even when considering any monetary returns from selling reclaimed lead. By tracking the range use and using the criteria discussed earlier (see Frequency of Lead Removal), the reclamation costs per quantity of lead can be optimized. For long term range management, routine lead removal will help future cost avoidance by minimizing the need for costly site remediation

Some reclaimers bid the lowest flat fee with all the lead provided to the range for selling. The range owners/operators must then consider the transportation costs and recycling fee associated with sending the reclaimed shot and bullets to a recycling company. Alternatively, the reclaimer will use the economic return of lead sold for recycling, based on the volume reclaimed and the current value of lead, to reduce the total cost of reclamation and recycling. Although the value of lead varies, the scrap value of reclaimed lead typically falls between $.06 and $.25 per pound, **excluding transportation cost**. See the appendix for contact information regarding lead reclamation companies that specialize in lead removal at outdoor ranges.

3.4 Documenting Activities and Record Keeping (Step 4)

Documenting activities and keeping good records is of paramount importance for an effective lead management program at a range. Owners/operators should document all activities done at the range with respect to BMPs and recycling of lead. Records should be kept on when services were provided and who provided them.

Owners/operators may want to document what type of BMP(s) were implemented to control lead migration, the date of service, and who did the services. The records should be kept for the life of the range. Records may be used to show that owners/operators are doing their part to

help prevent lead migration off-site and show that they are doing their part to be stewards of the environment.

3.5 Additional Economic Considerations

Not all BMPs need to be implemented at once. Many can be phased in over time. However, it is important to begin implementing BMPs, especially lead reclamation and recycling, as soon as possible. Implementing the most appropriate BMPs for your range requires consideration of your range characteristics and costs associated with implementing the BMPs. This manual provides a large selection of BMPs that vary in both cost and sophistication. In selecting BMPs for your range, it is important to look at all costs and all the benefits (or potential problems) associated with each BMP.

3.6 Summary of Key BMPs for Shooting Ranges

There are several BMPs that are highly recommended to be implemented, if applicable to your range. Table 3-1 identifies the advantages and disadvantages of all BMPs discussed in this chapter. This table serves as a quick reference guide for potential BMPs. Readers should refer back to the detailed discussions above for further information regarding these BMPs.

3.7 Certificate of Recognition

EPA has established a voluntary process whereby a shooting range may apply for a "Certificate of Recognition." The Certificate is intended to be awarded to ranges that have certified that they have prepared and intend to implement, or have implemented, a written Environmental Stewardship Plan that is consistent with the EPA *Best Management Practices for Lead at Outdoor Shooting Ranges* manual. To assist in this process, Appendix E contains a template for an Environmental Stewardship Plan, an electronic copy of which is available on EPA's shooting range website (http://www.epa.gov/region2/leadshot) in several formats. This template, combined with information provided throughout this manual, other resources and guidance, and site-specific factors, will help in guiding the process of evaluating relevant information about your facility and determining which BMP(s) might be appropriate for your ranges. EPA's template was adapted from Appendix C of the National Shooting Sports Foundation's manual, *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges* (the NSSF manual.) Accordingly, use of that template would also be acceptable for use in EPA's Certificate of Recognition program.

In order to request this certificate, a range must submit a notice to the Lead Shot Coordinator in EPA Region 2 stating that they have completed an Environmental Stewardship Plan as indicated above and are intending to implement it within six months. The certificate is intended to convey, to all that may see it, that the range has declared its intention to properly manage lead shot and bullets. However, it must be noted that a certificate is not a permit to operate and provides no additional operational approval, implied or otherwise.

Table 3-1 – Summary of Key BMPs

BMPs for Preventing Lead Migration		
Monitoring and Adjusting pH		
BMP Option	**Advantages**	**Disadvantages**
Lime Spreading	1. Easy 2. Inexpensive 3. Effective	1. Does not offer a permanent solution 2. Will not work in extremely acidic conditions
Immobilizing Lead		
BMP Option	**Advantages**	**Disadvantages**
Phosphate Spreading	1. Easy 2. Inexpensive 3. Effective	1. Does not offer a permanent solution
Controlling Runoff		
BMP Option	**Advantages**	**Disadvantages**
Vegetative Ground Cover (e.g., grass, etc.)	1. Easy 2. Aesthetically pleasing 3. Relatively inexpensive 4. Effectively slows and can redirect runoff 5. Some may "bioabsorb" lead	1. Requires periodic maintenance 2. Must be removed or reduced prior to reclamation 3. Excessive vegetation will interfere with reclamation
Organic Surface Cover (e.g., mulch and compost)	1. Easy 2. Aesthetically pleasing 3. Relatively inexpensive 4. Effectively slows and can redirect runoff	1. Requires periodic maintenance 2. Must be removed prior to reclamation 3. May not be suitable at ranges with acidic soil conditions
Filter Beds	1. Diverts and treats lead contaminated runoff 2. Low maintenance 3. Assists with range drainage	1. May require hiring a licensed engineer 2. Higher initial setup cost

Table 3-1 – Continued

Controlling Runoff (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Water/Sediment Traps	1. Low maintenance 2. Assists with range drainage	1. May require hiring a licensed engineer 2. Higher initial setup cost
Dams and Dikes	1. Low maintenance 2. Assists with range drainage	2. Higher initial setup cost
Ground Contouring	1. Lower initial setup cost 2. Assists with range drainage	1. May require hiring a licensed engineer
Controlling and Containing Bullets		
Bullet Containment Devices		
BMP Option	**Advantages**	**Disadvantages**
Earthen Backstop	1. Minimal (if any) initial setup cost 2. Accepts firing from various guns and directions	1. Build up of bullets increases chances of ricochet and fragmentation problems 2. Lead removal requires mining 3. Potential decreased value of lead because it is less clean than lead reclaimed from other trap systems 4. Does not eliminate lead's introduction into the environment
Sand Trap	1. Low initial setup cost 2. Ease of maintenance 3. Accepts firing from various guns and directions	1. Build up of bullets increases chances of ricochet and fragmentation problems 2. Lead removal requires mining
Pit and Plate Trap (Sand)	1. Low initial setup cost 2. Simple installation 3. Lead removal and recycling requires less extensive mining	1. Lead builds up on top layer of sand causing ricochet problems 2. Increased bullet fragmentation 3. Higher level of maintenance than sand traps

[1] Much of this information was obtained from Action Target's Bullet Containment Trap Technologies video. Reference to various pros and cons of individual bullet containment devices is included in this manual for informational purposes only. The USEPA does not endorse any particular bullet containment device, design, or product.

Table 3-1 – Continued

Controlling and Containing Bullets (Cont.)		
Bullet Containment Devices (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Escalator Trap (Steel)	1. Can be used indoors and outdoors	1. Deflection plates require regular oiling. The oil used is hazardous and can easily migrate at outdoor ranges 2. Relatively high maintenance 3. Poor lead collection because the bullets may become clogged at the spiral collection area at the top of the deflection plate 4. Increased bullet fragmentation 5. May require rubber curtains to be placed in front of the trap to slow bullets 6. More noise 7. Possible creation of lead dust
Vertical Swirl (Steel)	1. Can be used indoors or outdoors 2. Bullets are captured in pure form in containers, thus removal and recycling is easy	1. Does not accept shooting from all directions 2. Corners where each unit meet can cause ricochet and fragmentation problems 3. More noise 4. May create lead dust
Wet Passive Bullet Trap (Steel)	1. Can be used indoors and outdoors 2. Excellent results (i.e., low ricochet, low fragmentation, ease of removal) 3. Bullets are captured in containers, thus removal and recycling is easy	1. Expensive 2. Oil and water mixture is hazardous 3. More noise
Lamella Trap	1. Can be used indoors or outdoors 2. Reduction of lead dust	1. Rubber strips quickly become destroyed and must be replaced 2. Potential fire hazard 3. High maintenance 4. Scattered lead fragments mixed with rubber can migrate; lead contaminated granules are hazardous and require special handling

Table 3-1 – Continued

Controlling and Containing Bullets (Cont)		
Bullet Containment Devices (cont.)		
BMP Option	**Advantages**	**Disadvantages**
Rubber Granule	1. Can be used indoors or outdoors 2. Reduction of lead dust 3. Minimizes fragementation, compared with some backstops	1. Rubber strips can quickly become destroyed and must be replaced 2. Some pose potential fire hazard, although fire-retardant/resistant materials are available in some designs 3. High maintenance 4. Scattered lead fragments mixed with rubber can migrate; lead contaminated granules are hazardous and require special handling
Shock Absorbing Concrete	1. Adaptable/can be formed in any shape 2. Can be used to reduce erosion in soil berms/target emplacements 3. Crushed concrete can potentially be recast after fragments removed	1. Mechanical lifting and handling equipment must be used during installation and maintenance 2. High maintenance (replacement) costs
Removal and Recycling of Lead		
Hand Raking and Sifting	1. Easily done by club members 2. Inexpensive 3. Can be done outside operating hours 4. Relatively effective	1. May be more time consuming at large ranges 2. Weather sensitive (i.e., works best under dry conditions) 3. Exposure to lead and lead dust possible
Screening	1. Effective 2. Potential economic returns	1. Vegetation must be removed 2. Weather sensitive (i.e., works best under dry conditions)
Vacuuming	1. Effective 2. Can be used at least accessible ranges 3. Less vegetation needs to be removed	1. Weather sensitive (i.e., works best under dry conditions)
Soil Washing	1. Effective at cleaning the soil to remove the lead particles so one is left with non-lead soil	1. Vegetation must be removed

References

Battelle Memorial Institute, *Field Demonstration of a Sieving and Stabilization Technology on Lead-Contaminated Soils at a Small Arms Range at Mayport Naval Air Station,* Columbus, Ohio, February 1991

Brister, B. The Speed Factor, Field and Stream, January 1995

Connecticut Coastal Fisherman's Ass'n v. Remington Arms Co., Inc., 989 F.2d 1305 (2d Cir. 1993)

George, C.J., Joachim, A., and Le, Phu Trong, *Long-Buried Lead Shot: Its Stability, Possible Transport by Waterfowl and Reexposure by Hydraulic Dredging at Collins Lake,* Department of Biological Sciences, Union College, Schenectady, NY, June 1991

Long Island Soundkeeper Fund, Inc. v. New York Athletic Club of the City of New York, 1996 U.S. Dist. LEXIS 3383 (S.D.N.Y. 1996)

Magdits, Louis J., *Recycling Regulations*, Proceeding from the Third National Shooting Range Symposium, June 23-25, 1996, Orlando, Florida

Middleton, J.R., *Development of Toxic Free Ammunition,* U.S. Armament Research, Development and Engineering Center

National Rifle Association of America, *Lead Article,* Risk Issues in Health and Safety - Volume I, Pages 6-8, Winter 1990

National Rifle Association of America, *Metallic "Bullets" Lead Deposits on Outdoor and Indoor Firing Ranges*, 1991

National Rifle Association, *The NRA Range Source Book: A Guide to Planning and Construction*, June 1998

National Shooting Sports Foundation, *Environmental Aspects* of Construction and Management of Outdoor Shooting Ranges, June 1998

Ordija, Victor, *Lessons from Lordship*, Proceedings from the National Shooting Range Symposium, October 17-19, 1993, Salt Lake City, Utah

Peddicord, Richard K., *Lead Mobility in Soils*, Proceedings from the Third National Shooting Range Symposium, June 23-25, 1996, Orlando, Florida

Sever, C.W., *Lead and Outdoor Ranges*, Proceedings from the National Range Symposium, October 17-19, 1993, Salt Lake City, Utah

Sporting Arms and Ammunition Manufacturers Institute, Inc., *Lead Mobility at Shooting Ranges,* Newtown, CT, 1996

Stansley, W., Widjeskog, L., and Roscoe, D.E., *Lead Contamination and Mobility in Surface Water Trap and Skeet Ranges,* Bulletin of Environmental Contamination Toxicology, Springer-Verlag, New York, NY, 1992

U.S. Department of the Interior, *Pollution Prevention Handbook -- Firing Ranges,* Department of the Interior, Office of Environmental Affairs, Washington, D.C.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., Directive 9355.4-12, *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, July 14 1994

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington D.C., *A Citizen's Guide to Soil Washing*, EPA 542-F-96-002. , April 1996.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. *Physical/Chemical Treatment Technology Resource Guide*, EPA 542-B-94-008. September 1994.

Appendix A: Resources

This manual provides contacts for lead reclamation companies, lead recycling companies, bullet trap manufacturers, and organizations that provide prevention and/or remediation techniques to assist clubs and firing ranges in implementing Best Management Practices for shooting ranges. The list was updated for the June 2005 printing. Vendors who are interested in being added to the list of lead reclaimers or remediation contractors should contact:

Lead Shot Coordinator
RCRA Compliance Branch
US EPA Region 2
290 Broadway
New York, NY 10007-1866
Telephone: (212)637-4145
E-mail: Leadshot.Region2@epa.gov

Lead Recycling Companies

Below is a list of recycling companies for lead in soils and spent lead shot/bullets that were contacted during the writing of this manual. Lead recycling companies smelt lead. It is not inclusive and is included for informational purposes only. Local scrap metal recyclers may also accept spent lead shot or spent bullets. Mention of these companies does not serve as an endorsement by the EPA.

The Doe Run Company Resource Recycling Divsion HC1 Box 1395 Boss, MO 65440 800-633-8566 573-626-3476 Lou Magdits l.magdits@doerun.com	**East Penn Manufacturing Company, Inc**. P.O. Box 147 Lyon Station, PA 19536 610-682-6361 Rick Leiby Web Site: http://www.eastpenn-deka.com
Exide Spring Valley & Nolan Streets Reading, PA 19612 800-437-8495 Robert Jordan, Maritza Rojas-Suarez Web site: http://www.exide.com	**Gopher Smelting and Refining** 3385 Highway 149 South Eagan, MN 55121 651-454-3310 800-354-7451 Mark Kutoff Web Site: http://www.gopherresource.com/
Gulf Coast Recycling 1901 N. 66th St Tampa, FL 33619 813-626-6151 William Weston	**Kinsbursky Brothers, Inc**. 1314 N. Anaheim Blvd Anaheim, CA 92801 714-738-8516 Paul Schneider Web Site: http://www.kinsbursky.com
Reserve Trading Corp. P.O. Box 302 Medina, OH 44258 330-723-3228	

Lead Reclamation Companies

Below is a list of reclamation companies for lead in soils and spent lead shot/bullets that were contacted during the writing of this manual. Lead reclamation companies reclaim lead from ranges. It is not inclusive and is included for informational purposes only. Mention of these companies does not serve as an endorsement by the EPA.

Brice Environmental 3200 Shell St, P.O. Box 73520, Fairbanks, AK 99707 Craig Jones 907-456-1955 www.briceinc.com Reclaims primarily from earthen backstops and sand traps.	**En·Range, Inc.** 3326 NW 29th St. Miami, FL 33142-6310 Thomas M. Taylor 305-999-9965 Fax 305-635-8645 Email: enrange1@yahoo.com www.en-range.com Provides lead reclamation and other environmental and maintenance services.	**Entact** 1010 Executive Court Suite 280 Westmont, IL 60559 630-986-2900 www.entact.com Performs physical removal of the lead from backstops, chemical treatment of soils and returns soil to the backstop.
Karl & Associates, Inc. 20 Lauck Road Mohnton, PA 19540 Edmund Karl III 610-856-7700 Works primarily in the the mid-Atlantic area. Lead-containing soil is physically removed and sent to licensed disposal sites or licensed recycling facilities.	**MARCOR** 246 Cockeysville Road Hunt Valley, MD 21030 Dave Jungers 410-785-0001 www.marcor.com Uses a pneumatic separation unit to remove lead from contaminated soil and treats soil to pass TCLP.	**Metals Treatment Technologies, LLC (MT^2)** 12441 West 49th Avenue Suite 3 Wheat Ridge, CO 80033 Jim Barthel 303-456-6977 www.metalstt.com Removes lead from soil and treats soils at all types of ranges.
Sears Trucking Company P.O. Box 38 El Reno, OK 73036 Garland Sears 800-522-3314 Fax 405-262-2811 Physically removes lead from soils at trap and skeet ranges.	**Solucorp Industries, Ltd.** 250 West Nyack Road West Nyack, NY 10994 Mike DeLuca 845-623-2333 Fax 845-623-4987 Email: solucorpmbs@aol.com www.solucorpltd.com Removes and treats soil using their Molecular Bonding System (MBS) soil stabilization technology.	**Southern Lead Removal** P.O. Box 2645 Daytona Beach, FL 32115 Kevin Gilchrist 386-763-0115 Fax 386-761-6991 Removes lead from indoor and outdoor pistol ranges only.
Sport Shooting Services P.O. Box 667 Crawfordville, FL 32326 Ed Tyer 850-926-7375 Cellphone 850-294-0132 Email: envirorange@aol.com Removes lead from earthen berms, uses a shaker and screen system to separate lead from soils, rents screening equipment, and consults on range design, primarily in Florida.	**Terra Resources, Ltd.** HC4 Box 9311 Palmer, AK 99645 Larry Wood 907-746-4981 Cellphone: (907) 232-5059 Fax: 907-746-4980 www.terrawash.com Uses gravimetric process to separate lead and TerraWash™ soil washing technology.	**Waste Recycling Solutions, Inc.** 1850 Route 112 Medford, NY 11763 Tommy Arabia, President 631-654-3811 Uses a vacuum system to remove lead from trap and skeet ranges.

Other Resources

Below is a list of additional phone numbers that may be of use if you have general questions including questions on range construction, design, and implementing BMPs.

U.S. Fish and Wildlife Service 4401 North Fairfax Arlington, VA 22203 703/358-2156 Web site: http://www.fws.gov/	**Institute of Scrap Recycling Industies, Inc**. 1325 G Street, NW, Suite 1000 Washington, DC 20005-3104 202/737-1770 Web site: http://www.isri.org/
Lead Industries Association, Inc. 13 Main Street Sparta, NJ 07871 973/726-LEAD (973/726-5323) fax: 973/726-4484 Web site: http://www.leadinfo.com	**National Rifle Association of America** 11250 Waples Mills Road Fairfax, VA 22030 800/NRA-3888 Web site: http://www.nra.org
National Shooting Sports Foundation and National Association of Shooting Ranges 11 Mile Hill Road Newtown, CT 06470 203/426-1320 NSSF web site: http://www.nssf.org NASR web site: http://www.rangeinfo.org	**Sporting Arms and Ammunition Manufacturers' Institute, Inc.** Flintlock Ridge Office Center 11 Mile Hill Road Newtown, CT 06470-2359 203/426-4358 Web site: http://www.saami.org
Wildlife Management Institute 1101 14th Street, N.W. Suite 801 Washington, DC 20005 202/371-1808 Web site: http://www.wildlifemanagementinstitute.org	

Web Resources

Useful Web Sites	
Description	**Web Address**
Federal Government Sites	
U.S. EPA's Outdoor Shooting Range Home Page	http://www.epa.gov/region2/waste/leadshot/
U.S. EPA – Military Munitions Rule	http://www.epa.gov/epaoswer/hazwaste/military/ http://www.epa.gov/tribalmsw/thirds/remunition.htm
U.S. Occupational Safety and Health Administration (OSHA)	http://www.osha.gov/
National Institute for Occupational Safety and Health (NIOSH)	http://www.cdc.gov/niosh/
State Government Sites	
Florida: BMPs for Shooting Ranges	http://www.dep.state.fl.us/waste/categories/shooting_range/
Massachusetts : Lead Shot in the Environment	http://www.state.ma.us/dep/files/pbshot/pb_shot.htm
Minnesota: Poster for "Firing Range Hazards"	http://www.cdc.gov/niosh/mnables.html
Ohio: Lead Shot Reclaimers list	http://www.epa.ohio.gov/dhwm/leadrecy.htm
Wyoming: Lead Recyclers List	http://deq.state.wy.us/outreach/lead.htm
Court Decisions	
Connecticut Coastal Fishermen's Association v. Remington Arms	http://www.duedall.fit.edu/summer/rcra.htm
Long Island Soundkeeper Fund and NY Coastal Fishermen's Assoc. v. New York Athletic Club	http://www.epa.gov/region02/waste/leadshot/lisfnyac.htm
Articles and Research	
USAF - Lead Contamination in Soils at Military Small Arms Firing Ranges	http://www.afcee.brooks.af.mil/pro-act/fact/june98a.asp
U.S. Army Env. Center (AEC) – Small Arms Range Technology	http://aec.army.mil/usaec/range/operations03.html http://aec.army.mil/usaec/technology/rangexxi03.html http://aec.army.mil/usaec/publicaffairs/update/win97/range.htm
AEC – Green Bullets	http://aec.army.mil/usaec/publicaffairs/publicity02.html http://aec.army.mil/usaec/technology/rangexxi00a.html http://aec.army.mil/usaec/publicaffairs/update/spr97/bullets.htm
AEC - Recycling of Firing Range Scrap	http://aec.army.mil/usaec/publicaffairs/update/spr99/spr9911.htm
Florida Center for Solid and Hazardous Waste Management	http://www.floridacenter.org/
National Association of Shooting Ranges' Reference Library	http://www.rangeinfo.org/resource_library/facility_mngmnt/

Bullet Trap Manufacturers[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Action Target (801) 377-8033 Contact: John Curtis, CEO actiontarget.com	Total Containment Trap (TCT)	$1,600 to $1,800 /linear foot (dependent on features selected)	Purchase of Equipment Installation Delivery (Freight included)		Rifle Pistol Armor - piercing* *depends on type of armor-piercing	The TCT is a funnel-style trap that uses steel plates mounted at low angles to direct bullets into a deceleration chamber. The low angles prevent break up of the bullets until they reach the chamber, where the bullets lose energy and drop into removeable storage containers. An optional dust collection unit uses a powerful vacuum to remove lead dust and other fine particles from the collection chamber.	The TCT is designed for both indoor and outdoor applications. It may be used safely with handguns, shotguns, and high-powered rifles, and has been successfully tested and used with 50-caliber fire.
Action Target (Cont.) see details above	Rubber Berm Trap (RBT)	$1100/liner foot	Installation and Delivery		Rifle or Pistol. Armor-piercing. Cannot use incendiary rounds.	The RBT is very similar in form and function to a traditional sand or earthen berm trap, with the obvious difference being the use of chopped rubber instead of sand as a collection medium. Bullets fired into the trap are absorbed by the rubber and remain there until reclamation through mining of lead from the trap.	Because rubber is a softer collection medium, bullets can be captured with less break-up and fragmentation. The resulting reduction in lead dust levels is especially beneficial in indoor ranges. This benefit is decreased as more rounds accumulate in the trap, causing newly fired bullets to impact bullets already in the trap.

[1] EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Copius Consultants (516) 783-7489 Contact: Craig Copius	Containment/ Recovery System	Ranges from $600/linear foot to $1,000/linear foot (Price varies with specific design selected)	Purchase of Equipment	Shipping	Rifle Pistol Machine gun Shotgun	This is a modification of the sand backstop. Sizes vary depending on the needs and characteristics of the range; however, average height is 10' - 12' and average width is 12' - 14'. The trap utilizes ballistic grade sand to trap bullets and bullet fragments in a sealed system. The system contains collection and filtration systems to ease reclamation and eliminate off-site migration of lead.	Specific recommended bullet trap is based on the following: 1) Type of usage, quantity of usage, etc. 2) Location in country 3) Environmental issues (e.g., location near a waterbody) Price will depend on the design adopted. One unique feature is that shooting can occur at any angle.
Meggitt Defense Systems Caswell (612) 706-6201 Contact: Brian Danielson	Granular Rubber Bullet Traps	$940 to $1,300/linear foot (dependent on type of trap and other features selected)	Purchase of Equipment Installation Delivery (Freight included)		Pistol Rifle Armor- Piercing Shotgun Machine gun Tracers (Speak to Sales Rep.)	The trap absorbs bullets fired from any angle or distance. No exposed steel surfaces; bullets are not fragmented. The granulated material used in the trap can be turned over quickly to recover the spent rounds.	Suitable for indoor and outdoor ranges. Eight types of traps available. Custom builds traps. Provides site-specific design, if requested. Reclamation is recommended after approximately 90,000 rounds have been fired (depending on trap type.)

[1] EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Range Systems (888) 999-1217 (763) 533-9200 Contact: Steve Thomas range-systems.com	Encasulator Bloc Trap™ Encasulator Granular Trap™	$800-$1,250/linear ft (Price varies with design criteria and product selection)	Purchase of Equipment Installation	Freight	Pistol Rifle Shotgun (shot and slugs)	The bullet traps are constructed for maximum bullet retention with minumum space and cost. The bullet traps virtually eliminate ricochet and airborne lead.	Full service shooting range provider from design and engineering to construction and maintenance. Custom-built traps with exclusive patented rubber technology.
Savage Range Systems (413) 568-7001 Contact: Joan Drucker snailtraps.com	The SNAIL™ Trap	Two types of traps: Pistol Wet: $2,250/linear ft Pistol Dry: $2,150/linear ft Rifle Wet: $2,400/linear ft Rifle Dry: $2,300/linear ft	Purchase of Equipment	Shipping Installation	Rifle (up to .50 cal BMG) Pistol	The SNAIL trap is designed with low angle entrance ramps to guide the bullet into the circular deceleration chamber without scarring the plate. The bullet loses all of its energy in the chamber and drops into a collection system. The use of water and synthetic oil contains the lead particulates and dust, and minimizes friction on the plates.	Usage for indoor and outdoor ranges. Can also be provided with a conveyance system that drops the bullet to a single collection point (e.g., 55-gallon drum) for recycling. Low-maintenance system

[1] EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Stapp EBC, Incorporated (703) 239-9223 Contact: Matt Ciskowski, P.E. 8101 Ox Road Fairfax Station, VA 22039 Fax: (703) 239-9224 bulletcatcher.com	STAPP Bullet Catcher	Varies by specific design (measured by square foot)	Purchase of Equipment Installation Delivery (Freight)		Pistol & Rifle (best for calibers up to 12mm) Can handle jacketed rounds and tracers	The STAPP bullet catcher (consisting of a bottom rubber liner, drainpipe reservoir, rubber granule fill, and cover layer of rubber) collects lead and any infiltrating water without runoff. The system is constructed over an earthen berm and can be modified to any range configuration. Projectiles are completely collected by the bullet catcher with minimal fragmentation. The surrounding structure is ricochet-proof even under the most extreme temperatures.	Designs are site adapted. Reclamation can be performed by Stapp EBC or by range personnel. Email: mciskowski-trc@verizon.net

[1] EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Bullet Trap Manufacturers Con't.[1]

Bullet Trap Manufacturer	Designs Available	Estimated Cost of Trap	Price Includes	Not Included in Price	Usage of Trap	Description	General Comments
Super Trap Inc. (951) 736-9440 Contact: Art Fransen, Retired, L.A.S.D. 1601 Commerce St Corona, CA 92880 Fax: (951)736-9450 Email: info@supertrap.com supertrap.com	Gel-Cor™ Class A, Fire-Rated Rubber Bullet Traps ELIxIR™ Tactical Shooting Ranges Super Trap® Range Backstops SACON® Perimeter Facilities, Walls, Blocks & Tiles	Approx $520 to $1,600 per linear foot Varies by design, including: - indoor - outdoor - foundation - width of trap	Purchase of Equipment Installation Training	Shipping (Price will depend on destination)	Rifle & Pistol (up to and including .50 cal) Machine Gun Armor Piercing Tracer & Incendiary Ammunition *Also:* Frangible & Tungsten Traditional & Tactical Shooting	STI specializes in tactical shooting ranges. The firing range system captures and contains bullets whole, using a treated, granular ballistic media of recycled pure SBR (styrene-butadiene rubber), free of all steel and fiber contaminants that could normally allow fires to ignite. The infrastructure is 10 gauge galvanized steel and the hopper/deflection baffle is 3/8″ AR 500 steel rifle rated (indoor and outdoor.) Outdoor Ranges: The backstop base typically lies on a graded berm at the appropriate angle determined by the user and STI staff. SACON® can absorb bullets and prevent lead contamination, replacing railroad ties, logs, brick walls and concrete enclosures on firing ranges.	STI's bullet trap systems eliminates hazardous materials contamination (TCLP tests below 1ppm), in addition to preventing ricochets and lead splash-back. Reclamation is recommended after approximately 100,000 to 130,000 rounds per 4 ft lane, based on type of shooter position and layout of targetry (static vs. dynamic.) Lead reclamation is performed using a vacuum air density separator system and rubber media is continuously reused. Use of recycled rubber media in the trap may qualify the range improvement for grant funding. Contact regional recycling associations for more information. STI offers more than six versions of Tactical Shooting Ranges, as well as custom built traps.

[1] EPA does not endorse any particular bullet containment device or product. Information on this table is offered to readers for a general understanding of some common bullet trap options and is based on vendor marketing literature.

Appendix B: Lead Shot Alternatives

Another method of preventing lead contamination at pistol, rifle, trap, skeet, or sporting clays ranges is to use less toxic or non-lead ammunition.

Much progress has been made in the development of alternatives to lead shot for hunting uses. Information gathered since 1976 on lead poisoning of endangered and non-endangered migratory birds due to lead shot ingestion led the United States Fish and Wildlife Service (USFWS) to consider several alternatives to eliminate lead poisoning among migratory waterfowl birds. A ban on lead shot for water fowl hunting was phased in beginning in 1986 and finalized in 1991. Lead shot is also now banned for shotgun hunting occurring near wetlands in national wildlife refuges. Starting in the fall of 1998, the USFWS banned the use of lead shot in waterfowl production areas. Additionally, many state-managed hunting areas require non-toxic shot for upland/small game hunting.

There are several alternatives to lead shot on the market today and still more alternatives are being developed. Before being used for waterfowl hunting, these alternatives must be approved by the USFWS. Bismuth, steel, tungsten/iron, and tungsten/polymer shots have been approved by the USFWS and additional alternative shot materials are in the USFWS approval process. Most of the ammunition manufacturers in the United States, as well as the military, have developed non-toxic alternatives to lead. Research in Europe may also result in additional non-toxic shot alternatives from which U.S. shooters may choose in the future. The following pages compare lead shot to non-toxic, alternative shot.

Summary of Lead Shot Alternatives†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Lead	$5.00/box $3.00 - $4.00/box of reloaded shells	Standard to which all alternatives are compared	Readily available	Lead is heavy and malleable
Bismuth* 97% Bismuth/ 3% tin	Bismuth shells are packed in 10 round boxes @ $15.00 - $25.00/ 10 round box	Similar to lead	Limited world supply of bismuth	Bismuth is a byproduct of lead and gold mining. There are currently many uses, including: medicine (Pepto-Bismol), cosmetics, pigments, and shotgun shot. The addition of tin makes bismuth more malleable and reduces frangibility. Bismuth shot is safe to use in older firearms.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Steel*	$8.00 - $12.95/box $6.00/box of reloaded shells $15.00/box (copper-plated)	In test performance by the Cooperative North American Shotgun Education Program (CONSEP) in hunting situations, no significant differences were found between lead and steel shot at reasonable distances. Lead is more effective at longer ranges.	Readily available from both domestic and imported sources.	Steel shot is about 33% lighter then lead. Therefore, the initial velocity must be increased so that downrange pellet energy remains similar. In hunting situations, larger, and therefore heavier, steel shot is used. Few shooting competitions allow steel shot at this point, but the number is increasing. While steel target loads are available, shooter perception that steel will adversely affect guns and scoring seems to be the limiting factor in acceptance of steel shot for target shooting. Steel shot will not damage newer guns, but may cause ring bulge in older guns if a very tight choke is used. This problem has been resolved in the newer guns with the use of screw-in chokes.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Contiued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Steel* (cont.)				Another concern with steel shot is safety. Because steel is much less malleable then lead, steel shot is likely to ricochet if it strikes something hard. Lead shot, on the other hand, will deform and flatten. In Europe, steel shot is banned for hunting because it can become embedded in trees. The steel shot in trees cut for lumber can cause damage to sawmill equipment and raise concerns about worker safety. Although steel shot can be reloaded, components are not readily available.
Tungsten/Iron* 40% tungsten/ 60% iron	$62.50/box (tungsten/iron shots are packed in 10 round boxes @ $25.00/10 round box)	Preliminary reports indicate that tungsten/iron shot is as effective as lead shot. However, the amount of shot in each cartridge is significantly less then in typical lead cartridges or even steel cartridges. The density of tungsten/iron is 94% that of lead.	Readily available	The tungsten/iron shot currently available is harder than steel. It would, therefore, cause similar damage to older guns.

† Product reference within this table is not an endorsement by EPA.

* Approved by USFWS for migratory waterfowl hunting.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Tungsten/polymer* Various manufacturers have received final approval from the USFWS to market this type of shot.	Not available yet	Comparable to tungsten/iron	Currently not available	Two ammunition manufacturers are currently producing tungsten/polymer shot. This shot is more malleable than the tungsten/iron alloy and would, therefore, be less damaging to shotguns. A research and development company has developed a tungsten/polymer material as a substitute for lead in all its uses. According to this company, its tungsten/polymer can be formulated to be flexible or stiff, depending on the application. This material has been tested by the US Army in projectiles, but has not been used to manufacture shot. However, the company has initiated the process of applying to the USFWS for approval of this material as non-toxic shot.

† Product reference within this table is not an endorsement by EPA.

[1] Costs will vary from store to store and were valid at the time of manual development.

Summary of Lead Shot Alternatives – Continued†

Shot Material	Approximate Cost per 25 Round Box[1]	Ballistic Performance	Availability	Comments
Tungsten/steel Same as tungsten/Iron				
Tin USFWS granted temporary approval for 1999-2000 hunting season	Not available yet	Since tin is just being developed as an alternative to lead, performance information is not yet available. However, since the density of tin is less than steel, performance may be less effective than steel.	Currently not available	This material is just being developed as a lead shot alternative. However, it has similar problems as steel in that it is lighter then lead. The International Tin Research Institute in england is developing this product.

Other materials that are currently being experimented with as alternatives to lead are molybdenum and zinc. Not enough information is available to have included these alternatives in the above table.

† Product reference within this table is not an endorsement by EPA.

Summary of Lead Shot Alternatives - Conclusions

The table clearly illustrates that a number of non-toxic alternatives to lead shot exist such as steel and tungsten as well as alloys and synthetic polymers. As demand for shot from these metals increases from migratory waterfowl hunters, it is anticipated that the costs will come down. However, alternatives currently cost approximately two to twenty times more than lead shot.

The ban on lead shot in hunting situations impacts target shooting. The alternatives to lead shot that are now being developed for or are already approved by the USFWS for migratory bird hunting could be considered for use by target shooters.

Although alternatives to lead shot are now being used by hunters, it is rare that the alternatives are used by target shooters. The limiting factors appear to be the expense and performance. All the alternatives to lead are much more expensive, some prohibitively. Unfortunately, the least expensive alternative, steel, is also perceived to be less effective.

To encourage use of lead shot alternatives, some ranges sponsor shooting competitions using lead-free ammunition, but these are rare. The use of steel or other alternative shot is a recommended BMP in established sporting clays areas at which reclamation of lead shot is difficult to impossible.

Note: Switching to non-toxic shot may create additional issues. For instance, steel has an increased risk of ricochet. Switching to steel may require additional safety features and/or operating procedures.

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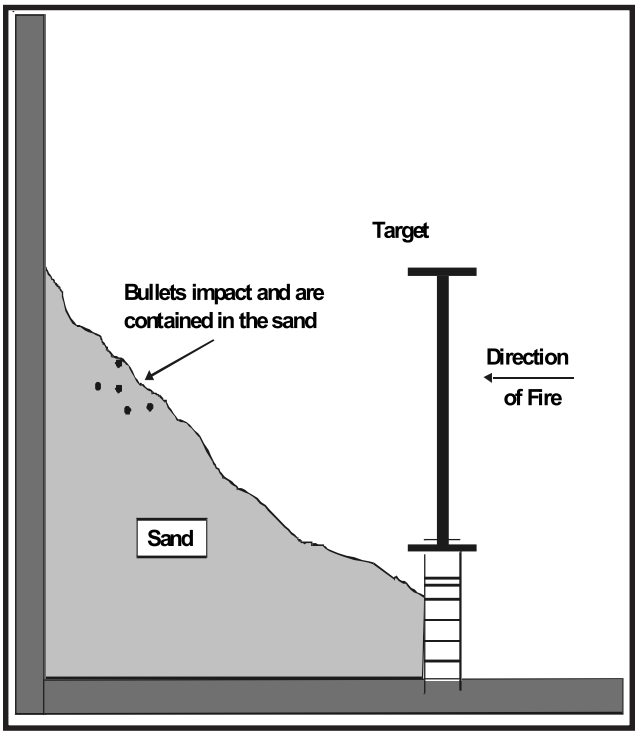
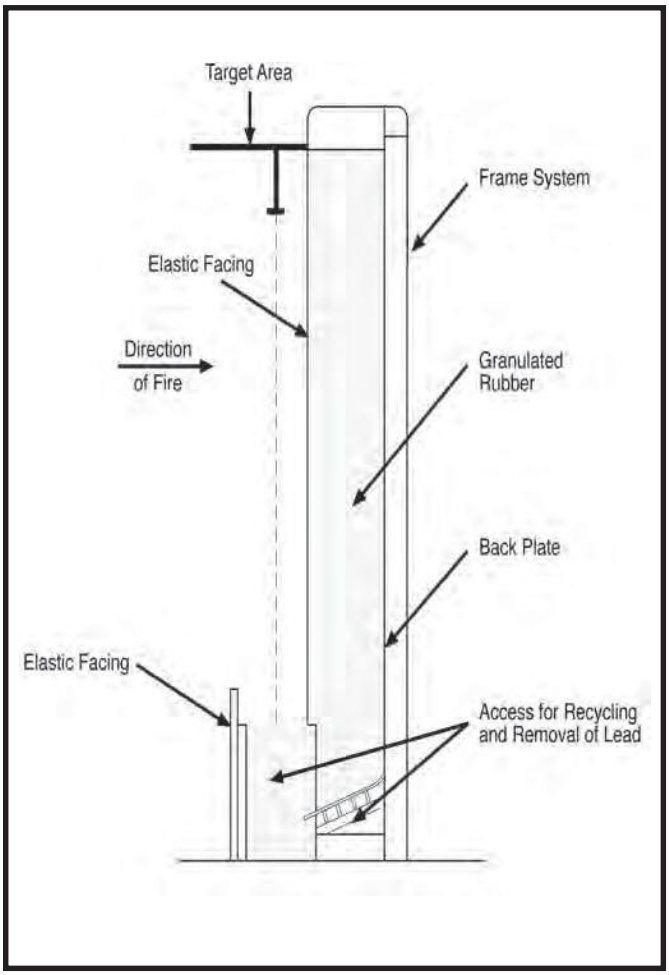
Appendix C: Sample Bullet Containment Devices

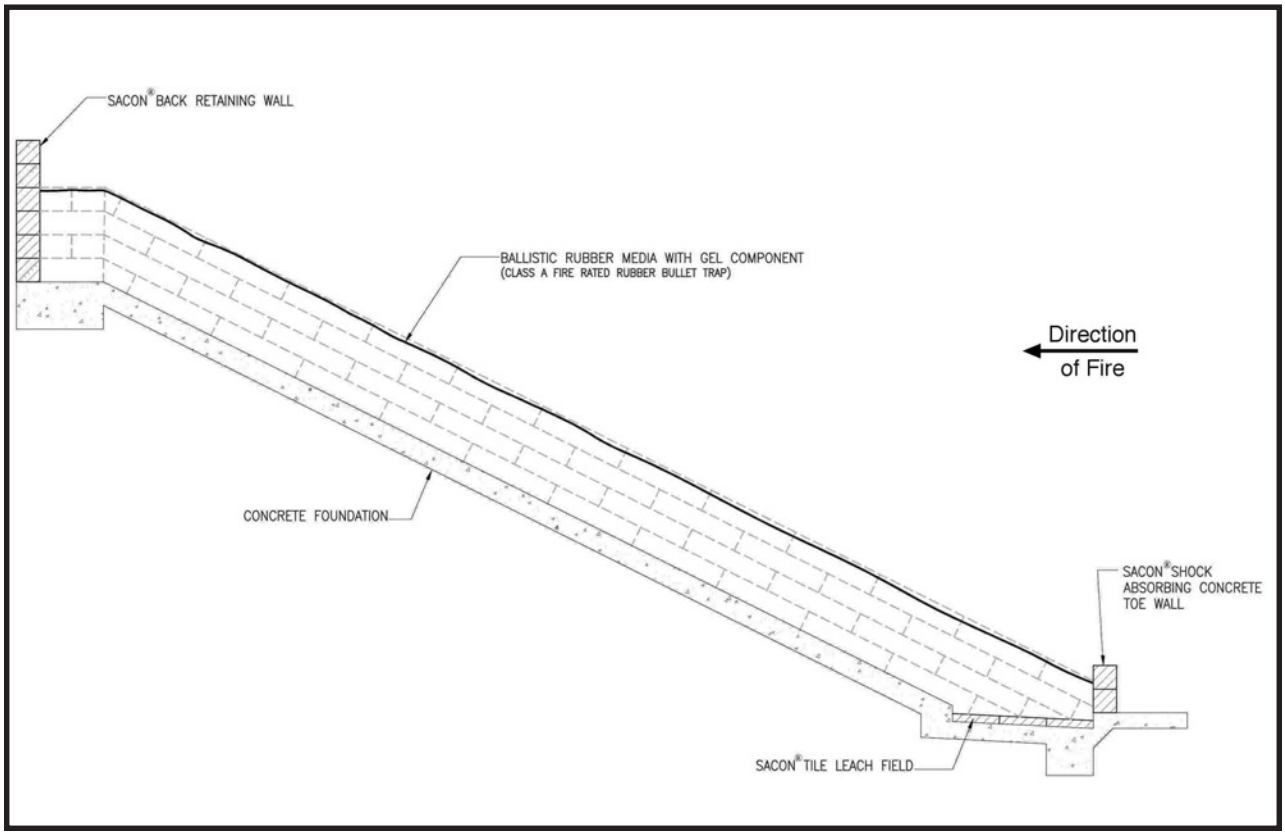
The bullet containment designs in this appendix are sample designs for the containment systems mentioned in this manual. Design systems may vary from different manufacturers. Reference to various individual bullet containment devices is included in this manual for informational purposes only. EPA does not endorse any particular bullet containment device, design, or product.



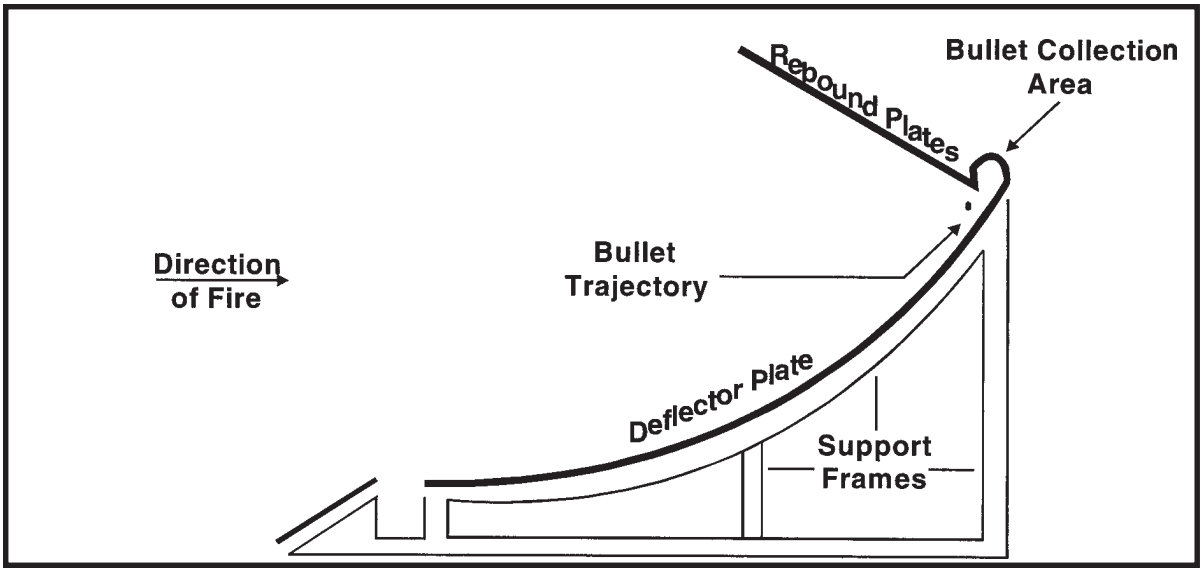
Sand Trap



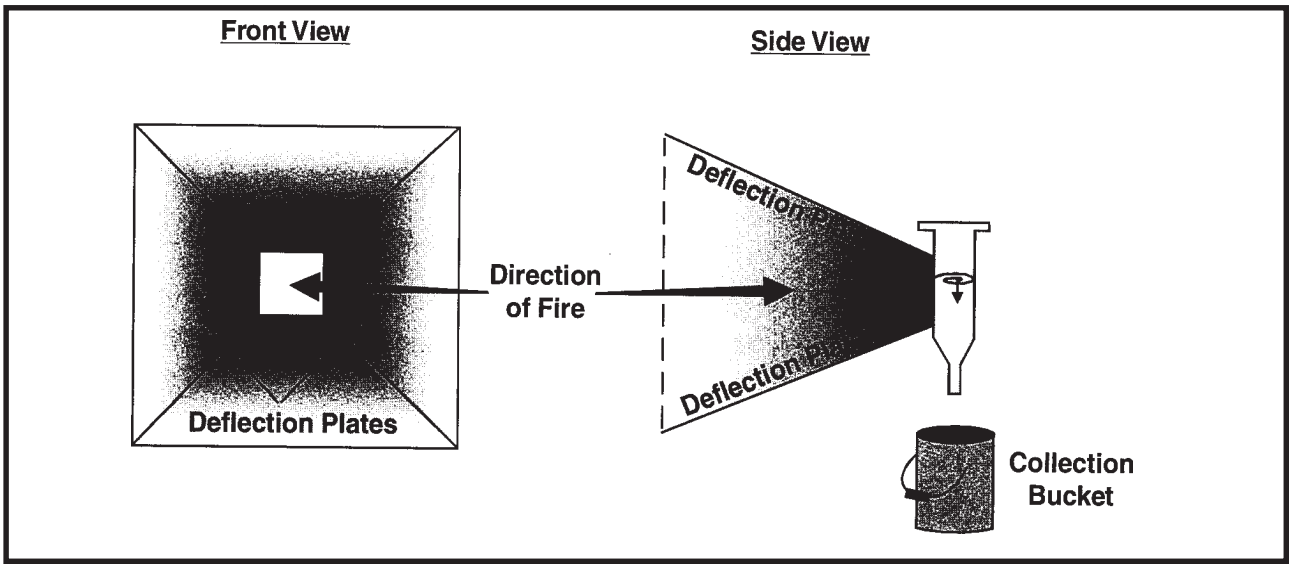
Rubber Granule Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



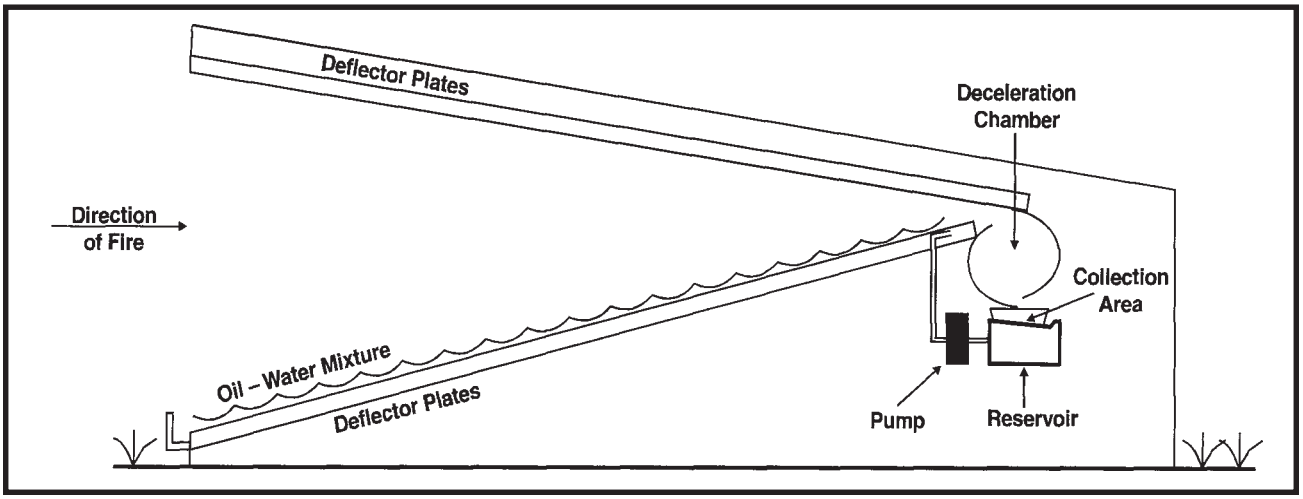
Gel-Cor Bullet Trap™ (Provided by Super Trap, Inc.)



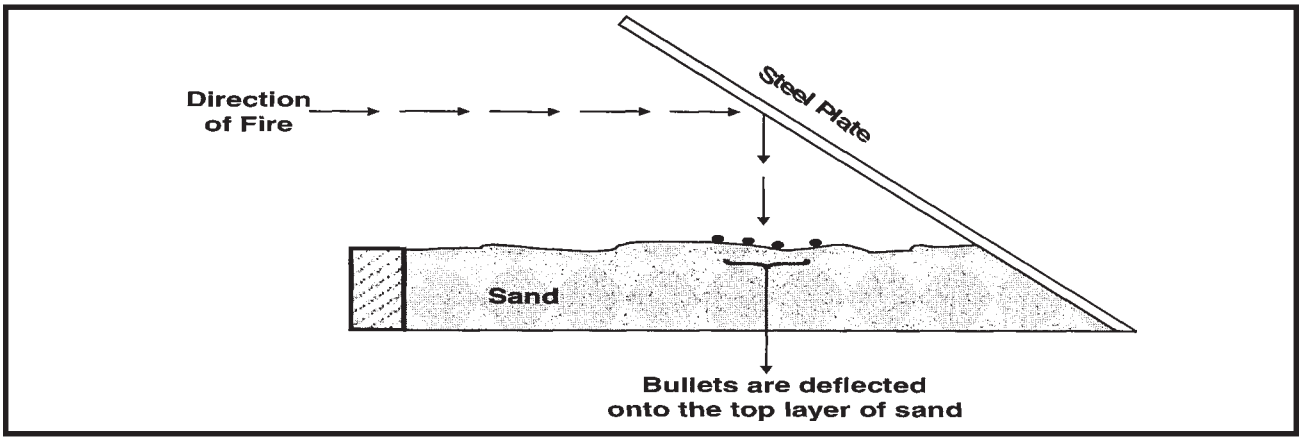
Escalator Trap (Adapted from: *Bullet Trap Technologies,* Action Target Educational Video Series)



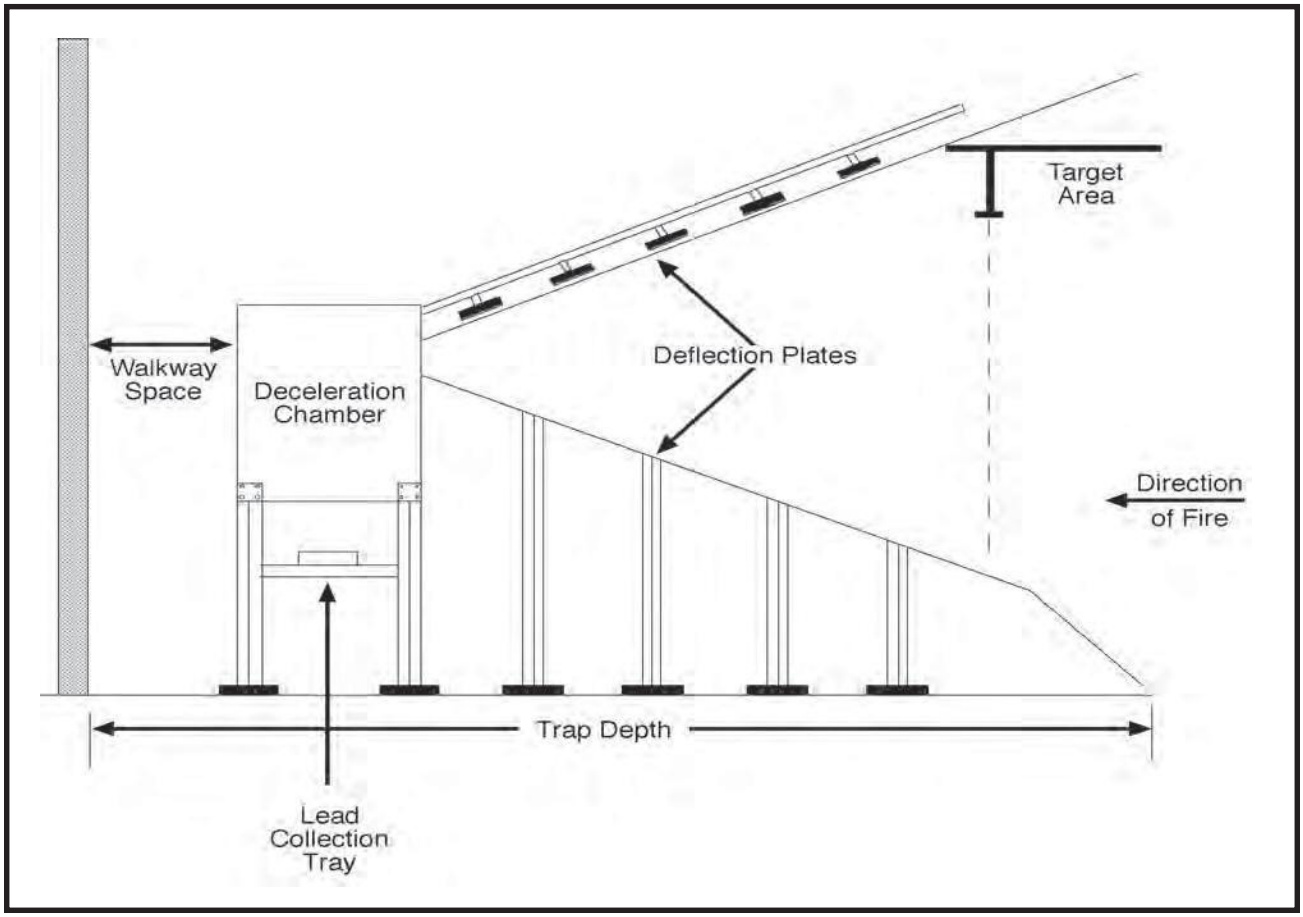
Vertical Swirl Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



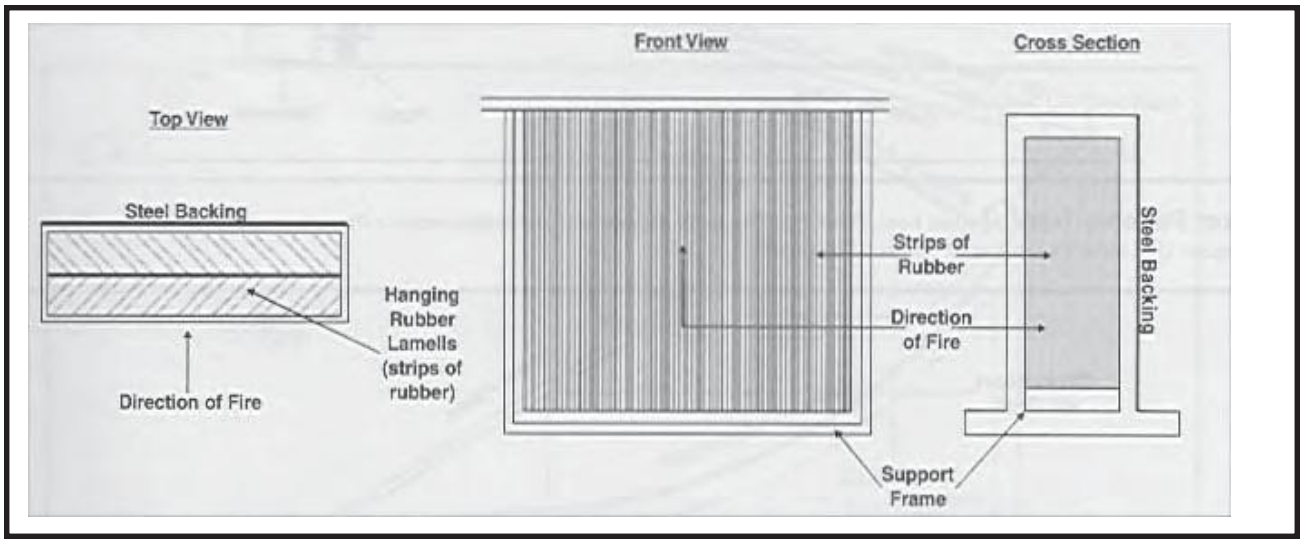
Wet Passive Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



Pitt and Plate (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)



Steel Bullet Trap (Adapted from: *Bullet Trap Technologies*, Action Target Educational Video Series)



Lamella Trap (Adapted from: *Bullet Trap Feasibility Assessment and Implementation Plan: Technology Identification Final Report*, U.S. Army Environmental Center, March 1996)

Appendix D: RCRA Regulatory Requirements and Interpretations

Timely separation of lead shot and bullets from soil at active ranges, recycling of the lead, and subsequent redeposition of the soil on the active range is exempt from RCRA regulation.

1. Reclaiming and Recycling Lead Shot

EPA's Office of Solid Waste issued guidance in 1997 indicating that lead shot, when recycled, is considered a scrap metal and is therefore exempt from RCRA regulation. A copy of the March 17, 1997 letter with this guidance is attached. Under the RCRA Subtitle C hazardous waste management regulations, lead shot would be considered scrap metal, which is exempt from hazardous waste regulations if it is recycled (see 40 CFR 261.6(a)(3)(ii)). Although storage of scrap metal being recycled is not affected by specific time limits such as the speculative accumulation provision (40 CFR 261.1(b)(8)), the scrap metal must legitimately be recycled to remain exempt under this provision. It should also be noted that lead shot may be subject to the authority of RCRA 7003, which addresses imminent hazards. However, use of best management practices is likely to prevent situations which would present an imminent hazard. Using such practices, together with following a clear, written policy governing the facility's recycling efforts, should also assist in assuring that the facility's practices can be demonstrated to be legitimate recycling.

2. Storage of Lead on Shooting Ranges Prior to Recycling

Some ranges have indicated that it may be desirable to store recovered lead shot and bullets on the range property for some periods of time prior to sale for recycling.

Provided that best management practices are followed in terms of storing and recycling the sorted lead, a range that follows such practices, and engages in legitimate recycling, should be able to store such material prior to recycling without RCRA regulatory controls (see discussion below). Best practices would suggest that the sorted lead, at a minimum, should not be exposed to the elements and should be managed so as to prevent releases to the environment. Best practices also indicate that the sorted lead should be stored in containers in good condition, regular inspections of the container condition should be conducted, and the records of inspections should be maintained and be readily available. Further, best practices also suggest that the sorted lead should be recycled in a timely manner and storage times should not exceed the time-frames or goals articulated in a clear, written policy.

3. Placement of Soil After Removal of Lead

For soil placed back on an active range after a BMP has been applied to remove the lead, the following regulatory approach has been followed. On February 12, 1997, EPA published the RCRA Subtitle C Military Munitions Rule in the Federal Register (62 Fed. Reg. 6621). The Military Munitions Rule considers range management to be a necessary part of the safe use of munitions for their intended purpose. Thus, the range clearance activity (recovery of lead shot and bullets) is an intrinsic part of the range operation. Therefore, the rule excludes range clearance activities (including the placement of soil back on the range) from RCRA Subtitle C regulation. Although the Military Munitions Rule did not apply to non-military ranges, EPA, in its response to comments on the proposed rule, clearly stated that "it felt that the 'range clearance' interpretation in the final Military Munitions Rule is consistent with the EPA's interpretations for non-military ranges." In addition, the EPA's Director of the Office of Solid Waste sent the New York State Department of Environmental Conservation a letter dated April 29,1997, confirming that the Military Munitions Rule range clearance principles apply equally to non-military ranges. A copy of the letter is attached.

4. Relocation of Backstop and Shotfall Zone Soil

Some ranges have indicated to the EPA that it may be desirable to transport and/or relocate a backstop in order to reorient or modify their range. This may occur when there is a need to reorient the range due to environmental concerns (e.g., shooting over water (wetland, stream, pond) or excessive runoff), alter the layout to improve shooter safety, or redesign to modify shooting conditions (e.g., adjusting number of shooting positions, increasing or decreasing target distance.) In some cases backstop material would not be moved off the range property, but to another area on the range property.

EPA's position is that range backstop materials are part of the range and are not wastes when they are moved or relocated, as long as the range continues to be used as a range and the backstop materials continue to be used as backstop materials. Hence, backstop materials that are still in use are not subject to the RCRA hazardous waste management regulations and need not be tested for hazardous waste characteristics. However, removal of lead from backstop materials that are to be relocated or moved is a normal practice of good range management in that it extends the usable life of the materials and reduces the possibility of releases of lead into the environment. If lead removal does not occur before moving the backstop material, the lead will become more dispersed throughout the material during movement and will thus be more difficult to recover in future reclamation events.

As a range management practice, it is environmentally preferable to use soil that may already contain lead and is on an active portion of the range, which will therefore undergo regular lead reclamation in the future, than to leave such soil in place and construct a new backstop with lead-free soil. Records of all movements of berm and shotfall zone soils, along with corresponding site plans, should be maintained indefinitely, as they will be necessary in evaluating cleanup needs during subsequent construction or range closure.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
March 17, 1997

Mr. Duncan Campbell
Environmental Protection Agency, Region V
RCRA Enforcement
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Dear Mr. Campbell:

Enclosed please find a memorandum on the regulatory status of lead shot, which includes a general discussion on the regulatory status of lead shot as scrap metal. I hope that this information is sufficient to address your specific concerns as they relate to the pile of lead shot at the Saxon Metals facility.

If you have any questions or would like to discuss this matter further, please contact me at (703) 308-8826.

Sincerely,
Jeffery S. Hannapel
Office of Solid Waste

Enclosure

To: Duncan Campbell, EPA Region V
From: Jeff Hannapel, EPA Office of Solid Waste
Date: March 13, 1997
Re: Regulatory Status of Lead Shot

Based on our conversations, it is my understanding that Saxon Metals received for recycling a shipment of approximately 30,000 pounds of lead shot from a commercial indoor shooting range. Smokeless gun powder is, presumably, commingled with the lead shot. The mixture appears to exhibit the ignitability characteristic of hazardous waste (as evidenced by the incident in which the material ignited when Saxon Metals was attempting to load it into the furnace with a front-end loader). You have asked our office to provide you with guidance on the regulatory status of the lead shot portion of the mixture, specifically whether it is considered a spent material or scrap metal.

The Agency has taken the position that the discharge of ammunition or lead shot does not constitute hazardous waste disposal because the Agency does not consider the rounds from the weapons to be “discarded.” As you know, discard is a necessary criterion to be met

before a material can be considered a solid waste and subsequently a hazardous waste. (40 CFR §261.2(a).) The Agency's interpretation regarding discard is based on the fact that shooting is in the normal and expected use pattern of the manufactured product, i.e., the lead shot. Enclosed for your information is a September 6, 1988 letter from EPA to IDEM on this particular point.

In the federal regulations, the term, "scrap metal," is defined as "bits and pieces of metal parts (e.g., bars, turnings, rods, sheets, wire) or metal pieces that may be combined together with bolts or soldering (e.g., radiators, scrap automobiles, railroad box cars), which when worn or superfluous can be recycled." (40 C.F.R. §261.1.) In the Federal Register preamble for the final regulations on the definition of solid waste, EPA indicated that "scrap metal is defined as products made of metal that become worn out (or are off-specification) and are recycled to recover their metal content, or metal pieces that are generated from machine operations (i.e., turnings, stampings, etc.) which are recycled to recover metal." (50 Fed. Reg. 614, 624 (1985).) The lead shot portion of the Saxon Metals pile would be considered scrap metal pursuant to the regulatory definition of scrap metal.

EPA provided further clarification on the regulatory status of scrap metal in the Federal Register preamble to the definition of solid waste final regulations:

> [a]t proposal, scrap metal that was generated as a result of use by consumers (copper wire scrap, for example) was defined as a spent material. (This type of scrap is usually referred to as "obsolete scrap.") Scrap from metal processing, on the other hand (such as turnings from machining operations) was defined as a by-product. (It is usually called "prompt scrap.") Yet the scrap metal in both cases is physically identical (i.e., the composition and hazard of both by-product and spent scrap is essentially the same) and, when recycled is recycled in the same way - by being utilized for metal recovery (generally in a secondary smelting operation). In light of the physical similarity and identical means of recycling of prompt scrap and obsolete scrap, the Agency has determined that all scrap metal should be classified the same way for regulatory purposes. Rather than squeeze scrap metal into either the spent material or by-product category, we have placed it in its own category.

(50 Fed. Reg. at p. 624) Based on these regulatory passages, the lead shot portion of the pile would be considered scrap metal, and not a spent material. The lead shot is a product that is made of metal that can be recycled to recover metal content. Furthermore, the lead shot has not been "discarded" by virtue of its discharge at the shooting range, because the discharge is within the normal and expected use pattern of the manufactured product. Accordingly, lead shot would be considered scrap metal for regulatory purposes. Scrap metal is a solid waste, but it is exempt from the regulatory requirements of Subtitle C when it is recycled. (40 C.F.R. §261.6(a)(3)(ii).) As part of the Phase IV land disposal restrictions supplemental rulemaking (which was proposed January 25, 1996 and is expected to be finalized in April 1997), processed scrap metal and two categories of unprocessed scrap metal that is being recycled would be excluded from RCRA jurisdiction.

Please note that this discussion of the regulatory status is limited to the lead shot portion of the pile as you requested. To the extent that the entire pile exhibits the ignitability or reactive characteristic of hazardous waste, the mixture of materials would be considered hazardous waste and not scrap metal. The scrap metal designation for the lead shot would be applicable only to the extent that the lead shot could be segregated from the other materials in the pile.

I hope that this guidance on the regulatory status of lead shot recovered from shooting ranges provides you with the clarification that you needed. If you have any questions or would like to discuss this matter further, please contact me.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
APR 29 1997

Mr. John P.Cahill
Acting Commissioner
State of New York
Department of Environmental Conservation
Albany, New York 12233-1010

Dear Mr. Cahill:

Thank you for your letter of April 3, 1997 to Administrator Browner requesting a clarification of the Environmental Protection Agency (EPA) Final Military Munitions Rule regarding the extension of its range clearance principles to non-military ranges. Although the final rule addresses only military ranges, we agree with your view that the range clearance principles apply equally to non-military ranges [see comment no. 5 on page 36 of the enclosed excerpt from the Military Munitions Final Rule Response to Comments Background Document].

We are aware of the State of New York's active leadership role in the clean-up of private firing ranges. We appreciate your writing in support of the range clearance aspects of the final Military Munitions Rule and we will consider your suggestions that we issue broader guidance on the applicability of its principles to non-military ranges.

Sincerely yours,

Elizabeth Cotsworth, Acting Director
Office of Solid Waste

Enclosure

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Appendix E: Template for an Environmental Stewardship Plan for Management of Lead Shot/Bullets

Instructions

EPA encourages outdoor shooting ranges to adopt and implement the Best Management Practices (BMPs) found in this manual. To this end, it is recommended that ranges first prepare an Environmental Stewardship Plan (ESP or Plan), which gathers information about, and guides evaluation of, site specific conditions of each range. As such, the ESP assists in selection of appropriate BMPs.

This document serves as a template that may be used by sportsmen's clubs and shooting ranges in their preparation of an ESP. This template was adapted from Appendix C of the National Shooting Sports Foundation's manual, *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges* (the NSSF manual.) This template is only a tool to assist in making ESP preparation easier and can, and in some cases should, be modified to incorporate specific information relative to your club and its ranges. It is intended to be used in conjunction with a full understanding of the NSSF, U.S. Environmental Protection Agency (EPA) and, for ranges in Florida, Florida Department of Environmental Protection (DEP) manuals for the safe management of lead at outdoor shooting ranges. This template is intended to encourage ranges to prepare ESPs and submit them to EPA or NSSF to obtain a Certificate of Recognition from EPA. In this regard, either the following template or the NSSF template is recommended for use in conjunction with EPA's Certificate of Recognition program.

An electronic copy of this template is available on EPA's shooting range website (http://www.epa.gov/region2/leadshot) in several formats.

Disclaimer: This template does not serve as a substitute for understanding the concepts and techniques discussed in the EPA manual or other manuals. This template is not to be used as a substitute for consultation with scientists, engineers, attorneys, other professionals, or U.S. EPA.

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Environmental Stewardship Plan for Management of Lead/Bullets at Outdoor Shooting Ranges

Club Name

Address
City/Town, State & Zip Code
Phone #:

Date

Table of Contents

- ❑ **Introduction**
  - Mission Statement
  - Purpose
  - Goal
  - Delete

- ❑ **Site Assessment**
  - Description of Ranges and Support Facilities
  - Existing Environmental Conditions
    - Trap and Skeet Fields
    - Sporting Clays Course
    - Rifle and Black Powder Range(s)
    - Outdoor Handgun Range(s)

- ❑ **Trap and Skeet Fields**
  - Action Plan
    - Potential Management Options
    - Selection of Management Options to be Implemented
    - Options Selected
      - a) Management Actions
      - b) Operational Actions
      - c) Construction Actions
  - Plan Implementation
    - Schedule for Implementation
    - Responsibilities

- ❑ **Rifle, Black Powder, and Outdoor Handgun Ranges**
  - Action Plan
    - Potential Management Options……...
    - Selection of Management Options to be Implemented……...
    - Options Selected…….
      - a) Management Actions……...
      - b) Operational Actions…….
      - c) Construction Actions……...
  - Plan Implementation……..
    - Schedule for Implementation…….
    - Responsibilities……..

Table of Contents (continued)

- ❑ **Sporting Clays Course**……
  - Action Plan……
    - Potential Management Options……...
    - Selection of Management Options to be Implemented……...
    - Options Selected……
      - a) Management Actions……...
      - b) Operational Actions……
      - c) Construction Actions……...
  - Plan Implementation……..
    - Schedule for Implementation……
    - Responsibilities……..
- ❑ **Measuring Success**……...
  - Vegetation……..
  - Soil and Runoff pH……
  - Erosion……..
- ❑ **Plan Review and Revisions**……

Figures

Figure 1: Site Location Map
Figure 2: Facilities Diagram
(Additional figures, as appropriate)

Tables

Table 1:
Table 2:

Appendices

Appendix A:
Appendix B:
(Additional Appendices, as appropriate)

Introduction

The XYZ Club, Inc. is located at 123 X Road in Anytown, USA…

Mission Statement

The XYZ Club, Inc. is committed to…

- *Purpose*:

The Purpose of this Environmental Stewardship Plan (i.e., the Plan) is to:

- Identify potential environmental concerns that may exist;
- Identify, evaluate, and prioritize appropriate actions to manage lead shot and bullets safely, as well as identifying and addressing environmental concerns;
- List short- and long-term steps needed for implementation;
- Develop an implementation schedule;
- Identify ways to measure the Plan's success;
- Evaluate annual progress made towards achieving environmental stewardship goals;
- etc.

- *Goal* – To minimize the release of lead into the environment.

Activities to Reach Goal:
Examples include:

- ▷ Avoid shooting over and into water and wetlands.
- ▷ Prevent off-site migration of lead through groundwater and surface water runoff.
- ▷ Conduct lead recovery.
- ▷ Discourage ingestion of lead by wildlife.
- ▷ Maintain soil pH between 6.5 and 8.5 in the shotfall zone.

Site Assessment

Description of Ranges and Support Facilities

The XYZ Club has an x position Trap Range, a y position Skeet Range, a z position Sporting Clays Course, and a q position Small Arms Range. These ranges are located in a rural setting and are oriented away from residential areas and surface water bodies.

[Briefly describe each range, its dimensions, orientation, vegetative cover, numbers of shooters and targets used per year, wildlife usage, etc.]

Existing Environmental Conditions

[Describe any known environmental conditions associated with the ranges. This might include type of soil, depth to groundwater, soil pH, drainage to surface water, unique animal or bird populations, etc. Refer to figures, tables, the results of surveys, inspections, professional opinions, etc.]

- *Trap and Skeet Fields*

- *Sporting Clays Course*

- *Rifle and Black Powder Range(s)*

- *Outdoor Handgun Range(s)*

Trap and Skeet Fields

Action Plan

[Briefly describe the management options selected.]

- *Potentially Applicable Management Options*

[See EPA or NSSF guidance manual for full listing of options]

Examples include:
- Vegetate sparse grass area of trap/skeet field.
- Reorient trap field to avoid lead shot entering wetlands.
- Reorient sporting clays stations to maximize the overlap of falling shot into the open field where it can be more easily recovered for recycling.
- Limit use of the trap/skeet range to only those stations that do not have wetland area within the shotfall zone.
- Apply lime to shotfall zones if soil test results indicate this would be beneficial.
- Prepare fields for lead reclamation.
- Get bids for lead reclamation project.
- Conduct lead reclamation within the trap/skeet shotfall zones.
- Change mowing frequency to closely mow grass in shotfall zones.
- Construct lean-tos at backstop berms.
- Construct a lime lined drainage swale for stormwater management.
- List additional Best Management Practices that may be appropriate to your club.

In addition to appropriate site-specific management options, the list should always include conducting lead reclamation within the berm for rifle and pistol ranges and conducting lead reclamation within the trap, skeet, and sporting clays shotfall zones.

- *Selection of Management Options to be Implemented*

Option x:
Option y:
Option z:

[Describe why the above options were selected and the general roles of club officers, the membership, and outside consultants, as applicable, in implementation.]

In order to implement the options selected, the following actions are necessary.

a) Management Actions: [Examples include: assign personnel responsible for initiating, conducting, and completing the alternatives selected above.]
b) Operational Actions: [Examples include: collect soil samples for pH analysis, consult with USDA's Natural Resources Conservation Service and/or the county Cooperative Extension Service regarding best suited vegetative management recommendations.]
c) Construction Actions: [Examples include: do site preparation work, get bids, institute mowing and vegetative management recommendations, reorient shooting position as appropriate.]

Plan Implementation

- *Schedule for Implementation*

Winter/Spring: [Examples include: pH survey, contact local officials for vegetation management recommendations, reorient shooting positions as appropriate, realign shooting positions as appropriate.]

Summer/Fall: [Examples include: prepare site for reclamation project, apply lime/fertilizer/seed, get bids for berm lean-tos/reclamation. As a rule of thumb, 50 pounds of lime per 1,000 square feet should raise soil pH by 1 once the residual acidity is overcome.]

- *Responsibilities*

[Specific duties (i.e., the trap/skeet chairman/chairmen will…, The club treasurer will…, The membership will provide the labor to…)]

Rifle, Black Powder, and Outdoor Handgun Range(s)

Action Plan

[Briefly describe the management options selected.]

Potentially Applicable Management Options

[See EPA or NSSF guidance manual for full listing of options]

Examples include:
- Culvert the stream through the shooting ranges.
- Vegetate the backstop berm(s) to minimize erosion.
- Construct a lime lined drainage swale for stormwater management.
- Apply lime to the berm and foreground if pH test determines it is necessary.
- Begin planning a lead reclamation project.
- Construct lean-tos at berms.
- List additional Best Management Practices that may be appropriate to your club.

Selection of Management Options to be Implemented

Option x:
Option y:
Option z:

[Describe why the above options were selected and the general roles of club officers, the membership, and outside consultants, as applicable, in implementation.]

In order to implement the options selected, the following actions are necessary.

a) Management Actions: [examples include: assign personnel responsible for initiating, conducting, and completing the alternatives selected above.]
b) Operational Actions: [examples include: collect soil samples for pH analysis, consult with USDA's Natural Resources Conservation Service and/or the county Service Forester regarding best suited vegetative management recommendations.]
c) Construction Actions: [examples include: do site preparation work, get bids, institute mowing and vegetative management recommendations, reorient shooting position as appropriate.]

Plan Implementation

- *Schedule for Implementation*

Winter/Spring: [examples include: pH survey, contact local officials for vegetation management recommendations, reorient shooting positions as appropriate, realign shooting positions as appropriate.]

Summer/Fall: [examples include: prepare site for reclamation project, apply lime/fertilizer/seed, get bids for berm lean-tos/reclamation.]

- *Responsibilities*

[Specific duties (i.e.: the small arms range chairman/chairmen will…,The club treasurer will…, The membership will provide the labor to…)]

Sporting Clays Course

Action Plan

- *Potentially Applicable Management Options*

[See EPA or NSSF guidance manual for full listing of options]

- *Selection of Management Options to be Implemented*

- *Options Selected*

Plan Implementation

- *Schedule for Implementation*

- *Responsibilities*

Measuring Success

By monitoring the success of the Plan, the club is best prepared to make whatever changes may be necessary to reinforce success and make the most of environmental stewardship efforts. Below are some examples of areas to monitor:

Lead Recovery

[Document the quantity (pounds) of lead recovered and recycled, along with the cost of conducting the activities.]

Vegetation

[The density of vegetation growth should be measured throughout the growing season, especially in areas of sparse growth where steps have been taken to increase the vegetative cover. This is can be done by taking periodic photographs (e.g., once a month) from the same places to document the impact of the Plan.]

Wildlife

[Keep a log of visual observations made regarding the frequency of range usage by the variety of species in your area.]

Soil and Runoff pH

[Track soil and runoff pH through semiannual monitoring and adjust the amount of lime applied to different areas of the range to maintain a pH level that will prevent lead from dissolving (i.e., a pH of 6.5-8.5).]

Erosion

[Again, keeping a photographic record of problem areas best prepares your club to document achievements and adjust the Plan as appropriate.]

Plan Review and Revisions

Review the Plan on an annual basis. Update the Plan as needed and schedule activities for subsequent years. Make recommendations for future club officers to consider when updating the Plan and designating future activities to be conducted (tell them what worked, what didn't work, and what still needs to be done.)

FIGURES

Figure 1
Facility diagrams

Figure 2
Resource maps (USGS topographic map, wetlands maps, soil survey maps, FEMA floodplain map, etc.)

Figure 3 (Optional)
Site photographs

Figure 4 (Optional)
Aerial photo of range and surrounding area

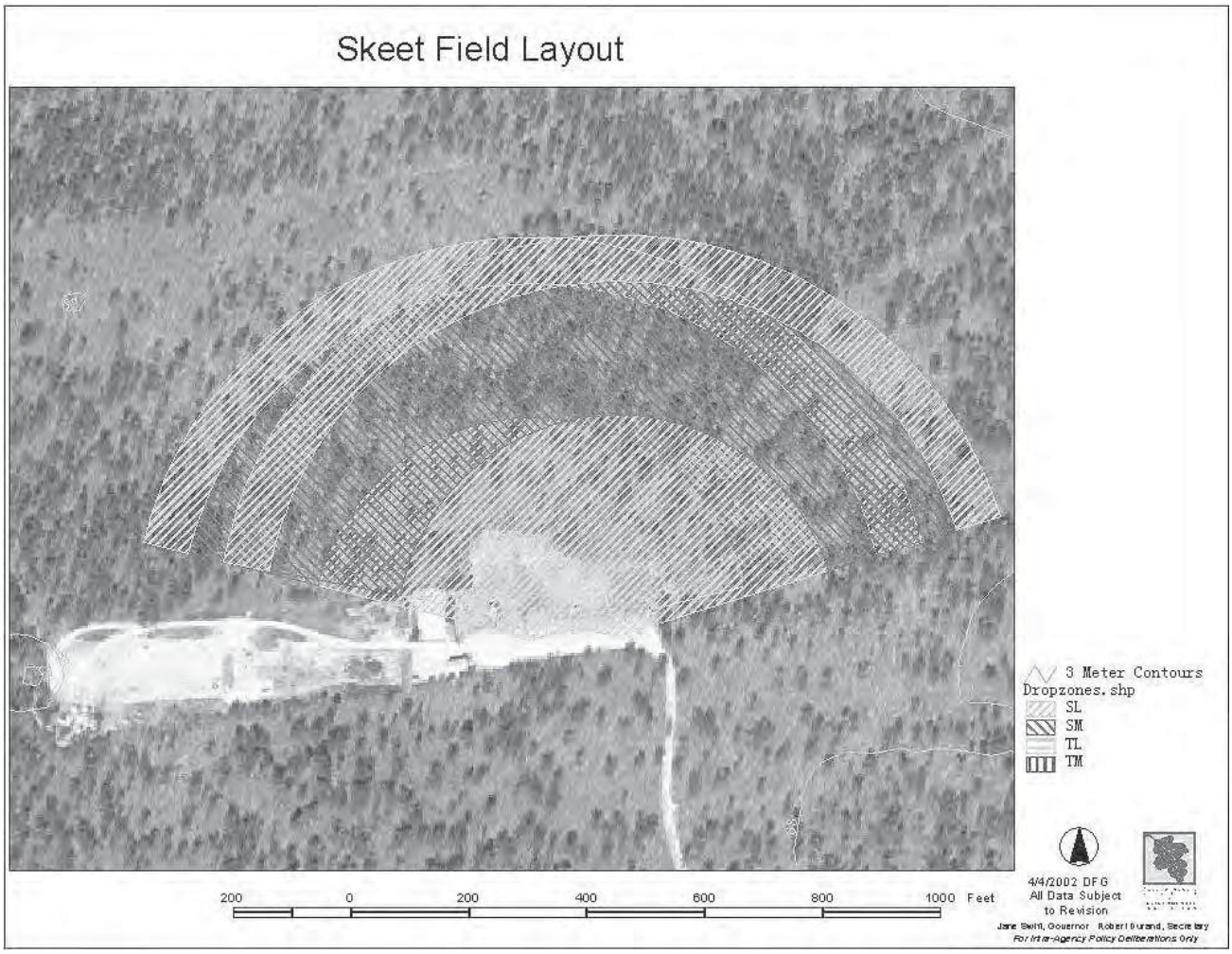
Appendix A
(Optional)

Appendix B
(Optional)

[Insert other figures as necessary to support the text]

Other figures may include an aerial photograph, and sketches of the Club property in general and/or specific ranges in particular.

Example:



[Insert Site Location Map Here]

Typically, a Site Location Map is cut from a USGS Topographic Map of you Club's area. The Club should be centered on the map. Indicate the property boundaries and layout of the range.

Appendix A

Information from USDA, Natural Resources Conservation Service [and/or county Cooperative Extension Service]

[concerning soil and vegetation management recommendations]

Appendix B (etc.)
[For other supporting documentation as needed.]

U.S. Environmental
Protection Agency
Region 2

EPA-902-B-01-001
Revised June 2005

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